

**SUID-AFRIKAANSE  
WETENSKAPLIKE EN NYWERHEID-  
NAVORSINGSRAAD**

**SOUTH AFRICAN  
COUNCIL FOR SCIENTIFIC  
AND INDUSTRIAL RESEARCH**

**TIENDE  
JAARVERSLAG**

**TENTH  
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**P R E T O R I A**

**UNIE VAN SUID-AFRIKA**

**UNION OF SOUTH AFRICA**

*Posbus 395, Pretoria*

*5 Oktober 1955.*

*Meneer,*

*Ek het die eer om aan u voor te lê die Tiende Jaarverslag van die Wetenskaplike en Nywerheidsnavorsingsraad vir die jaar geëindig 4 Oktober 1955.*

*'n Balansstaat en 'n staat van inkomste en uitgawe vir die boekjaar eindigende 31 Maart 1955, soos nagegaan deur die Kontroleur en Ouditeur-Generaal, word ook voorgelê.*

*Dienswillig die uwe,*

*S. M. NAUDÉ*

*President: Wetenskaplike en Nywerheidsnavorsingsraad*

*Sy Edele Dr. A. J. R. van Rhijn,  
Minister van Ekonomiese Sake,  
Paul Hof,  
Minnaarstraat,  
PRETORIA.*



*P.O. Box 395, Pretoria*

*5th October, 1955.*

*Sir,*

*I have pleasure to present to you the Tenth Annual Report of the Council for Scientific and Industrial Research, for the year ended October 4th, 1955.*

*A balance sheet and statement of income and expenditure for the financial year ended 31st March, 1955, certified by the Controller and Auditor-General, is also presented.*

*I have the honour to be,*

*Sir,*

*Your obedient Servant,*

*S. M. NAUDÉ*

*President: Council for Scientific and Industrial Research*

*The Hon. Dr. A. J. R. van Rhijn,  
Minister of Economic Affairs,  
Paul Hof,  
Minnaar Street,  
PRETORIA.*

# Inhoudsopgawe

SAMESTELLING EN VERGADERINGE VAN DIE RAAD .. .. .	1
ALGEMENE OORSIG .. .. .	3
SKAKELAFDELING	
PRETORIASE KANTOOR	
Navorsingsontwikkeling .. .. .	27
Streekskakeling .. .. .	28
Patente .. .. .	28
Verdedigingswetenskap .. .. .	28
Publikasies .. .. .	28
Internasionaal .. .. .	29
WETENSKAPLIKE SKAKELKANTOOR, LONDEN	
Besoekers .. .. .	29
Tegniese Navrae .. .. .	30
Verhouding met Suid-Afrikahuis .. .. .	30
Konferensies .. .. .	30
Administrasie .. .. .	30
Dokumente .. .. .	30
WETENSKAPLIKE SKAKELKANTOOR, WASHINGTON	
Besoeke en Konferensies .. .. .	31
Besoekers .. .. .	31
Dokumente en Verslae .. .. .	31
Navrae .. .. .	31
BIBLIOTEK- EN INLIGTINGSAFDELING	
UITLEENDIENS	
Publikasies wat uitgeleen is .. .. .	33
Takke .. .. .	33
Duplikaattdyskrifte .. .. .	33
BOEKBEREIDINGSDIENS .. .. .	33
INLIGTINGS- EN PUBLIKASIEDIENS	
Catalogue of Union Periodicals .. .. .	34
Publikasies .. .. .	35
ALGEMENE WERKSAAMHEDE	
Samewerking in die Gemeenebes .. .. .	37
Raadgewende Werk .. .. .	37
Geskenke .. .. .	37
Huisvesting .. .. .	37
NASIONALE CHEMIESE NAVORSINGS-LABORATORIUM	
MINERAALSTOWWE	
Klei .. .. .	40
Sout .. .. .	41
Fosfate .. .. .	41
Olie uit Steenkool .. .. .	42
WATER	
Ontsooting van Gemeneraliseerde Waters deur Elektrodialise .. .. .	42
Hergebruik van Riooluitvloeiels .. .. .	42
Rivierondersoeke .. .. .	44
Waterbronne .. .. .	44
Aërobiese Behandeling van Riooluitvloeiels .. .. .	44
Anaërobiese suiweringsprosesse .. .. .	45
Die Aanwending van Munisipale Afval- en Komposproduksie .. .. .	46
Ander Onderzoekwerk en Konsulerende Dienste .. .. .	46

# Contents

MEMBERSHIP AND MEETINGS OF THE COUNCIL .. .. .	1
GENERAL REVIEW .. .. .	3
LIAISON DIVISION	
PRETORIA OFFICE	
Research Development .. .. .	27
Regional Liaison .. .. .	27
Patents .. .. .	28
Defence Science .. .. .	28
Publications .. .. .	28
International .. .. .	29
SCIENTIFIC LIAISON OFFICE, LONDON	
Visitors .. .. .	29
Technical Enquiries .. .. .	30
Relations with South Africa House .. .. .	30
Conferences .. .. .	30
Administration .. .. .	30
Documents .. .. .	30
SCIENTIFIC LIAISON OFFICE, WASHINGTON	
Visits and Conferences .. .. .	31
Visitors .. .. .	31
Documents and Reports .. .. .	31
Enquiries .. .. .	31
LIBRARY AND INFORMATION DIVISION	
LENDING SERVICES	
Publications issued on loan .. .. .	32
Branches .. .. .	32
Duplicate periodicals .. .. .	33
PROCESSING SERVICES .. .. .	33
INFORMATION AND PUBLISHING SERVICES	
Catalogue of Union Periodicals .. .. .	34
Publications .. .. .	35
GENERAL ACTIVITIES	
Commonwealth Co-operation .. .. .	37
Consultation Work .. .. .	37
Gifts .. .. .	37
Accommodation .. .. .	37
NATIONAL CHEMICAL RESEARCH LABORATORY	
MINERAL PRODUCTS	
Clays .. .. .	40
Salt .. .. .	41
Phosphates .. .. .	41
Oil from Coal .. .. .	42
WATER	
Desalting of Mineralized Water by Electro-dialysis .. .. .	42
Re-use of Sewage Effluents .. .. .	42
Stream Surveys .. .. .	44
Water Supplies .. .. .	44
Aerobic Treatment of Effluents .. .. .	44
Aerobic Treatment of Distillery Effluents .. .. .	45
Municipal Waste Utilization and Compost Production .. .. .	46
Other Investigational and Consultant Services .. .. .	46



<b>DIEREPRODUKTE</b>		
Wolweselskeikunde .. .. .	46	
Wolwas .. .. .	47	
Suiwelprodukte .. .. .	47	
Visolies .. .. .	48	
Breinlipiede .. .. .	48	
<b>PLANTPRODUKTE</b>		
Suikerrietwas .. .. .	48	
Sisal .. .. .	48	
Struktuur van Sterkuliensuur .. .. .	48	
Bitterstowwe van die Cucurbitaceae (Komkommerfamilie) .. .. .	49	
Die Ondersoek van Giftige Plante .. .. .	49	
Saadproteïene .. .. .	49	
Kafferkoring .. .. .	50	
Kenaf (Stokroos of Hibiscus Cannabinus) .. .. .	51	
Seegrass .. .. .	51	
Piesangs .. .. .	52	
Pynappelafval .. .. .	52	
Gepolimeriseerde Olies .. .. .	52	
<b>MIKROBIOLOGIESE CHEMIE</b>		
Pekeluitjies .. .. .	52	
Aantasting van Yster deur Sulfaatreduserende bakterieë .. .. .	52	
Swawelstofwisseling deur Bakterieë .. .. .	53	
Die Oksidasie van Koolstofmonoksied deur 'n Hidrogenomonas-soort .. .. .	53	
Mikrobiologiese bederf in die Nywerheid .. .. .	53	
Voeding van Herkouers .. .. .	53	
<b>BIOCHEMIE</b>		
Studies in Verband met Vitamien A Stofwisseling en die Voorkoms van die Vitamien in Dierlike Vette .. .. .	53	
<b>FISIESE, ANORGANIESE EN ANALITIESE CHEMIE</b>		
Amalgaamchemie .. .. .	54	
Gasadsorpsie .. .. .	54	
Diffusie in Vaste Stowwe .. .. .	54	
Radioskeikunde .. .. .	55	
Korrosie .. .. .	55	
Analitiese Laboratoriums .. .. .	56	
<b>NASIONALE FISIESE LABORATORIUM</b>		
<b>KERNSPEKTROSKOPIE</b>		
Siklotron .. .. .	58	
Toerusting .. .. .	58	
Kernemulsies .. .. .	58	
<b>BIOFISIKA EN TOEGEPASTE RADIOAKTIWITEIT</b>		
Standaardisering van Radioaktiwiteit .. .. .	59	
Opname van Radioaktiewe Jodium deur die Menslike Liggaam .. .. .	59	
Uraanprospektering .. .. .	59	
Beskerming teen Straling .. .. .	60	
Verskaffing van Radioisotope .. .. .	60	
<b>MASSASPEKTROMETRIE</b>		
Geologiese Ouderdomsbepalings .. .. .	60	
Toepassings van Massaspektrometriese Tegnieke .. .. .	61	
<b>ELEKTRONMIKROSKOPIE</b>		
Studie van Oppervlaktestrukture .. .. .	61	
Roetine-ondersoeke .. .. .	62	
<b>X-STRAALDIFFRAKSIE</b>		
Kristalstruktuurbeplating .. .. .	62	
X-straalondersoeke van Plasties-ervormde Metale .. .. .	62	
Ontwikkeling en Toepassing van X-stral-tegniek .. .. .	62	
<b>SPEKTROCHEMIE</b>		
Spektrochemiese ligbronne .. .. .	63	
Direklesende Metodes .. .. .	63	
Spoorelementnavorsing .. .. .	64	
Roetine-ontledings .. .. .	64	
<b>ANIMAL PRODUCTS</b>		
Wool Fibre Chemistry .. .. .	46	
Wool Wax .. .. .	47	
Dairy Products .. .. .	47	
Marine Oils .. .. .	48	
Brain Lipids .. .. .	48	
<b>PLANT PRODUCTS</b>		
Cane Wax .. .. .	48	
Sisal .. .. .	48	
Structure of Sterculic Acid .. .. .	48	
Bitter Principles of the Cucurbitaceae (Cucurbit family) .. .. .	49	
Investigations of Plant poisons .. .. .	49	
Seed Proteins .. .. .	49	
Kaffircorn .. .. .	50	
Kenaf (Stokroos or Hibiscus cannabinus) .. .. .	50	
Seaweeds .. .. .	51	
Bananas .. .. .	52	
Pineapple Waste .. .. .	52	
Polymerized Oils .. .. .	52	
<b>MICROBIOLOGICAL CHEMISTRY</b>		
Pickled Onions .. .. .	52	
Corrosion of Iron by Sulphate-reducing Bacteria .. .. .	52	
Metabolism of Sulphur Compounds by Bacteria .. .. .	52	
Carbon Monoxide Oxidation by a Hydrogenomonas Species .. .. .	53	
Microbiological Spoilage in Industry .. .. .	53	
Ruminant Nutrition .. .. .	53	
<b>BIOCHEMISTRY</b>		
Studies relating to the metabolism of Vitamin A and to its Occurrence in Animal Fats .. .. .	53	
<b>PHYSICAL, INORGANIC AND ANALYTICAL CHEMISTRY</b>		
Amalgam Chemistry .. .. .	54	
Gas Adsorption .. .. .	54	
Diffusion in Solids .. .. .	54	
Radiochemistry .. .. .	55	
Corrosion .. .. .	55	
Analytical Laboratory .. .. .	56	
<b>NATIONAL PHYSICAL LABORATORY</b>		
<b>NUCLEAR SPECTROSCOPY</b>		
Cyclotron .. .. .	58	
Equipment .. .. .	58	
Nuclear Emulsions .. .. .	58	
<b>BIOPHYSICS AND APPLIED RADIOACTIVITY</b>		
Standardization of Radioactivity .. .. .	59	
Uptake of Radioiodine by the Human Body .. .. .	59	
Uranium Prospecting .. .. .	59	
Radiation Protection .. .. .	60	
Supply of Radioisotopes .. .. .	60	
<b>MASS SPECTROMETRY</b>		
Geological age Determinations .. .. .	60	
Application of Mass Spectrometer Techniques .. .. .	61	
<b>ELECTRON MICROSCOPY</b>		
Study of Surface Structures .. .. .	61	
Routine Investigations .. .. .	62	
<b>X-RAY DIFFRACTION</b>		
Crystal Structure Determinations .. .. .	62	
X-Ray Studies of Plastically Deformed Metals .. .. .	62	
Development and Application of X-Ray Techniques .. .. .	62	
<b>SPECTROCHEMISTRY</b>		
Spectrochemical Light Sources .. .. .	63	
Direct Reading Methods .. .. .	63	
Trace Element Research .. .. .	64	
Routine Analysis .. .. .	64	



<b>OPTIKA</b>				<b>OPTICS</b>			
Fotometriese Standaardisasie .. .. .	64			Photometric Standardization .. .. .	64		
Spektroradiometriese Ondersoek van Daglig ..	64			Spectroradiometric Investigation of Daylight	64		
Daglig in Geboue .. .. .	64			Daylight in Buildings .. .. .	64		
Lensontwerp .. .. .	65			Lens Design .. .. .	65		
Ander Dienste .. .. .	65			Other Services .. .. .	65		
<b>HITTE</b>				<b>HEAT</b>			
Standaarde van Temperatuur .. .. .	65			Standards of Temperature Measurement ..	65		
Bepaling van Warmtegeleidingsvermoë ..	65			Measurement of Thermal Conductivity ..	65		
Ondersoek van Kondensasie- en Vriesprosesse	66			Study of Condensation and Freezing Processes	66		
<b>TOEGEPASTE GEOFISIKA</b>				<b>APPLIED GEOPHYSICS</b>			
Magnetiese Studies van Stollingsgesteentes ..	66			Palaeomagnetic Studies of Igneous Rocks ..	66		
Hittevloei in die Aardkors .. .. .	66			Heat Flow Through The Earth's Crust ..	66		
Kortafstand Seismiese Ondersoeke .. .. .	67			Short-range Seismic Exploration .. .. .	67		
<b>FISIKA VAN MATERIE</b>				<b>PHYSICS OF MATTER</b>			
Fundamentele Standaarde .. .. .	68			Fundamental Standards .. .. .	68		
Windvlae wat deur Vliegtuie Teengekom word	68			Gusts Experienced by Aircraft .. .. .	68		
Lugbesoedeling .. .. .	68			Atmospheric Pollution .. .. .	68		
Foto-elastiese Metodes .. .. .	68			Photoelasticity Methods .. .. .	68		
<b>AKOESTIEK</b>				<b>ACOUSTICS</b>			
Verstaanbaarheid van Spraak .. .. .	69			Intelligibility of Speech .. .. .	69		
Akoestiek van Geboue .. .. .	70			Acoustics of Buildings .. .. .	70		
Geraas en Vibrasies .. .. .	71			Noise and Vibrations .. .. .	71		
Akoestiese Metodes .. .. .	71			Acoustic Methods .. .. .	71		
Akoestiese Eienskappe van Boumateriale ..	71			Acoustical Characteristics of Building Materials .. .. .	71		
<b>ELEKTROTEGNOLOGIE</b>				<b>ELECTROTECHNOLOGY</b>			
Standaardisasie .. .. .	71			Standardization .. .. .	71		
Hoë-stroom Neweluitings .. .. .	71			High Current Shunts .. .. .	71		
Diëlektriese Konstante en Verlies van				Dielectric Constant and Loss of Rocks ..	72		
Gesteentes .. .. .	72			Vacuum Tube Construction .. .. .	72		
Vakuumbuiskonstruksie .. .. .	72			Magnetic and Crystal Amplifiers .. .. .	72		
Magnetiese en Kristalversterker .. .. .	72			Servomechanisms .. .. .	73		
Servomeganismes .. .. .	73			Electronic Computers .. .. .	73		
Elektroniese Rekenmasjiene .. .. .	73			Instrumentation .. .. .	73		
Instrumentasie .. .. .	74						
<b>WISKUNDE</b>				<b>MATHEMATICS</b>			
Basiese Navorsing in Wiskunde .. .. .	75			Basic Research in Mathematics .. .. .	75		
Basiese Navorsing in Statistiek .. .. .	75			Basic Research in Statistics .. .. .	75		
Toegepaste Navorsing in Wiskunde en				Applied Research in Mathematics and Statistics .. .. .	75		
Statistiek .. .. .	75			Assistance to other Divisions .. .. .	75		
Hulp aan Ander Afdelings .. .. .	75			<b>GENERAL</b> .. .. .	76		
<b>ALGEMEEN</b> .. .. .	76			<b>ACKNOWLEDGEMENTS</b> .. .. .	76		
<b>BEDANKINGS</b> .. .. .	76						
<b>NAVORSINGSEENHEID VIR WERKTUIGKUNDIGE INGENIEURSWESE</b>				<b>MECHANICAL ENGINEERING RESEARCH UNIT</b>			
<b>METAALKUNDE</b>				<b>METALLURGY</b>			
Voorvervorming en die Plastiese Eienskappe van Metale .. .. .	77			Predeformation and the Plastic Properties of Metals .. .. .	77		
Invloed van Spanning op Korrosie .. .. .	78			Influences of Stress on Corrosion .. .. .	78		
Alkaliese Verbrossing van Ketelplaatstaal ..	78			Caustic Embrittlement of Boiler Plate Steel ..	78		
Swigtings in die Praktyk .. .. .	78			Operational Failures .. .. .	78		
<b>STERKTELEER</b>				<b>STRENGTH OF MATERIALS</b>			
Vermoeidheid van Metale .. .. .	79			Fatigue of Metals .. .. .	79		
Rotsstortings in Diep Myne .. .. .	79			Rock Bursts in Deep Level Mining .. .. .	79		
Benutting van Plaaslike Hout .. .. .	81			Utilization of Local Timber .. .. .	81		
Dienste aan die Nywerheid .. .. .	81			Services to Industry .. .. .	81		
<b>MEGANIKA</b>				<b>MECHANICS</b> .. .. .			
Dempingsvermoë van Materiale .. .. .	81			Damping Capacity of Materials .. .. .	81		
<b>HITTEVOORTPLANTING</b>				<b>HEAT TRANSFER</b> .. .. .			
Hittevoortplanting tussen Vaste Wande en Vloeistowwe .. .. .	81			Heat Transfer Between Solid Surfaces and Fluids .. .. .	81		
Hittevoortplantingseienskappe van „Gevinde Buisse” .. .. .	82			Heat Transfer Characteristics of Finned Tubing	82		
Meet van Hittevloei vanaf die Menslike Liggaam .. .. .	82			Measurement of Heat Flow from the Human Body .. .. .	82		
<b>LUGREÏLING EN VERKOELING</b>				<b>AIR CONDITIONING AND REFRIGERATION</b>			
Die Klimaatskamer .. .. .	82			Climatic Chamber .. .. .	82		
Noukeurige Meting van Hoë Voggehalte ..	83			Accurate Measurement of High Humidity ..	83		



<b>TERMODINAMIKA</b>		<b>THERMODYNAMICS</b>	
Gasturbiennavoring .. .. .	83	Gas Turbine Research .. .. .	83
Ontwikkeling van 'n Verbrandingsoond .. .. .	84	Development of an Incinerator .. .. .	84
Bosilindersmering .. .. .	84	Upper Cylinder Lubrication .. .. .	84
<b>VLOEIMEGANIKA</b>		<b>AERODYNAMICS</b>	
Die Meting van Lae Lugspoede .. .. .	85	The Measurement of Low Velocities .. .. .	85
Studie van Dakventilatore .. .. .	85	Studies of Roof Ventilators .. .. .	85
Lugvervoer van Gekorrelde Stowwe .. .. .	86	Pneumatic Conveyance of Granular Material .. .. .	86
Windtonnel-ontwikkeling .. .. .	86	Wind tunnel Development .. .. .	86
'n Studie van Lugvloei deur Lemroosters .. .. .	86	A Study of Flow through Cascades .. .. .	86
'n Studie van Waaierontwerp met Betrekking tot Geraas .. .. .	87	A Study of Fan Design in Relation to Noise .. .. .	87
Die Werksvermoë van 'n Hidrouliese Lug-kompressor .. .. .	88	Performance of Hydraulic Air Compressor .. .. .	88
Ander Hidro- en Lugdinamiese Ondersoeke .. .. .	88	Other Aero- and Hydrodynamic Investigations .. .. .	88
<b>TELEKOMMUNIKASIE-NAVORSINGS-LABORATORIUM</b>		<b>TELECOMMUNICATIONS RESEARCH LABORATORY</b>	
Die Frekwensievoorrekeningsdiens .. .. .	89	The Frequency Prediction Service .. .. .	89
Ionosfeerstudies .. .. .	89	Ionospheric Studies .. .. .	90
Afstandmeting deur Radio .. .. .	90	Distance Measurement by Radio .. .. .	90
Radioruisele en Navigasiehulpmiddels .. .. .	90	Radio Noise Levels and Navigational Aids .. .. .	90
Opname van Grondkonstantes .. .. .	91	Ground Constants Survey .. .. .	91
Kristalbeheer van Veranderbare Frekwensie .. .. .	91	Variable Frequency Crystal Control .. .. .	91
Afdeling vir Verdedigingsnavorsing .. .. .	92	Defence Research Section .. .. .	92
<b>NASIONALE BOUNAVORSINGSINSTITUUT</b>		<b>NATIONAL BUILDING RESEARCH INSTITUTE</b>	
<b>AFDELING ARGITEKTUUR</b>		<b>ARCHITECTURAL DIVISION</b>	
Publikasie van 'n Brosjyre oor Behuising .. .. .	93	Publication of a Housing Brochure .. .. .	94
W.N.N.R.-beurs oor Naturellebehuising .. .. .	94	C.S.I.R. Bursary on Native Housing .. .. .	94
Sosio-Ekonomiese Studies .. .. .	94	Socio-Economic Studies .. .. .	94
Skoolmeubels .. .. .	95	School Furniture .. .. .	95
Skoolgeboue .. .. .	95	School Buildings .. .. .	95
Hospitaalgeboue .. .. .	95	Hospital Buildings .. .. .	95
Kostestudies .. .. .	96	Cost Studies .. .. .	96
<b>AFDELING FUNKSIONELE DOELTREFFENDHEID</b>		<b>FUNCTIONAL EFFICIENCY DIVISION</b>	
Plafonhoogte .. .. .	96	Ceiling Heights .. .. .	96
Termiese Eienskappe van Boumateriale .. .. .	96	Thermal Properties of Building Materials .. .. .	96
Hitte-oordrag in Geboue .. .. .	97	Heat Transmission in Buildings .. .. .	97
Klamigheid in Geboue .. .. .	97	Dampness in Buildings .. .. .	97
Termiese Toestande en Lugreëling in Geboue .. .. .	97	Thermal Conditions and Ventilation in Buildings .. .. .	97
Verligting in Geboue .. .. .	98	Lighting in Buildings .. .. .	98
<b>AFDELING GRONDMEGANIKA</b>		<b>SOIL MECHANICS DIVISION</b>	
Drukselle .. .. .	99	Pressure Cells .. .. .	99
Fondamente op Uitsettende Grond .. .. .	99	Foundations on Expansive Soils .. .. .	99
Skuifweerstand in Gedeeltelik-Versadigde Grond .. .. .	99	Shear in Partially Saturated Soils .. .. .	99
<b>INGENIEURSAFDELING</b>		<b>ENGINEERING DIVISION</b>	
Bewapende Baksteenmure .. .. .	99	Reinforced Brick Walls .. .. .	99
Koste van Sanitêre Dienste .. .. .	100	Costs of Sanitation Services .. .. .	100
Weerstand van Dakmateriale teen Hael .. .. .	100	Hail Resistance of Roofing Materials .. .. .	100
Kontrakondersoeke .. .. .	100	Contract Investigations .. .. .	100
<b>MATERIALE-AFDELING</b>		<b>MATERIALS DIVISION</b>	
Betontechnologie .. .. .	100	Concrete Technology .. .. .	100
Kalk en Sement .. .. .	101	Limes and Cements .. .. .	101
Algemeen .. .. .	101	Miscellaneous .. .. .	101
<b>NASIONALE INSTITUUT VIR PERSONEEL-NAVORSING</b>		<b>NATIONAL INSTITUTE FOR PERSONNEL RESEARCH</b>	
Personeelkeuring .. .. .	104	Personnel Selection .. .. .	104
Ambagsvakleerlinge .. .. .	107	Artisan Apprentices .. .. .	106
Verdedigingsnavorsing .. .. .	107	Defence Research .. .. .	106
Werkstudie .. .. .	107	Work Study .. .. .	107
Absentisme en Arbeidsomset .. .. .	108	Absenteeism and Labour Turnover .. .. .	108
Opname van Arbeidskragte .. .. .	108	Manpower Survey .. .. .	108
Studies van die Mentaliteit van die Bantoe .. .. .	109	Studies of the Mentality of the Bantu .. .. .	109
Mobiele Toetslaboratorium .. .. .	110	Mobile Testing Laboratory .. .. .	110
Studie oor die Aard en Meting van Persoonlikheid .. .. .	111	Studies of the Nature and Measurement of Personality .. .. .	111
Motorfietsongelukke .. .. .	112	Motor Cycle Accidents .. .. .	112



Psigometriese Metodes .. .. .	112	Psychometric Methods .. .. .	112
Wiskundige Statistiek .. .. .	113	Mathematical Statistics .. .. .	113
<b>NASIONALE VOEDINGNAVORSINGS- INSTITUUT</b>		<b>NATIONAL NUTRITION RESEARCH INSTITUTE</b>	
FUNKSIE .. .. .	115	FUNCTION .. .. .	114
SUID-AFRIKAANSE VOEDSEL		SOUTH AFRICAN FOODS	
Voedseltabelle .. .. .	116	Food Tables .. .. .	116
Bone .. .. .	116	Beans .. .. .	116
Afgeroomde Melkpoer .. .. .	116	Skimmed Milk Powder .. .. .	116
Voedselgis .. .. .	116	Food Yeast .. .. .	116
Spesiale Ondersoeke .. .. .	117	Special Studies .. .. .	117
VOEDSELVERRYKING		FOOD ENRICHMENT	
Aanvullingswaarde van Vismeel in Brood ..	118	Supplementary Value of Fishmeal in Bread ..	117
Mieliemeel .. .. .	118	Maizemeal .. .. .	118
Verrykte Magou (Gefermenteerde mielie- papdrank) .. .. .	119	Enriched Magou (Fermented maizemeal gruel)	119
Geënkapsuleerde Vitamien A-poer .. .. .	119	Encapsulated Vitamin A Powder .. .. .	119
SPEZIALE VOEDSEL		SPECIAL FOODS	
Babavoedsels .. .. .	119	Infant Foods .. .. .	119
Kunsmatige Melkdrank .. .. .	119	Synthetic milk drinks .. .. .	119
Kragmengsels .. .. .	119	Fortified food mixtures .. .. .	119
STUDIE OOR VROEGGEBORTE .. .. .	120	STUDY OF PREMATURE BIRTH .. .. .	120
VOEDSELVERARMING		FOOD IMPOVERISHMENT	
Die Verwydering van Kiem uit Mielies ..	120	Removal of the germ from maize .. .. .	120
Chemiese Stowwe in Voedsels .. .. .	120	Chemical manipulation of foods .. .. .	120
BROODNAVORSING .. .. .	120	BREAD RESEARCH .. .. .	120
VERGELYKING EN STANDAARDISERING VAN METODES .. .. .	121	COMPARISON AND STANDARDISATION OF METHODS	121
ONDERSOEK NAMENS DIE DEPARTEMENT VAN VOEDING .. .. .	122	INVESTIGATIONS ON BEHALF OF THE DEPARTMENT OF NUTRITION .. .. .	122
INDUSTRIËLE EN KLINIESE DIENS .. .. .	123	INDUSTRIAL AND CLINICAL SERVICE .. .. .	123
BESOEKERS EN BESOEKE .. .. .	123	VISITORS AND VISITS .. .. .	123
HUISVESTING .. .. .	123	ACCOMMODATION .. .. .	123
KOMITEEWERK .. .. .	123	COMMITTEE WORK .. .. .	123
<b>NASIONALE PADNAVORSINGSINSTITUUT</b>		<b>NATIONAL INSTITUTE FOR ROAD RESEARCH</b>	
Navorsingseenheid vir Bitumineuse Bindstof ..	125	Bituminous Binder Research Unit .. .. .	125
Fundamentele Werk oor Bindstowwe in Suid- Afrika Vervaardig .. .. .	125	Fundamental Work on South African-pro- duced Binders .. .. .	125
Volskaalse Proefpaaie .. .. .	126	Full-scale Road Experiments .. .. .	126
Die Werkverrigting van Bindstofsproeiers ..	127	The Performance of Binder Distributors ..	127
Publikasies .. .. .	127	Publications .. .. .	127
<b>SENTRALE WERKPLAAS</b> .. .. .	129	<b>CENTRAL WORKSHOPS</b> .. .. .	129
<b>MEDIESE NAVORSING</b>		<b>MEDICAL RESEARCH</b>	
Komitees .. .. .	130	Committees .. .. .	130
Fondse .. .. .	130	Funds .. .. .	130
Skenkings .. .. .	130	Donations .. .. .	130
Navorsingswerk na die Oorsaak van Sterftes onder Narkose .. .. .	130	Research into Anaesthetic Deaths .. .. .	130
Navorsingseenheid vir Pneumokoniose .. ..	131	Pneumoconiosis Research Unit .. .. .	131
Besoeke uit die Buiteland .. .. .	131	Overseas Visitors .. .. .	131
Skakeling .. .. .	131	Liaison .. .. .	131
Mediese Navorsingseenhede .. .. .	131	Medical Research Units .. .. .	131
AMEBIASISNAVORSINGSEENHEID		AMOEBIASIS RESEARCH UNIT	
Geneeskundige Proewe .. .. .	132	Therapeutic Trials .. .. .	132
Laboratoriumondersoek .. .. .	132	Laboratory Investigations .. .. .	132
Algemeen .. .. .	133	General .. .. .	133
NATUURHISTORIESE BILHARZIA-EENHEID		BILHARZIA NATURAL HISTORY UNIT	
Bilharziase in Proefdiere .. .. .	134	Bilharziasis in Experimental Animals .. ..	134
Herhaalde Herbesmettings in Ape .. .. .	135	Repeated Re-infections in Monkeys .. ..	135
Bilharziase in Mense .. .. .	136	Bilharziasis in Human Beings .. .. .	136
KARDIO-PULMONALE EENHEID		CARDIO-PULMONARY RESEARCH UNIT	
Hartbloedvatnavorsing .. .. .	137	Cardiovascular Research .. .. .	137
Pulmonale Navorsingswerk .. .. .	139	Pulmonary Research .. .. .	139
NAVORSINGSEENHEID VIR KLINIESE VOEDING		CLINICAL NUTRITION RESEARCH UNIT	
Koronêre Hartsiekte .. .. .	141	Coronary Heart Disease .. .. .	141



Kwashiorkor en Proteïenondervoeding ..	142	Kwashiorkor and Protein Malnutrition ..	142
Vloeistof- en Elektrolietbalans in Kwashiorkor ..	143	Fluid and Electrolyte Balance in Kwashiorkor ..	143
Voedingsedeem in Volwassenes ..	143	Nutritional Oedema in Adults ..	143
Oplossing van Nefrotiese Simptomegroep ..	143	Resolution of the Nephrotic Syndrome ..	143
<b>TANDHEELKUNDIGE NAVORSINGSEENHEID</b>		<b>DENTAL RESEARCH UNIT</b>	
Voedingsfaktore en Glasuurvorming ..	144	Nutritional Factors and Enamel Formation ..	144
Proteïenstudies ..	144	Protein Studies ..	144
Mondflora ..	144	Oral Flora ..	144
<b>NAVORSINGSEENHEID VIR GESINGSGESONDHEID</b>		<b>FAMILY HEALTH RESEARCH UNIT</b>	
Maatskaplike Studie ..	145	Social Study ..	145
Gesinstudies ..	146	Family Studies ..	146
Groei studies ..	146	Growth Studies ..	146
<b>HARTNAVORSINGSEENHEID</b>		<b>HEART RESEARCH UNIT</b>	
147		147	
<b>NAVORSINGSEENHEID VIR MENSLIKE BIOCHEMIE</b>		<b>HUMAN BIOCHEMISTRY RESEARCH UNIT</b>	
Kalsiummetabolisme van die Suid-Afrikaanse Bantoe ..	147	Calcium Metabolism of the South African Bantu ..	147
Ystermetabolisme van die Suid-Afrikaanse Bantoe ..	148	Iron Metabolism of the South African Bantu ..	148
Dieet, Cholesterolkonsentrasie in Serum en Aterosklerose ..	150	Diet, Serum Cholesterol Concentration and Atherosclerosis ..	150
Voedingstudies op Bantoebabas en Jong Kinders ..	151	Nutritional Studies of Bantu Babies and Young Children ..	151
<b>VOEDINGNAVORSINGSEENHEID</b>		<b>NUTRITION RESEARCH UNIT</b>	
Voeding ..	151	Nutrition ..	151
Eksperimentele Kankerverwekking ..	154	Experimental Carcinogenesis ..	154
Eksperimentele Fisiologie van die Bobbejaan ..	155	Experimental Physiology in the Baboon ..	155
Algemeen ..	156	General ..	156
<b>TERINGNAVORSINGSEENHEID</b>		<b>TUBERCULOSIS RESEARCH UNIT</b>	
Tipering van Monsters anders as van Longmateriaal ..	156	Typing of Non-pulmonary Specimens ..	156
Kenmerke van Afwykende Suurbestaande Basille ..	156	Characteristics of a typical Acid-fast Bacilli ..	156
Toets vir Patogeniteit ..	157	Tests for Pathogenicity ..	157
Serum/C.S.F.-Bromiedverhoudings ..	157	Serum/C.S.F. Bromide Ratios ..	157
Voorkoms van Swamme ..	157	Incidence of Fungus ..	157
Dunsnitte van Heel Organe ..	157	Thin Sections of Whole Organs ..	157
Onderskeiding van Saprofiete van M. Tuberculosis ..	157	Differentiation of Saprophytes from M. Tuberculosis ..	157
<b>VIRUSNAVORSINGSEENHEID</b>		<b>VIRUS RESEARCH UNIT</b>	
Oplosbare Antigene ..	158	Soluble Antigens ..	158
Steuringsstudies met U V-bestraalde Virus van Sinkdalkoors ..	158	Interference Studies with UV-irradiated Rift Valley Fever Virus ..	158
Steurings- en Herverbindingstoetse met Poliovirusse ..	159	Interference and Recombination Experiments with Poliomyelitis viruses ..	159
Grootte van Besmetlike Virusdeeltjies ..	159	Particle Sizes of Infective Virus ..	159
Gewasvirusse ..	159	Tumour Viruses ..	159
Bakteriofage ..	159	Bacteriophages ..	159
Afsondering van Virusse ..	160	Isolation of Viruses ..	160
Tetanustoksien ..	160	Tetanus Toxin ..	160
<b>NYWERHEIDSNVORSINGSINSTITUTE</b>		<b>INDUSTRIAL RESEARCH INSTITUTES</b>	
<b>LEERNYWERHEID-NAVORSINGSINSTITUUT</b>		<b>LEATHER INDUSTRIES RESEARCH INSTITUTE</b>	
Patente ..	161	Patents ..	161
Fundamentele Navorsingwerk ..	161	Fundamental Research ..	161
Algemene Tegnie se Vordering ..	162	General Technical Advances ..	162
Bedryfsnavorsing ..	162	Operations Research ..	162
Publikasies ..	163	Publications ..	163
<b>VISNYWERHEID-NAVORSINGSINSTITUUT</b>		<b>FISHING INDUSTRY RESEARCH INSTITUTE</b>	
Vars Vis ..	163	Fresh Fish ..	163
Soutvis en Droë Vis ..	163	Salted and Dried Fish ..	163
Ingemaakte Vis ..	164	Canned Fish ..	164
Kreef ..	164	Rock Lobster ..	164
Vismeel ..	164	Fish Meal ..	164
Roetinewerk ..	165	Routine Work ..	165
<b>SUIKERMEULE-NAVORSINGSINSTITUUT</b>		<b>SUGAR MILLING RESEARCH INSTITUTE</b>	
166		166	
<b>VERFNYWERHEID-NAVORSINGSINSTITUUT</b>		<b>PAINT INDUSTRIES' RESEARCH INSTITUTE</b>	
Pigmente ..	167	Pigments ..	167
Mediums ..	168	Media ..	168



SUID-AFRIKAANSE INSTITUUT	WOLTEKSTIEL-NAVORSINGS-			
Fundamentele Navorsingswerk	.. ..	..	..	169
Tegniese Ondersoeke	.. ..	..	..	169
Publikasies	.. ..	..	..	169
<b>BYLAAG I</b>				
Navorsingsbeurse en assistenskepe wat deur die W.N.N.R. gedurende 1955 toegeken is				xi
<b>BYLAAG II</b>				
Publikasies	.. ..	..	..	xxii
<b>BYLAAG III</b>				
Finansiële State	.. ..	..	..	xxviii

SOUTH AFRICAN WOOL TEXTILE RESEARCH INSTITUTE				
Fundamental Research	.. ..	..	..	169
Technical Investigations	.. ..	..	..	169
Publications	.. ..	..	..	169
<b>APPENDIX I</b>				
Research bursaries and assistantships awarded during 1955	.. ..	..	..	xi
<b>APPENDIX II</b>				
Publications	.. ..	..	..	xxii
<b>APPENDIX III</b>				
Financial Statements	.. ..	..	..	xxviii



JOHN DODGSON.

*Die Raad in Sitting.*

*The Council in Session.*

*(l.n.r./left to right): Mnr./Mr. J. E. Worsdale, Mnr./Mr. F. G. Hill, Mev./Mrs. P. N. Botha (notuleerder/recorder), Mnr./Mr. A. J. Miller-Smit (Sekretaris-Tesourier/Secretary-Treasurer), Dr. P. J. du Toit, Dr. S. M. Naudé (President), Mnr./Mr. E. W. Dohse (Vise/Vice-President), Dr. F. J. de Villiers, Dr. E. Taberner, Dr. H. O. Mönnig, Dr. H. J. van Eck, Dr. E. T. Stegmann.*

## Samestelling en Vergaderinge van die Raad

Lede van die Raad op 5 Oktober 1954 was:

- Dr. S. M. Naudé .. *President*
- Dr. T. B. Davie .. *Prinsipaal, Universiteit Kaapstad*
- Dr. F. J. de Villiers .. *Nywerheidsadviseur vir die Departement van Handel en Nywerheid, en Voorsitter van die S.A. Raad vir Standaarde.*
- Dr. P. J. du Toit, F.R.S. *Voorsitter van die Raad vir Wetenskaplike Navorsing in Afrika Suid van die Sahara, en gewese President van die W.N.N.R.*
- Dr. H. O. Mönnig .. *Besturende Direkteur, Agricura Laboratoria Bpk., en Voorsitter van die Raad van die Universiteit van Pretoria.*
- Mnr. P. E. Rousseau .. *Besturende Direkteur, S.A. Steenkool-, Olie- en Gas-korporasie Bpk.*
- Dr. E. T. Stegmann .. *Professor in Wiskunde, Universiteit Stellenbosch*
- Mnr. T. P. Stratten .. *Besturende Direkteur, Union Corporation, Ltd.*
- Dr. E. Taberner .. *Direkteur, African Explosives and Chemical Industries, Ltd.*
- Dr. R. W. Wilcocks .. *Gewese Rektor, Universiteit Stellenbosch*
- Mnr. J. E. Worsdale .. *Voorsitter en Besturende Direkteur, White's S.A. Portland Cement Co. Ltd.*

Teen die end van 1954 het mnr. T. P. Stratten uit die Raad bedank. Sy plek en die van dr. B. F. J. Schonland, wat vroeër in die jaar bedank het by sy aanstelling as Adjunk-Direkteur van die Britse Atoomkraginrigting, Harwell, is op 1 Januarie 1955 gevul deur dr. H. J. van Eck, voorsitter en besturende direkteur van die Nywerheidsontwikkelingskorporasie van S.A. Bpk., en mnr. F. G. Hill, konsulerende ingenieur, Rand Mines Ltd. Op 1 Februarie is prof. E. T. Stegmann se aanstelling as Raadslid hernieu vir 'n verdere drie jaar.

## Membership and Meetings of the Council

Membership of the Council on 5th October, 1954, was:—

- Dr. S. M. Naudé .. *President*
- Dr. T. B. Davie .. *Principial, University of Cape Town.*
- Dr. F. J. de Villiers .. *Industrial Adviser to the Minister of Economic Affairs and Chairman of the S.A. Standards Council.*
- Dr. P. J. du Toit, F.R.S. *Chairman of the Council for Scientific Research in Africa South of the Sahara and former President of the C.S.I.R.*
- Prof. H. O. Mönnig .. *Managing Director, Agricura Laboratoria Ltd., Chairman of the Council of the University of Pretoria.*
- Mr. P. E. Rousseau .. *Managing Director, S.A. Coal, Gas and Oil Corporation Ltd.*
- Prof. E. T. Stegmann .. *Professor of Mathematics, University of Stellenbosch.*
- Mr. T. P. Stratten .. *Managing Director, Union Corporation, Ltd.*
- Dr. E. Taberner .. *Director, African Explosives and Chemical Industries Ltd.*
- Prof. R. W. Wilcocks .. *Former Rector, University of Stellenbosch.*
- Mr. J. E. Worsdale .. *Chairman and Managing Director, White's S.A. Portland Cement Co. Ltd.*

Towards the end of 1954 Mr. T. P. Stratten resigned from the Council owing to pressure of work. His place and that of Dr. B. F. J. Schonland, who had resigned earlier in the year on his appointment as Deputy Director of the British Atomic Energy Research Establishment, Harwell, were filled on 1st January, 1955, by Dr. H. J. van Eck, Chairman and Managing Director of the Industrial Development Corporation of S.A. Ltd., and Mr. F. G. Hill, Consulting Engineer, Rand Mines Ltd. On the 1st February, Prof. E. T. Stegmann's appointment to the Council was renewed for a further term of three years.



### **Lidmaatskap en Vergaderings van die Uitvoerende Komitee**

Die Uitvoerende Komitee het vier keer gedurende die jaar vergader. Die lede was

Dr. S. M. Naudé (*Voorsitter*)

Dr. F. J. de Villiers

Dr. P. J. du Toit, met

Dr. E. Taberner en mnr. J. E. Worsdale as plaas-vervangende lede.

### **Sekretaris-Tesourier**

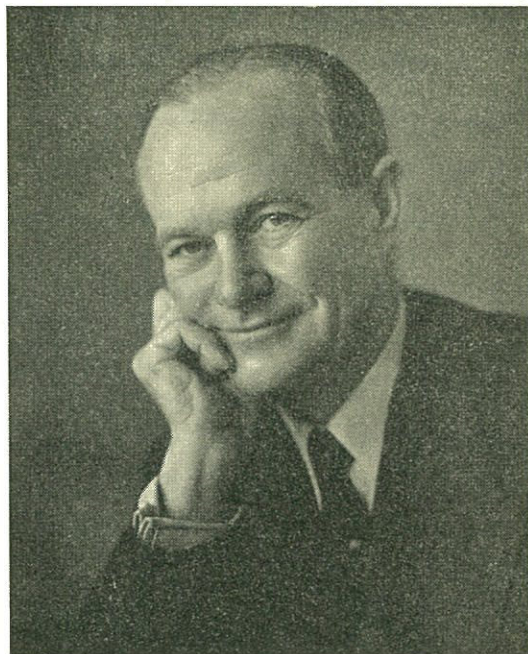
Mnr. A. J. Miller-Smit, B.A., M.Com. is op 15 Augustus 1955 aangestel as Sekretaris/Tesourier, in die plek van mnr. J. R. Sorrie wat bedank het.

### **Navorsingsadvieskomitees**

Soos in vorige jare is die Raad dank verskuldig aan die groot aantal wetenskaplikes en nyweraars wat hul tyd opgeoffer het om in die nasionale advieskomitees te dien en leiding te gee aan die navorsingswerkzaamhede van sy laboratoriums en institute.



*Mnr./Mr. A. J. Miller-Smit.*



*Mnr./Mr. F. G. Hill.*

### **Membership and meetings of the Executive Committee**

The Executive Committee met four times during the year. The members were

Dr. S. M. Naudé (*Chairman*).

Dr. F. J. de Villiers.

Dr. P. J. du Toit, with

Dr. E. Taberner and Mr. J. E. Worsdale as floating alternates.

### **Secretary Treasurer**

Mr. A. J. Miller Smit, B.A., M.Com., was appointed Secretary/Treasurer on 15th August, 1955, to fill the vacancy caused by the resignation of Mr. J. R. Sorrie.

### **Research Advisory Committees**

As in past years, the Council is indebted to the large number of scientists and industrialists who gave up their time to serve on the national advisory committees which guided the research activities of its laboratories and institutes.



# Algemene Oorsig

## Die Eerste Tien Jaar

*„Ek is daarvan oortuig dat hierdie liggaam een van die belangrikste organisasies vir die vooruitgang van die land sal word. Die tyd het aangebreek dat ons ons eie werk moet doen en die vraagstukke waarvoor Suid-Afrika te staan sal kom, self moet aanpak. Ons moet ons eie wetenskaplike hantering van daardie vraagstukke ontwikkel . . . .*

*Die wetenskap het met reusestappe vooruitgegaan en almal begin al hoe meer besef dat wetenskaplike navorsing 'n saak van die allergrootste belang is. Aan u Raad word hierdie taak toevertrou. Ek hoop u sal volle sukses behaal en die land help.”*

Tien jaar het verloop sedert generaal J. C. Smuts hierdie woorde gebruik het toe die Wetenskaplike en Nywerheidsnavorsingsraad op 8 Oktober 1945 vir sy eerste vergadering byeengekom het. In hierdie tien jaar het die personeel van die Raad tot oor 1,000 uitgebrei en sy jaarlikse uitgawes tot oor 'n miljoen pond. In die volgende paragrafe word gepoog om die ontwikkeling van die Raad gedurende die tien jaar in breë trekke te skets en sy werksaamhede op te som.

### vroë beplanning

Na 'n breedvoerige studie van die heersende toestande in Suid-Afrika en ander lande, het die eerste Raad, onder die presidentskap van dr. B. F. J. Schonland, F.R.S., besluit dat die bevordering van wetenskaplike en industriële navorsing in Suid-Afrika langs vier hoofweë nagestreef moes word:

- (1) die oprigting en inbedryfstelling van sentrale laboratoriums vir fundamentele sowel as toegepaste navorsingswerk waardeur die Regering en die nywerheid met die basiese fasiliteite vir moderne wetenskaplike navorsingswerk kan voorsien word;
- (2) die aansporing van S.A. Nyweraars om hul eie navorsingswerk te onderneem deur vir hulle vrystelling van inkomstebelasting op navorsingsuitgawes te verkry, deur regstreekse finansiële bystand aan koöperatiewe navorsingsverenigings te verleen en deur in die Raad se laboratoriums vertroulike navorsingswerk vir privaatfirmas op kontrak te verrig;
- (3) die opleiding van navorsers te ondersteun deur 'n stelsel van nagraadse studiebeurse en navorsingstoekennings aan die universiteite; en eendelik
- (4) die verskaffing van 'n omvattende wetenskaplike inligtings- en skakeldiens wat die resultate van navorsingswerk onverwyld beskikbaar sal stel vir toepassing in nywerhede en Suid-Afrikaanse

# General Review

## The First Ten Years

*“I am confident that this body will become one of the most important organizations of advancement in this country. The time has come when we must tackle our own job and the problems which lie before South Africa. We must develop our own scientific handling of those problems. . . .*

*“Science has come forward in gigantic strides and, more and more, everyone is beginning to feel that scientific research is a matter of vital importance. To your Council is entrusted this work. I hope you will have a full measure of success and help the country.”*

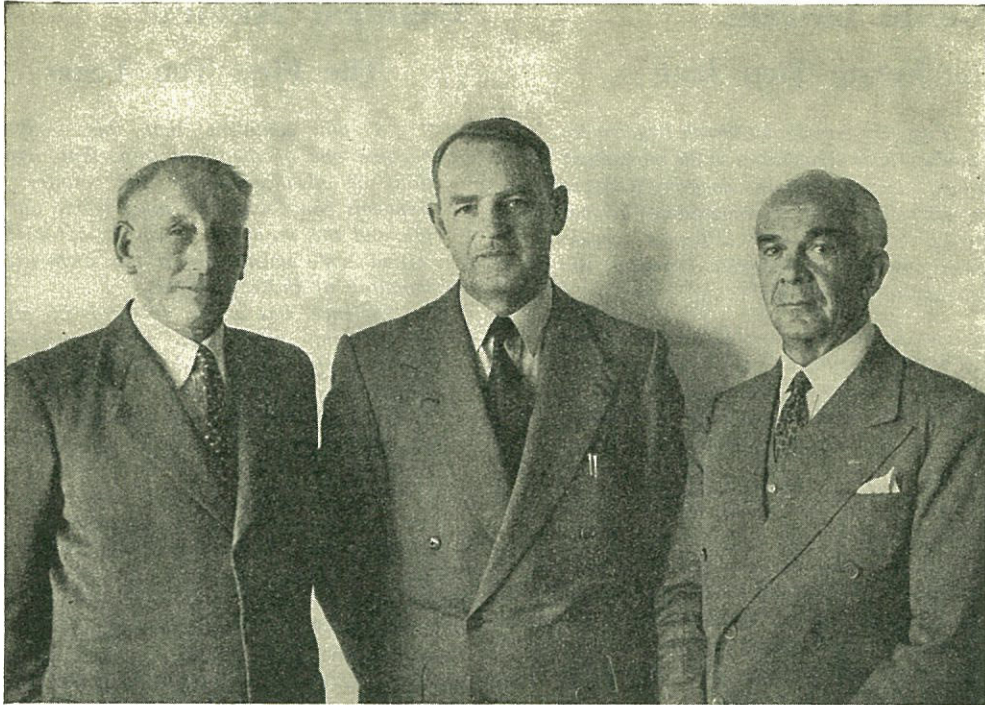
Ten years have passed since the late General J. C. Smuts, Prime Minister of the Union of South Africa, spoke these words when the Council for Scientific and Industrial Research assembled for its first meeting on the 8th of October, 1945. In these ten years the staff of the Council has grown to nearly a 1,000 and its annual expenditure to over a million pounds. In the following paragraphs an attempt will be made to outline the development and review the work of the Council during the past ten years.

### EARLY PLANNING

After studying conditions in South Africa and other countries, the first Council, under the presidency of Dr. B. F. J. Schonland, F.R.S., decided that the promotion of scientific and industrial research in South Africa should be directed along four main lines:—

- (1) providing the Government and Industry with the basic facilities for both fundamental and applied research by establishing and operating central laboratories,
- (2) inducing manufacturers to conduct their own research by remitting income tax on research expenditure, providing direct financial assistance to co-operative industrial research associations and by undertaking confidential research in its own laboratories on contract with private firms,
- (3) assisting in the training of research workers by a system of post-graduate bursaries and research grants in the universities, and
- (4) providing comprehensive scientific liaison and information services to keep South African scientists and industrialists in touch





ALAN YATES.

*Die Eerste Drie Presidente  
van die W.N.N.R.*

*The First Three Presidents  
of the C.S.I.R.*

*Links/Left: Dr. B. F. J. Schonland, F.R.S.—1945–1950. Middel/Centre: Dr. S. M. Naudé.  
Regs/Right: Dr. P. J. du Toit, F.R.S.—1950–1952.*

wetenskaplikes en nyweraars op die hoogte sal hou van navorsingswerk wat elders in die wêreld gedoen is.

Die snelle uitbreiding van die Raad se werksaamhede sedert sy stigting, getuig van die wysheid van hierdie vroeë beplanning.

#### UITBOUING VAN DIE LABORATORIUMS

Die eerste vyf jaar is hoofsaaklik gewy aan die oprigting, uitrusting en personeelvoorsiening van die Raad se ouere nasionale laboratoriums en die uitbouing van sy ander werksaamhede. Dit was destyds uiters moeilik om wetenskaplike uitrusting aan te koop, weens die algemene tekorte wat deur die oorlog meegebring is, maar die posisie het geleidelik verbeter sodat die nuwe laboratoriums vandag kan spog met fasiliteite wat nie ondergeskik is aan dié van enige soortgelyke organisasie in die wêreld nie.

Die vraagstuk om geskikte personeel te vind, was nog moeiliker. Uit hoofde van sy status as regs persoon wat hom onafhanklik gemaak het van sommige van die beperkings van die staatsdiensregulasies, wat veral bedoel

with research undertaken elsewhere in the world and encourage the rapid utilization of the results of research.

The rapid growth of the Council's activities since its establishment bears testimony to the wisdom of this early planning.

#### BUILDING UP THE LABORATORIES

The first five years were devoted mainly to the establishment, staffing and equipping of the Council's earlier national Laboratories and the building up of its other activities. The purchase of scientific equipment at the time was extremely difficult owing to the overall shortages caused by the war, but the position improved gradually until the new laboratories could boast of facilities not inferior to those available in any similar organization in the world.

More difficult was the problem of finding suitable men. By virtue of its corporate status which freed it from some of the restrictions inherent in the Public Service, which is concerned mainly with the administrative and regulatory functions of govern-



is vir die uitoefening van administratiewe en regulatoriese staatsfunksies, kon die Raad uit die staanspoor vir 'n atmosfeer sorg waarin die skeppende wetenskaplike sy vindingrykheid en inisiatief na die beste van sy vermoë aan die dag kon lê. Die W.N.N.R. kon dus verwag om uitstaande persone aan te lok en te behou teen kleiner salarisse as dié wat hulle elders kon kry. Die algemene wêreldtekort aan opgeleide wetenskaplikes gedurende die tyd is egter verskerp in Suid-Afrika, waar die opleiding van navorsers nog uiters gebrekkig was. Belowende jong wetenskaplikes het dikwels nie teruggekeer van oorsese navorsingsinrigtings waar hulle gaan studeer het nie, vanweë die groter geleentheid daar—'n proses van erosie wat een van Suid-Afrika se kosbaarste bates ernstig verminder het. Aan die ander kant was dit vanweë die onsekere toestand van Europa moontlik om 'n aantal uitstaande wetenskaplikes uit die buiteland te trek. Op dié wyse het sowat 30 wetenskaplikes uit ander dele van die Gemenebes en ander lande hulle in die afgelope tien jaar by die W.N.N.R. gevoeg en hul vindingrykheid aangewend vir die ontwikkeling van wetenskaplike navorsing in Suid-Afrika.

Suid-Afrika moet egter op sy eie jong manne en vroue staatmaak en dit was nog altyd die Raad se beleid om die grootste deel van sy personeel plaaslik te werf. Die W.N.N.R. was baie gelukkig dat hul eerste President, dr. Schonland, 'n wetenskaplike van wêreldfaam was, wie se werk vir Suid-Afrika groot onderskeiding gebring het. Hy kon sommige van Suid-Afrika se toonaangewende navorsers rondom hom skaar om aan die hoof te staan van die W.N.N.R.-laboratoriums. Onder hulle was prof. S. Meiring Naudé van Stellenbosch (die huidige President), wie benoem is tot hoof van die Nasionale Fisiese Laboratorium, dr. W. S. Rapson van Kaapstad, benoem tot hoof van die Nasionale Chemiese Navorsingslaboratorium en dr. S. Biesheuvel (wie so pas beroemdheid verwerf het vir die sukses wat hy behaal het met die keuring van lugmagpersoneel) aangestel om die Nasionale Instituut vir Personeelnavorsing te ontwikkel. Ook het hy die voordeel gehad van die hulp en raad van mnr. E. W. Dohse (die huidige Vice-President en destyds Hoofingenieur van die Departement van Openbare Werke), wie vroeg in 1945 belas is met die organisasie en leiding van die Nasionale Bounavorsingsinstituut in afwagting van die stigting van die W.N.N.R. Dié persone was in die wetenskaplike wêreld so hooggeag, dat baie jong, belowende en bekwame Suid-Afrikaanse wetenskaplikes hulle na die W.N.N.R. gevolg het.

Baie van hierdie jong manne en vroue is oorsee gestuur vir gevorderde opleiding en vir ondervinding in die gebruik van die jongste tegniek en toerusting voordat hulle teruggekeer het om die verskillende gespesialiseerde afdelings van 'n moderne navorsingsorganisasie uit te bou. Die beleid van die W.N.N.R. om lede van sy navorsingspersoneel oorsee te stuur sodat hulle op die hoogte kon bly met oorsese ontwikkeling, het groot diwidende afge-

ment, the Council was initially able to provide an atmosphere in which the creative scientist could exercise his ingenuity and initiative to the fullest of his ability. It could thus expect to attract and hold first-class men at salaries well below what they could command elsewhere. The general world shortage of qualified scientists at the time, however, had been accentuated in South Africa, where for many years the training of research workers had been largely neglected. Promising young scientists often failed to return from research laboratories overseas where they went to study, and remained because of the greater opportunities there—a process of erosion which seriously depleted one of South Africa's most priceless assets. On the other hand, owing to the troubled state of Europe it was possible to attract a number of outstanding scientists from overseas. In this way some 30 scientists from other parts of the Commonwealth and foreign countries have in the past ten years joined the



*Mr. E. W. Dohse who played an important part in the early organization of the N.B.R.I. and later became Vice-President of the C.S.I.R.*

*Mnr. E. W. Dohse wat 'n belangrike rol gespeel het in die ontwikkeling van die N.B.N.I. en later Vice-President van die W.N.N.R. geword het.*





*Dr. W. S. Rapson.*

werp en word nog steeds toegepas. Gedurende die tien jaar van sy bestaan het hy 94 van sy navorsers op besoeke wat wissel van twee maande tot twee jaar, na die beroemde navorsingslaboratoriums van die Verenigde Koninkryk, Europa en Noord-Amerika uitgestuur.

Die Raad se personeel het geleidelik uitgebrei in verhouding tot die oprigting en uitbouing van sy nasionale laboratoriums. Die eerste laboratoriums wat in volle werking getree het, was die Nasionale Bounavorsings-instituut en die Telekommunikasie-navorsingslaboratorium, waarvan die kerne gedurende 1945 gevorm is onder die Departement van Handel en Nywerheid en die Departement van Verdediging onderskeidelik. Hulle is in 1946 gevolg deur die Nasionale Fisiese Laboratorium en die Nasionale Buro vir Personeelnavorsing. Die direkteur van die Nasionale Chemiese Navorsingslaboratorium is in 1947 aangestel en die werklike laboratorium het in 1948 in werking getree, hoewel twee los eenhede van die laboratorium sedert 1946 by die Universiteit van Kaapstad en die Suid-Afrikaanse Instituut vir Mediese Navorsing onderskeidelik met hulle werksaamhede begin het.

Vir die volgende paar jaar het die Raad hom toegespits op die uitbouing van die genoemde vyf inrigtings, maar met verloop van tyd het dit duidelik geword dat sekere

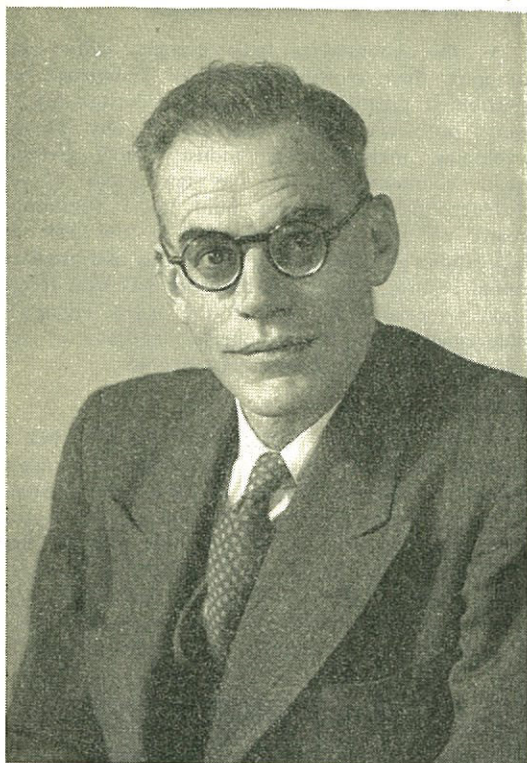
C.S.I.R. and their skills have been applied to the development of scientific research in South Africa.

But it is upon her own young men and women that South Africa must depend, and it has always been the Council's policy to recruit most of its staff locally. The C.S.I.R. was fortunate indeed that its first President, Dr. Schonland, was a scientist of international repute whose work has brought much distinction to South Africa. He was able to gather round him some of South Africa's leading research men to take charge of the C.S.I.R. laboratories—among them Prof. S. Meiring Naudé, from Stellenbosch, to head the National Physical Laboratory, and later to succeed to the post of President; Dr. W. S. Rapson, from Cape Town, to head the National Chemical Research Laboratory; and Dr. S. Biesheuvel, fresh from widely acclaimed success in the selection of Air Force personnel, to develop the National Institute for Personnel Research. At the same time he had the benefit of help and advice from the present Vice-President, Mr. E. W. Dohse, who as Chief Engineer of the Public Works Department, had been seconded early in 1945 to organize and act as first Director of the National Building Research Institute, in anticipation of the establishment of the C.S.I.R. Such was the scientific standing of these men that many young South



*Dr. S. Biesheuvel.*





*Mr. J. E. Jennings, Direkteur van die N.B.N.I. van 1946-1954.*

*Mr. J. E. Jennings, Director of the N.B.R.I. from 1946-1954.*

afdelings van hulle werksaamhede die oprigting van verdere aparte institute vereis. Gevolglik is in 1954 die Nasionale Voedingnavorsingsinstituut gestig wat navorsingswerk op dié gebied van die Nasionale Chemiese Navorsingslaboratorium oorgeneem het. Werktuigkundige ingenieurswese is sedert 1951 bedien deur 'n klein Eenheid wat onder beskerming gestaan het van die Nasionale Fisiese Laboratorium totdat die Eenheid in 1955 omskep is tot die selfstandige Nasionale Navorsingsinstituut vir Werktuigkundige Ingenieurswese. Navorsing in verband met materiaal vir padbolae het reeds in 1950 begin toe die Navorsingseenheid vir Bitumeneuse Bindstof gestig is as 'n koöperatiewe navorsingsinrigting wat sy fondse getrek het van die Departement van Vervoer, die Provinsiale Administrasies en 'n aantal produsente van bitumeneuse materiaal, maar onder direkte beheer van die W.N.N.R. geplaas is. In 1955 is die Nasionale Padnavorsingsinstituut in die lewe geroep om alle afdelings van padnavorsing te behartig.

African scientists, of great promise and ability, followed them into the C.S.I.R.

Many of these young men and women have been sent overseas for advanced training and to gain experience in the use of the latest techniques and equipment before returning to build up the various specialized sections which make up a modern research organization. This policy of sending members of its research staff overseas to keep them abreast of overseas developments has paid rich dividends, and is being continued by the C.S.I.R. which, during the ten years of its existence, has sent 94 of its research scientists on trips varying from two months to two years to the famous research laboratories of the United Kingdom, Europe and North America.

The expansion of the Council's staff has been gradual and in keeping with the establishment and building up of its national laboratories. The first laboratories to become fully operative were the National Building Research Institute and the Telecommunications Research Laboratory, the nuclei of which had been set up during 1945 under the Department of Commerce and Industries and the Department of Defence respectively. These were followed during 1946 by the National Physical Laboratory and the National Bureau for Personnel Research. The Director of the National Chemical Research Laboratory was appointed in 1947, and the laboratory proper started research work in 1948, although two detached units of this laboratory had been working at the University of Cape Town and the South African Institute for Medical Research respectively since 1946.

For the next few years the Council concentrated on building up these five laboratories but, in the course of time, it became apparent that some of the activities in which they engaged justified the setting up of further separate laboratories. Thus in 1954 the National Nutrition Research Institute was established and took over research in this field from the National Chemical Research Laboratory. From 1951 onwards mechanical engineering was catered for under the wing of the National Physical Laboratory by a small unit which was converted to the National Mechanical Engineering Research Institute in 1955. Research on road surfacing materials was undertaken by the Bituminous Binder Research unit established in 1950 as a co-operative research institute financed by the Department of Transport, the Provincial Administrations and a number of producers of bituminous materials and directly controlled by the C.S.I.R. During 1955 the National Institute for Road Research was established, and caters for all aspects of road research.



## DIE NASIONALE LABORATORIUMS

Namate die laboratoriums voorsien is van uitrusting en personeel, het hulle toenemende gespesialiseerde kennis 'n aansienlike bydrae gelewer tot 'n beter begrip van die menigvuldige probleme waarmee ons snel ontwikkelende fabriekswese en stede te doen gekry het.

In die tien jaar van sy bestaan het die W.N.N.R. 'n wesenlike rekord van prestasie opgebou, wat weerspieël word in die lyste van publikasies wat as bylaes by hierdie en vorige jaarverslae aangegee word. Baie van die werk het ook oorsee erkenning ontvang. Enkele van die belangriker prestasies van die Raad se inrigtings word in die volgende paragrawe bespreek.

### Fisika

Op die gebied van fisika het die W.N.N.R. wetlike verpligtinge vir die vasstelling en instandhouding van die Suid-Afrikaanse standaarde van meting en vir die sertifisering in terme van hierdie basiese standaarde, van instrumente en sub-standaarde wat deur die S.A.B.S., universiteite, regeringskantore en nywerhede gebruik word. Daar is reeds nasionale standaarde vir elektriese spanning, weerstand, massa en temperatuur opgestel. Namate geskikte huisvesting en die fasiliteite vir die

## THE NATIONAL LABORATORIES

As the laboratories have become staffed and equipped, their growing specialized knowledge has contributed greatly to the better understanding of many problems which have faced our rapidly developing manufacturing industry and growing urban communities. In the ten years of its existence the C.S.I.R. has built up a substantial record of achievement reflected in the lists of publications given as appendices to this and previous annual reports. Much of this work has won recognition overseas. A few of the more important achievements of the Council's laboratories are discussed in the following paragraphs.

### Physics

In the field of physics, the C.S.I.R. has a statutory responsibility for establishing and maintaining the South African standards of physical measurement and for the certification of the instruments and substandards used by the S.A.B.S., the Universities, Government and Industry in terms of these basic standards. National standards for voltage, resistance, mass and temperature have been set up. Several other important standards will be



*Die metode om radioisotope in die vlerkpunte van vliegtuie te vervoer, is vir die eerste keer deur die S.A. Nasionale Fisiese Laboratorium ontwikkel.*

*The wingtip method for the transport of radio-isotopes was first developed by the S.A. National Physical Laboratory.*



instandhouding van konstante toestande beskikbaar word in inrigtings wat nou in aanbou is, sal verskeie ander belangrike standaarde ook ingestel word.

Die Nasionale Fisiese Laboratorium het die voortou geneem in S.A. met die toepassing van radioisotope in basiese navorsing, die mediese wetenskap en nierversnietende toetse in die nywerheid. Die laboratorium het baanbrekerswerk gedoen toe hulle, in medewerking met die Suid-Afrikaanse Lugdiens, begin het met die vervoer van radioisotope in die vlerkspunte van vliegtuie. Die metode, wat die gewig van beskuttingsmateriaal en gevolglik ook die koste van lugvervoer aansienlik verminder, word nou in baie dele van die wêreld vir die vervoer van isotope gebruik. S.A. is tans die grootste invoerder onder die Britse Statebondslande van isotope uit Brittanje, wat die grootste uitvoerder is. 'n 16 Mev.-siklotron wat deur die N.F.L. ontwerp is om te dien as 'n middelpunt vir kernfisikanavorsing en die opleiding van kernfisici in Suid-Afrika, nader nou voltooiing. 'n Aanduiding van die industriële vordering wat in die afgelope jare in Suid-Afrika gemaak is, is die feit dat, afgesien van die ontwerp van hierdie groot instrument, dit feitlik uitsluitend deur Suid-Afrikaanse firmas en uit plaaslike materiale vervaardig is. 'n Ander belangrike hulpmiddel vir navorsingswerk wat tans in aanbou is, is 'n elektroniese analoogrekenmasjien. Dit sal die kern vorm van 'n berekeningsentrum in die laboratorium, wat in 'n groot behoefte sal voorsien in soverre dit 'n omvattende rekenrekeningsentrum beskikbaar sal stel aan die navorsingslaboratoriums van die W.N.N.R. asook aan die universiteite en nywerhede. Die onlangs voltooide akoestieklaboratorium verskaf spesiale geriewe, soos 'n weerklankvrye kamer, weerkaatsingskamer, en 'n ateljee met 'n verstelbare naklankperiode, wat gebruik word vir metings wat nodig is vir die behoorlike akoestiese ontwerp van geboue en in fundamentele navorsingswerk oor die beginsels van akoestiese ontwerp.

Fundamentele ondersoek van die plastiese vervorming van metale, deur gebruik te maak van X-straaldiffraksie en elektronmikroskopie, het baie bygedra tot 'n beter begrip van die onderliggende beginsels van ontwinging en vervorming in metale wat koud bewerk word. Die resultate wat verkry is tydens massaspektrometriese studies oor die ouderdom van die rotse van die Witwatersrandstelsel, wat die Unie se belangrikste goudafsettings bevat, het heelwat binnelandse sowel as buitelandse belangstelling gewek. Temperatuurmetings in boorgate deur prospekterders gemaak, het inligting oor die vloei van hitte in die aardkors verskaf wat waardevol was vir die voorspelling van hittegrade wat in diep myne kon verwag word. Ondersoek van die magnetiese eienskappe van rotsonderlinge uit goudmyne het lig gewerp op die voorgeskiedenis van die aarde se magnetiese veld.

In samewerking met die Departement van Landbou

established as soon as suitable accommodation and the facilities for maintaining constant conditions become available in buildings now under construction.

The S.A. National Physical Laboratory has taken the lead in the application of radio-isotopes which are used in basic research, medicine and non-destructive testing in industry. Pioneering work was done by this laboratory when, in co-operation with South African Airways, it initiated the wingtip method for the transport of radio-isotopes. This method of transport which considerably reduces the weight of shielding material and consequently the cost on air freight, is now used for the transport of isotopes in many parts of the world. South Africa is now the largest Commonwealth importer of isotopes from the United Kingdom, which is the largest exporter.

A 16 Mev cyclotron designed by the N.P.L. to serve as a focal point for nuclear physics research, and the training of nuclear physicists in South Africa, is now nearing completion. An indication of the industrial progress that has been made in South Africa in recent years is the fact that, apart from the design of this large instrument, its manufacture has been undertaken almost exclusively by South African firms, and locally-produced materials have been used throughout. Another important aid to research, at present under construction, is an analogue electronic computing machine. This will form the nucleus of a computing centre in the laboratory, which will fill a long-felt need by offering a comprehensive computing service, not only to the research laboratories of the C.S.I.R., but also to the universities and industrial firms. A recently completed acoustics laboratory provides special facilities, such as an anechoic chamber, reverberation room, and studio with variable echo period, which are necessary for the measurements needed for the proper acoustical design of buildings and for fundamental research into the principles of acoustical design.

Fundamental research, using X-ray diffraction and electron microscope techniques, into the plastic deformation of metals has contributed considerably to an understanding of the basic concepts of dislocations and cold-work distortion of metals. The results of the application of mass spectrometric techniques to the study of the age of the rocks of the Witwatersrand System, which contains the Union's principal gold deposits, has aroused interest both here and overseas. Measurements of the temperatures in boreholes made for prospecting have yielded information on the flow of heat in the Earth's crust, which is of value in predicting the temperatures likely to be encountered in deep mines. A study of the magnetic properties of samples of



word 'n opname gemaak van biologies belangrike spoorelemente in S.A. gronde. Spektrografiese tegniek word hiervoor aangewend.

### Chemie

Op die gebied van skeikunde het die W.N.N.R. 'n aantal projekte aangepak in medewerking met die Departement van Landbou. Dit behels werk oor die verwydering van uitvloeiels van die suiwelnywerheid, 'n studie van die bitter bestanddele wat soms in huishoudelike variëteite van die cucurbitaceae soos komkommers, skorsies en ander tuingroentes gekry word, die karakterisering van die kleifaksie van gronde, die chemie van die spysvertering van herkouers, en die vergiftiging van vee deur giftige plante. In al hierdie studies is die gespesialiseerde hulpmiddels van die Nasionale Chemiese Navorsingslaboratorium aangewend vir fundamentele aspekte van die vraagstuk, terwyl die laboratorium van die Departement hulle toegelê het op die praktiese sy van die werk. 'n Soortgelyke verstandhouding heers met die Raad se mediese navorsingseenhede, wat hul basiese chemiese vraagstukke na hierdie laboratorium stuur vir oplossing.

Heelwat van die werk van die N.C.N.L. het betrekking op die chemiese geartheid van nywerheidsgrondstowwe, bv. chroom, mangaan, klei, wol, wolwas, visolie, seewier

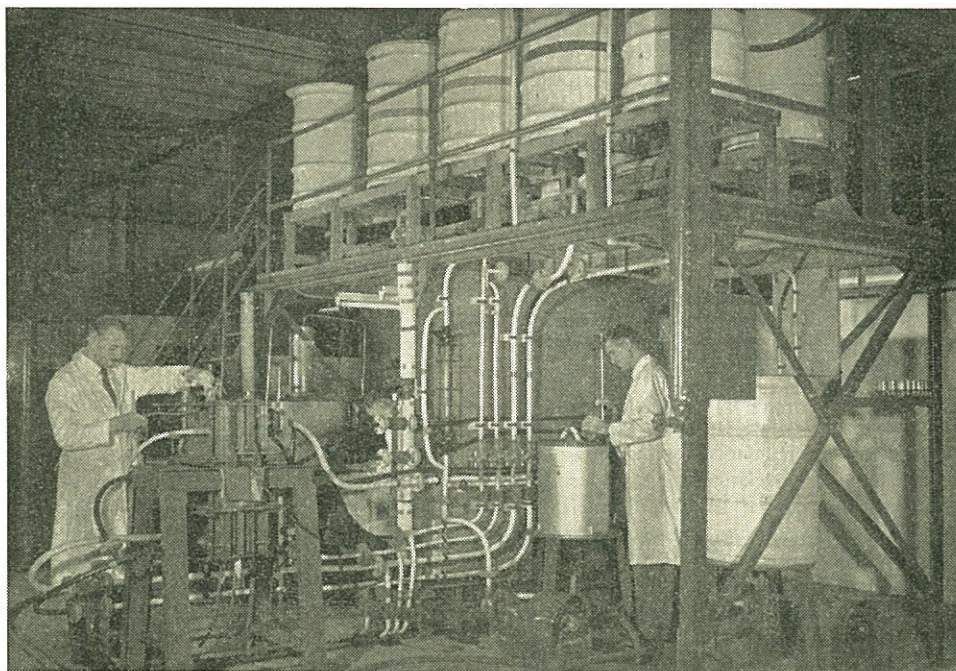
rock from the gold mines has thrown some light on the earlier history of the Earth's magnetic field.

In collaboration with the Department of Agriculture, spectrographic techniques are being applied to a survey of biologically important trace elements in South African soils.

### Chemistry

In the field of chemistry, the C.S.I.R. has entered upon a number of collaborative projects with the Department of Agriculture. These include work into the disposal of effluents from the dairy industry, a study of the bitter principles sometimes found in the domestic varieties of the cucurbits such as a cucumber, gem squashes and other garden vegetables, the characterization of the clay fraction of soils, the chemistry of ruminant digestion, and the poisoning of stock by poisonous plants. In all these studies the specialized resources of the National Chemical Research Laboratory were brought to bear on fundamental aspects of the problem, while the laboratories of the Department concentrated on the practical side of the work. A similar relationship exists with the Council's medical research units which pass on their basic chemical problems to this laboratory for solution.

Much of the work of the N.C.R.L. is concerned with the study of the chemistry of industrial raw



*'n Proefinstallasie vir navorsing oor die ont-souting van water in die Nasionale Chemiese Navorsingslaboratorium.*

*Pilot plant for water demineralization research in the National Chemical Research Laboratory.*



en wattlehout. Die doel van die studies is om 'n voldoende agtergrond van fundamentele feite aan nywerhede te verskaf sodat hulle beter gebruik kan maak van die natuurlike hulpbronne. Spesiale tegniek wat gedurende die studies deur die personeel ontwikkel is, word gedurig met voordeel gebruik in die ondersoek van praktiese probleme ten behoeve van vervaardigers.

Water is een van Suid-Afrika se skaarsste natuurlike hulpbronne en dit is dus nie verbasend dat watnavorsing altyd 'n belangrike werksaamheid in die N.C.N.L. was nie. Alle aspekte van watervoorsiening en -behandeling is bestudeer. Die werk het gestrek van biologiese en chemiese opnames van rivierbekkens tot die hergebruik van industriële en munisipale uitvloeiels. Van buitengewone belang is die laboratorium se werk oor die ont-souting van brakwaters. Die projek het op betreklik klein skaal in 1953 begin, maar die praktiese implikasies was so groot dat die mynbedryf kort daarna aansienlike finansiële steun verleen het sodat die werk heelwat vinniger kon voortgaan. Die proses wat uit dié navorsings-werk voortgevloei het, word nou op groot skaal in een van die Oranje-Vrystaatse goudmyne uitgetoets.

Op die gebied van fisiese skeikunde het 'n fundamentele ondersoek van die vloei en adsorpsie van gase deur poeiers en fyn verdeelde poreuse mediums baie bygedra tot ons kennis van hierdie onderwerp. Hoewel die werk fundamenteel is, het dit belangrike praktiese toepassing gevind by verskillende probleme bv. self-ontbranding van steenkool, werking van katalisatore in die produksie van olie uit steenkool, en oppervlakte-bepaling van fyn verdeelde stowwe soos sement en kleurstowwe.

### **Bounavorsing**

Die Nasionale Bounavorsingsinstituut is gestig in 'n tyd toe die nasleep van 'n lang oorlog ernstige tekorte aan huise, veral aan huisvesting vir die nie-blanke gedeelte van die bevolking, veroorsaak het. Destyds was daar baie teenstrydige menings oor die erns van die vraagstuk en oor die soort behuising wat nodig was. Een van die eerste belangrike projekte wat dus onderneem is, was 'n studie van die basiese menslike vereistes van behuising uit die oogpunt van gesondheid en essensiële sosiale geriewe. As gevolg hiervan kon die Nasionale Behuisings- en Beplanningskommissie die minimum standaarde neêr lê waarop ekonomiese huisontwerpe gebaseer kon word. Gedurende die werk het die Instituut 'n tegniek van sosio-ekonomiese opnames ontwikkel, sodat die behuisings-vereistes van verskeie groepe nou baie noukeurig bepaal kon word. Terselfdertyd is boukoste bestudeer, tesame met die koste van diensverskaffing en administratiekoste van dorpe. Ondersoek is ook ingestel in medewerking met munisipaliteite, oor plaatsing en ontwerp van naturelledorpe. Die bevinding van die navorsingsprojekte

materials, e.g., chromium, manganese, clay, wool, wool-wax, fish oils, seaweeds, and wattle wood. The object of these studies is to provide an adequate background of fundamental knowledge for use by Industry in the development of these natural resources. Through these studies the staff has developed research techniques which are constantly being applied to the solution of practical problems on behalf of manufacturing firms.

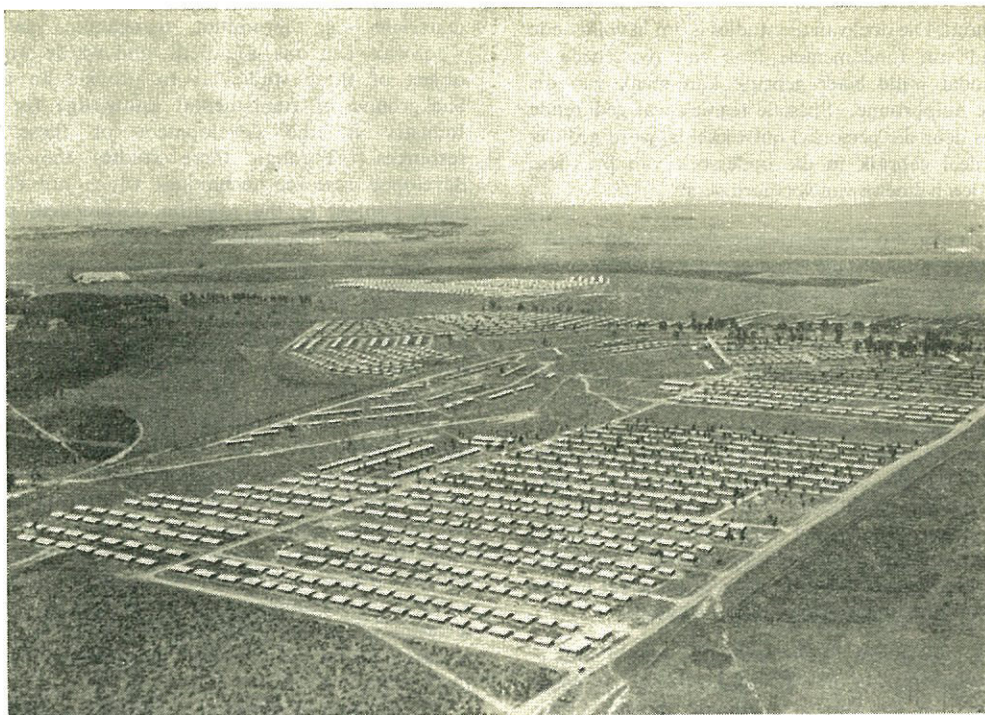
Water is among the scarcest of South Africa's natural resources, and it is not surprising to find that water research has always constituted a major activity in the N.C.R.L. All aspects of water supply and treatment have been studied from biological and chemical surveys of river basins to the reuse of industrial and municipal effluents. Of more than usual interest has been the Laboratory's work on the demineralization of saline waters. This project started on a relatively small scale during 1953, but the practical implications were so great that, shortly after, the Mining Industry gave substantial financial support which enabled the tempo of the work to be stepped up considerably. The process developed as a result of this research is now being tried out on a large scale on one of the Orange Free State gold mines.

In the field of physical chemistry, a fundamental investigation of the flow and adsorption of gases on powders and finely divided porous media has contributed much to our knowledge of this subject. Although fundamental, this work has proved to have a number of important practical applications, e.g., spontaneous combustion of coal, study of catalysts used in the production of oil from coal, and the measurement of the surface area of finely divided materials such as cement and paint pigments.

### **Building Research**

The National Building Research Institute was formed at a time when the aftermath of a long war had resulted in acute shortages in housing, particularly in accommodation for the non-European sections of the population. At the time there was much conflicting opinion as to the extent of the problem and the type of housing needed. Thus, one of the first major projects undertaken was a study of the basic human requirements of housing from the point of view of health and basic social amenities. This work enabled the National Housing and Planning Commission to lay down the minimum standards upon which economical house designs could be based. In continuation of this work, the Institute developed a socio-economic survey technique which enabled the housing requirements of various groups to be determined with great accuracy. At the same time, building costs were studied, together with the costs of providing services and of administration of townships. Studies of





DOTMAN PRETORIUS.

*Die naturelledorp, Kwa Thema, Springs, 'n geslaagde proefneming in die beplanning en bou van behuisingskemas vir stedelike Bantoes.*

*Kwa Thema Township, Springs, a successful experiment in the layout and building of urban Bantu housing developments.*

is op Springs in die Transvaal op volle skaal uitgetoets met uitstekende resultate. Die nuwe proefdorp, Kwa Thema, het reeds die model gevorm vir soortgelyke ontwikkelinge dwarsdeur die Unie. As gevolg van dié samewerking en die wetgewing wat dit moontlik gemaak het vir Bantoes om bouwvakwerkers te word, kan natuurlike behuisingskemas wat beter huisvesting bied as die wat algemeen in die verlede verskaf is, nou onderneem word teen sowat die helfte van die koste wat 'n paar jaar gelede nog nodig was.

Die werk van die N.B.N.I. is egter nie tot natuurlike behuising beperk nie. Die aard van die vraagstuk van „stygende kleigronde” wat ernstige barste in geboue veroorsaak, is vir die eerste keer deur die Instituut beseef en baie navorsingswerk is gedoen om die natuurlike verskynsels wat hierby betrokke is, te verklaar en om boumetodes te ontwerp vir die voorkoming van die barsting. Die Instituut word nou inderdaad beskou as een van die wêreld se toonaangewende gesaghebbendes op hierdie gebied van grondmeganika. Die Instituut kan ook aanspraak daarop maak dat dit die verwante vraagstuk van krimpende aggregate in beton, wat ook barsting in geboue veroorsaak, opgelos het. As gevolg van die werk kan boukontrakteurs nou duursame bouwerke lewer deur die

layout and siting of Native townships have been made with the co-operation of municipal authorities. At Springs, in the Transvaal, the results of these research projects were given a full-scale trial with outstanding results in the new Kwa Thema Township, which has set the pattern for similar developments in Native housing throughout the Union. As a result of this co-operative work and the enactment of legislation permitting the Bantu to work as craftsmen, Native housing schemes, providing superior accommodation to that commonly supplied in the past, can now be undertaken at approximately half what they would have cost only a few years ago.

The work of the N.B.R.I. has not been confined to work on Native housing. The problem of “heaving clay soils” which cause serious cracking in buildings, was first recognized for what it was by the Institute, which has done much towards elucidating the natural phenomena involved, and evolving methods of construction which overcome cracking. Indeed, the Institute is now regarded as one of the foremost World authorities on this aspect of soil mechanics. The Institute can claim the



gebruik van klip en sand uit sekere geologiese formasies te vermy. Hierdie formasies kom egter oor groot gebiede in die Unie voor en tans word navorsingswerk by die Instituut gedoen om geskikte behandelingsmetodes te vind wat veilige gebruik van die materiale sal verseker en die koste van die vervoer van aggregate oor lang afstande uit gruisgate buite die betrokke gebiede sal uitskakel.

'n Suksesvolle ondersoek na die oorsake van wegvreting in betonriole, wat gesamentlik deur die N.B.N.I. en die N.C.N.L. uitgevoer is, sal tot aansienlike besparings in die koste van rirole in baie Suid-Afrikaanse stede lei. Voordat hierdie werk gedoen is, is bevind dat rirole wat vir 'n dienstydperk van ten minste 40 jaar ontwerp is, in sommige plekke na slegs 15 jaar vervang moes word. In die navorsingswerk is bevind dat dit veroorsaak word deur bakterieë wat sulfiede in die riool omsit in swawelsuur wat dan die pype wegvreet. Die oplossing wat deur die Instituut aan die hand gedoen word, hang af van sekere wysigings aan die rioolstelsel en van 'n nuwe formulering vir die beton wat vir die vervaardiging van die pype gebruik word. Die resultate van hierdie navorsingsprojek word reeds deur sommige munisipale ingenieurs in Suid-Afrika toegepas en behoort aansienlike besparings vir die belastingbetaler teweeg te bring.

Voordat die N.B.N.I. begin ondersoek instel het na die geskiktheid van dolomietkalk vir bouwerk in Suid-Afrika, het die gebruik daarvan dikwels minderwaardige mortel en pleisters gelever wat groot skade veroorsaak het. Die Instituut se studie oor die vraagstuk het gelei tot 'n bevredigende metode vir die vervaardiging van goeie dolomietkalk, die gebruik waarvan nie soos voorheen buitensporige onderhouds- en afskrywingskoste tot gevolg sal hê nie.

Vir baie jare ondervind die Unie periodieke tekorte aan sement. Ten gevolge van werk van die N.B.N.I. word 'n nuwe bron van sement nou beskikbaar—die hoogoonkslakke van die Suid-Afrikaanse yster- en staalnywerheid. Hierdie tipe afvalprodukt word reeds lank in die buiteland gebruik, maar in die Unie het die mening bestaan dat die hoë magnesiagehalte wat inherent is in die Suid-Afrikaanse produk, dit ongeskik sou maak vir die vervaardiging van sement. Die werk van die N.B.N.I. het egter getoon dat 'n bevredigende produk uit Suid-Afrikaanse slakke vervaardig kan word.

### **Telekommunikasies**

Die Telekommunikasie-navorsingslaboratorium, het 'n uitstaande bydrae gelever tot die wetenskaplike prestige van die Unie. Sy studie van die kenmerke van die ionosfeer, waarvan kortgolfradioverbindinge afhanklik is, het 'n voorrekeningsdiens moontlik gemaak wat dit vir gebruikers van hoëfrekwensieradio soos die posdienste, die lugvaartdiens, die Suid-Afrikaanse Uitsaai-korporasie

credit for bringing to light the allied problem of shrinking concrete aggregates, which also cause buildings to crack. As a result of this work, contractors can now ensure sound construction by avoiding the use of rock and sand from certain geological formations. These formations, however, cover wide areas of the Union, and current research at the Institute is aimed at finding suitable methods of treatment which will enable them to be used with safety, obviating the expense of transporting aggregates over long distances from quarries outside the affected areas.

A successful investigation of the causes of corrosion in concrete sewers, undertaken jointly by the N.B.R.I. and N.C.R.L., will lead to considerable savings in the cost of sewers in many South African cities. Previous to this work it had been found that, in some places, sewers which were designed for a service life of at least 40 years, were having to be replaced after only 15 years. The research traced the cause to bacteria which converted sulphides in the sewage to sulphuric acid, which in turn attacked the pipes. The solution advocated by the Institute depends on certain modifications to the sewer system and on a new formulation of the concrete used for the manufacture of the pipes. The results of this research project are now being applied by municipal engineers in South Africa, and should result in appreciable savings to the ratepayers.

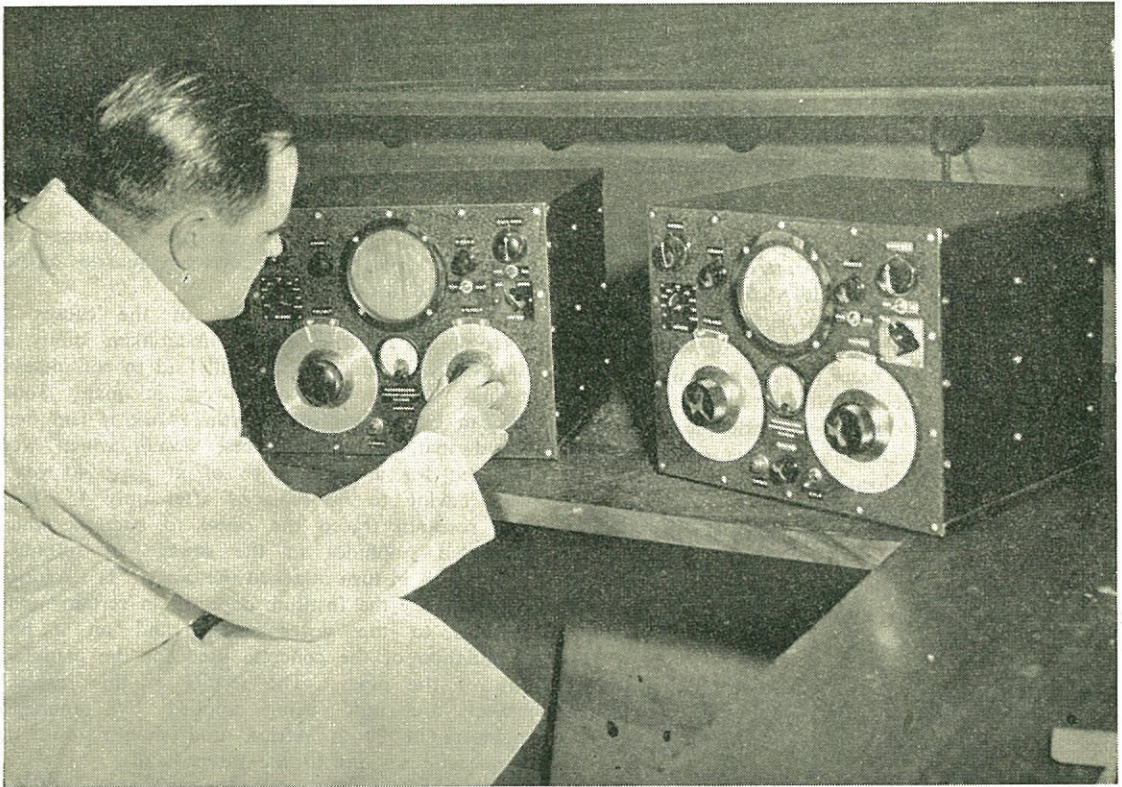
Until the N.B.R.I. started work on the subject, the use of dolomitic limes for building in South Africa frequently led to costly failures in mortars and plasters. Out of the Institute's study of the problem has come a satisfactory method for the manufacture of sound limes, the use of which will no longer lead to excessive depreciation and maintenance so commonly met for buildings in which unsound limes were used.

As a result of the work of the N.B.R.I., a new source of cement—the blast furnace slag from the South African iron and steel industry—has become available. This waste product from the steel industry has long been used overseas, but was not used here because it was believed that the high magnesia content inherent in the South African product precluded its use in the manufacture of blended cements. The work of the N.B.R.I. has shown, however, that it is possible to produce a satisfactory product from South African slags.

### **Telecommunications**

The Telecommunications Research Laboratory has made an outstanding contribution to the scientific prestige of the Union. Its study of the characteristics of the ionosphere upon which short-wave radio communications are dependent has made possible the operation of a prediction service by means





*Prototipemodelle van 'n kristalbeheerde radio-ontvangtoestel wat deur die Telekommunikasie-navorsingslaboratorium uitgevind is.*

*Prototype models of a crystal-controlled radio receiver invented by the Telecommunications Research Laboratory.*

en die Departement van Verdediging moontlik maak om die beste golflengtes vir hul uitsendings op enige bepaalde tyd te kies. Terselfdertyd werk die laboratorium saam met ander lede van die Internasionale Wetenskaplike Radio-Unie in 'n wêreldwye ondersoek na lugsteurings. Die studie is veral van belang vir gewone radiouitsending en vir radiohulpmiddels vir navigasie. Onlangs is 'n opname voltooi van grondkonstantes wat radiouitsending beïnvloed in die mediumgolfgebied wat baie algemeen in Suid-Afrika gebruik word vir uitsendings en vir oorlandse navigasiehulpmiddels soos mediumfrekwensiebakens. Dit het gegewens verskaf wat 'n meer betroubare beplanning van radiostelsels en die korrekte plasing van senders moontlik sal maak.

'n Praktiese metode van kristalbeheer van veranderbare frekwensie vir radiotoerusting wat vir beide ontvangers en senders gebruik kan word, is ontwikkel. Die Raad het patente uitgeneem en aan twee vervaardigers, een in Suid-Afrika en een in die Verenigde Koninkryk, is lisensies toegestaan om hierdie ontvangers kommersieel te vervaardig. Kristalbeheerde frekwensiegenerators vir gebruik by senders word in militêre sowel as siviele kommunikasiestelsels gebruik.

of which users of high frequency radio, such as the postal services, the airways, the South African Broadcasting Corporation and the Department of Defence, are able to select the best wavelengths for their transmissions at any particular time. At the same time this Laboratory is co-operating with other members of the International Scientific Radio Union in a world-wide investigation of atmospheric noise, commonly known as "atmospherics" or "static." This study is particularly important, not only for ordinary radio broadcasting, but for radio aids to navigation. A recently completed survey of ground constants, which affect radio transmission in the medium-wave region used extensively in South Africa for broadcasting and for overland navigation aids such as medium frequency beacons, has provided data which will enable more reliable planning of radio systems and the correct location of transmitters.

A practical method of variable frequency crystal control for radio equipment has been developed, which is applicable to both receivers and transmitters. Patents have been taken out by the



'n Aansienlike hoeveelheid navorsingswerk is ook gedoen oor die ontwerp en toepassings van radar vir verdedigingsdoeleindes onder die spesiale toestande wat in Suidelike Afrika heers, ten behoeve van die Departement van Verdediging.

### **Werktuigkundige Ingenieurswese**

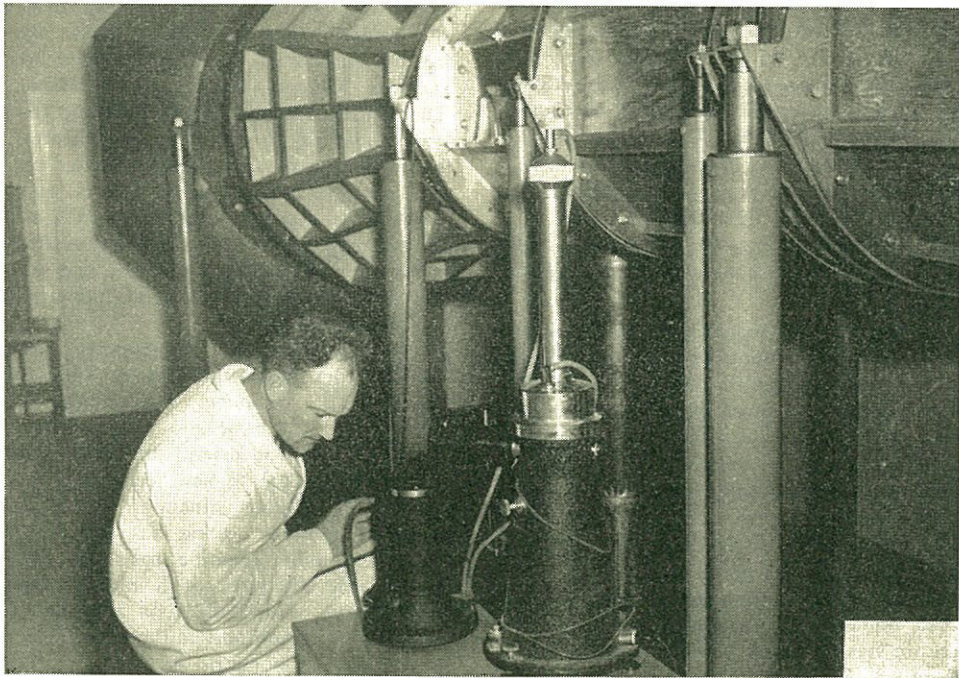
In 1951 is vir die eerste keer begin met navorsingswerk op die gebied toe 'n klein Navorsingseenheid vir Werktuigkundige Ingenieurswese onder beskerming van die Nasionale Fisiese Laboratorium gestig is. In 'n merkwaardige kort tyd het die Eenheid vaste betrekkinge aangeknoop met sommige van die belangrikste nywerhede in die land en die aanvraag na hul dienste was so groot dat die Raad in 1955 besluit het om dit uit te brei tot 'n volwaardige nasionale laboratorium.

Council and two manufacturers, one in South Africa and one in the United Kingdom, have been licensed to manufacture receivers of this design commercially. Crystal controlled frequency generators for use with transmitters are finding applications in both military and civil communications systems.

Extensive research into the design and applications of radar for defence purposes under the special conditions obtaining in Southern Africa has been undertaken on behalf of the Department of Defence.

### **Mechanical Engineering**

Research in this field did not commence until 1951, when a small Mechanical Engineering Research Unit was established under the wing of the National Physical Laboratory. In a remarkably short time this Unit established close relations with some of the most important industries in the country, and the demand on its services was such that the Council decided during 1955 to expand it into a fully fledged national laboratory.



*Die werkseksie van die 24-dm. agthoekige windtonnel van die Navorsingseenheid vir Werktuigkundige Ingenieurswese.*

*The work section of the 24-in. octagonal wind tunnel of the Mechanical Engineering Research Unit.*

'n Klimaatkamer wat die moontlikheid skep om enige stel klimaatstoestande na te boots is vir die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese gebou. Dit sal gebruik word vir die studie van die invloed van temperatuur en humiditeit op die doeltreffendheid van ondergrondse werkers.

A climatic chamber, by means of which any set of climatic conditions can be duplicated, has been developed for the Transvaal and Orange Free State Chamber of Mines for use in studying the effect of temperature and humidity on the efficiency of workers underground.



Dié stuk uitrusting is, sover bekend, die enigste in die wêreld waarin die vier fisiese faktore wat die hitteuitruiling tussen die menslike liggaam en sy omgewing beïnvloed, naamlik lugbeweging, vogtigheid, lugtemperatuur en gemiddelde stralingstemperatuur afsonderlik en met groot noukeurigheid gereël kan word.

'n Ander belangrike projek is 'n ondersoek na die oorsake van rotsstortings in die Witwatersrandse goudmyne. Hoewel die vraagstuk nog nie opgelos is nie, is aansienlike vordering gemaak en die belowende resultate wat verkry is, toon dat selfs al sou rotsstortings nie heeltemal vermy kan word nie, baie gedoen kan word om die uitwerking daarvan tot 'n minimum te beperk.

### **Beroepsielkunde**

Aan die end van die wêreldoorlog is besef dat baie van die metodes wat vir die keuring van personeel vir die gewapende magte ontwikkel is, met welslae toegepas kon word vir die keuring van nywerheidswerkers. Die Raad het die saak aanvanklik as 'n proefneming benader, maar nadat 'n groepie opgeleide navorsers van die Aanlegtoetsafdeling van die Suid-Afrikaanse Lugmag oorgeneem kon word, was dit moontlik om sy Nasionale Buro vir Personeelnavorsing in die lewe te roep. Die Buro het gou sy waarde getoon en is mettertyd omskep tot die Nasionale Instituut vir Personeelnavorsing. Die terrein van sy studies is die veelvuldige menslike faktore wat produksievermoë en werksbevrediging bepaal, soos geskiktheid van die man vir die werk, die organisasie van werk om vermoeidheid, foute en kragverkwisting te verminder, en die instandhouding van gesonde menslike verhoudings in die werksomgewing.

In die laboratorium is fundamentele navorsing en toegepaste werk gelyktydig onderneem. Die praktiese vraagstukke van personeelbestuur het leemtes in die basiese kennis van die werking van die verstand aan die lig gebring en omgekeerd het 'n soektog na die basiese kennis aanleiding gegee tot nuwe metodes wat in bestaande omstandighede in die nywerheid toegepas kan word. Op dié wyse het werk oor aanlegtoetsing daartoe gelei dat die Instituut 'n meer wetenskaplike grondslag vir taakwaardering ontwikkel het en 'n redeliker grondslag vir die opstelling van aanlegtoetse wat in bepaalde beroepe toegepas kan word, ontdek het. Aanlegtoetse het ook aanleiding gegee tot verskeie psigometriese vraagstukke wat deur die Instituut opgelos is; dit het gelei tot die ontwikkeling van die begrip van werkingskarakteristiek waarvolgens die waarskynlikheid van die sukses van enige kandidaat in 'n bepaalde werksomgewing of die invloed van verskillende standaarde van toelating volgens die beskikbare mannekrag, bepaal kan word.

Werk oor personeelkeuring was nie beperk tot die keuring van ambagslui en werkers in die laer beroepsvlakke nie. Die Raad het uit die staanspoor as sy eie proefkonyn gedien en daarop aangedring dat alle kandi-

This piece of equipment is the only one of its kind in the world in which the four physical factors, air movement, humidity, air temperature and mean radiant temperature, which affect the heat exchange between the human body and its environment, can be controlled independently and within very close limits of accuracy.

Another major project is an investigation into the causes of rock bursts on the Witwatersrand gold mines. Although this problem has not yet been solved, substantial progress has been made, and the promising results obtained indicate that, even if it does not prove possible to prevent rock bursts completely, much can be done to minimize their effects.

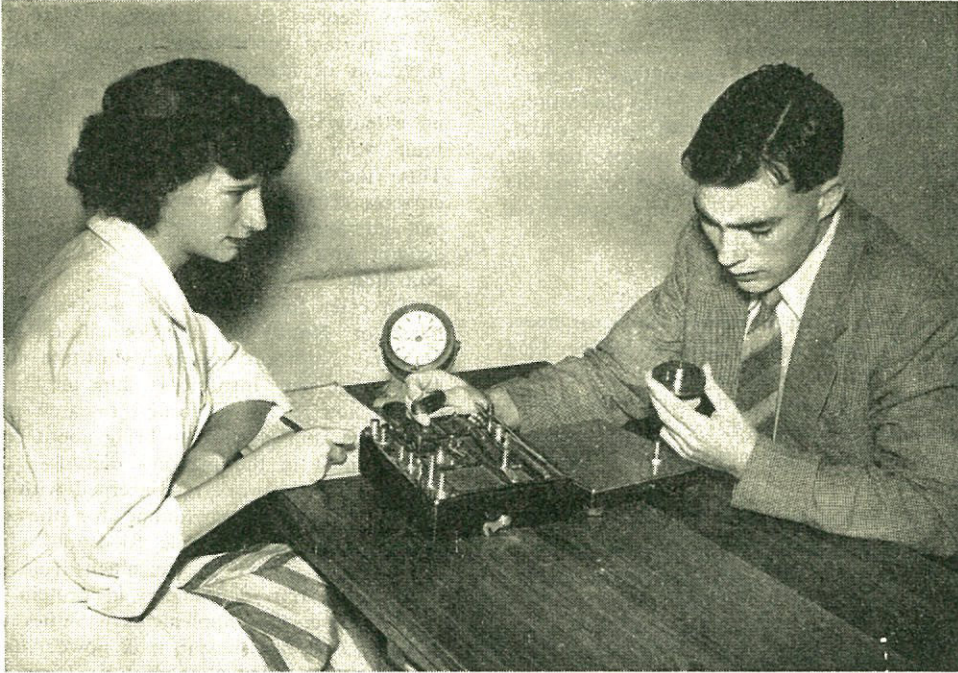
### **Occupational Psychology**

At the end of the war it was realized that many of the techniques developed for the selection of personnel for the armed forces could be applied with advantage in the selection of workers for Industry. The Council's approach was at first somewhat tentative, but it was able to take over a nucleus of trained research workers from the Aptitude Testing Section of the South African Air Force to staff its National Bureau for Personnel Research. This Bureau rapidly proved itself and in due course was converted to the National Institute for Personnel Research. The subject matter of its studies embraces the many human factors that determine productivity and job satisfaction, such as the fitness of the man for the job, the organization of work so as to minimize fatigue, error and wasted effort, and the maintenance of good human relations in the work situation.

In this laboratory fundamental research and applied work have gone side by side, the practical problems of personnel management bringing to light gaps in the basic knowledge of the working of the mind and, conversely, the search for this basic knowledge leading to new techniques which can be applied in existing situations in Industry. Thus work on aptitude testing has led the Institute to develop a more scientific basis for job evaluation and to the discovery of a rational basis for the construction of aptitude tests applicable to specific occupations. Aptitude testing, too, has given rise to various psychometric problems which have been solved by the Institute; it has led to the development of the concept of operating characteristics, whereby the probability of any candidate being successful in a particular work situation, or the effect of different standards of acceptance in a particular manpower situation can be determined.

Work in personnel selection has not been confined to selection of tradesmen and workers at the lower levels. Serving as its own guinea-pig, the Council has from the early days insisted that all





*'n Toets vir meganiese aanleg wat deur die Nasionale Instituut vir Personeelnavorsing ontwikkel is.*

*A test of mechanical aptitude devised by the National Institute for Personnel Research.*

date vir laere administratiewe poste en vir baie tegniese betrekings wat op sy personeel vakant word, deur die Instituut getoets word. 'n Doeltreffende toetsprosedure vir kandidate vir senior betrekings is ook ontwikkel. Hierdie metodiek vind nou uitgebreide toepassing in ander arbeidsgebiede soos die staatsdiens, die gewapende magte en die nywerheid.

Die behoefte aan toetse vir die klassifisering van naturellemynwerkers uit baie verskillende stamme, het aanleiding gegee tot die ontwikkeling van 'n metode van toetsing deur middel van 'n stil rolprent. Met hierdie metode kan dieselfde toets enige plek in Afrika onder standaardtoestande toegepas word en dit word reeds gebruik in ander Afrikaanse gebiede.

Werk wat vir die nywerheid gedoen is, het gelei tot 'n nuwe statistiese benadering tot die ontleding van ongeluksgegewens en die ophelderling van die begrip ongeluksvatbaarheid, terwyl gehaltebeheertegniek op gegewens van afwesigheid en arbeidsomset toegepas is. Die werk is uitgebrei tot 'n studie van houdings en menslike verhoudings in die nywerheid, wat uiters belangrik is vir doeltreffende personeelbestuur, nie alleen in die nywerheid nie, maar op alle gebiede van die lewe.

Die beroepstoepassings van sielkunde hang uitendelik af van 'n beter begrip van menslike gedrag en persoonlikheid. Baie teoretiese navorsingswerk is oor die onder-

applicants for lower administrative posts and many technical posts which fall vacant on its own staff be tested by the Institute, which has in addition developed an effective testing procedure for candidates for senior appointments. These techniques are now being used extensively in other fields such as the Public Service, the Armed Forces and Industry.

The exigencies of devising tests for the classification of Native mineworkers from many different tribes led to the development of a method of test administration by means of a silent film. This method has made it possible to apply the same test under standard conditions anywhere in Africa, and is already being used in other African territories.

Work carried out for Industry has led to a new statistical approach to the analysis of accident data and elucidation of the concept of accident proneness, while quality control techniques have been applied to absentee and labour turnover data. This work extends into a study of attitudes and human relations in Industry, subjects of vital importance in efficient personnel management not only in Industry but in all walks of life.

The occupational applications of psychology ultimately depend on advances made in the understanding of human behaviour and personality. Much academic research has been carried out on



werp gedoen, maar dit bly 'n gebied van die sielkunde waaroor daar nog meer teorieë as feite bestaan. 'n Belangrike bydrae op dié gebied was die omskrywing van faktore wat die gestelsbasis van persoonlikheid bepaal. Met behulp van die elektroënsefalograaf het die Instituut ook 'n uitgebreide studie gemaak van die elektriese aktiwiteit van die brein. Hierdie instrument registreer die klein elektriese strome wat in verskillende dele van die brein opgewek word en 'n poging word aangewend om die aktiwiteit met gedrag te korreleer.

### Voeding

Om in die navorsingsbehoefes van die Departement van Voeding te voorsien, het die Raad in Oktober 1954 die Nasionale Voedingnavorsingsinstituut in die lewe geroep. Die nuwe Instituut is dus pas 'n jaar oud, maar 'n aantal belangrike navorsingsprojekte is reeds aan die gang en stel in die vooruitsig aansienlike verbeterings in die nasie se dieet.

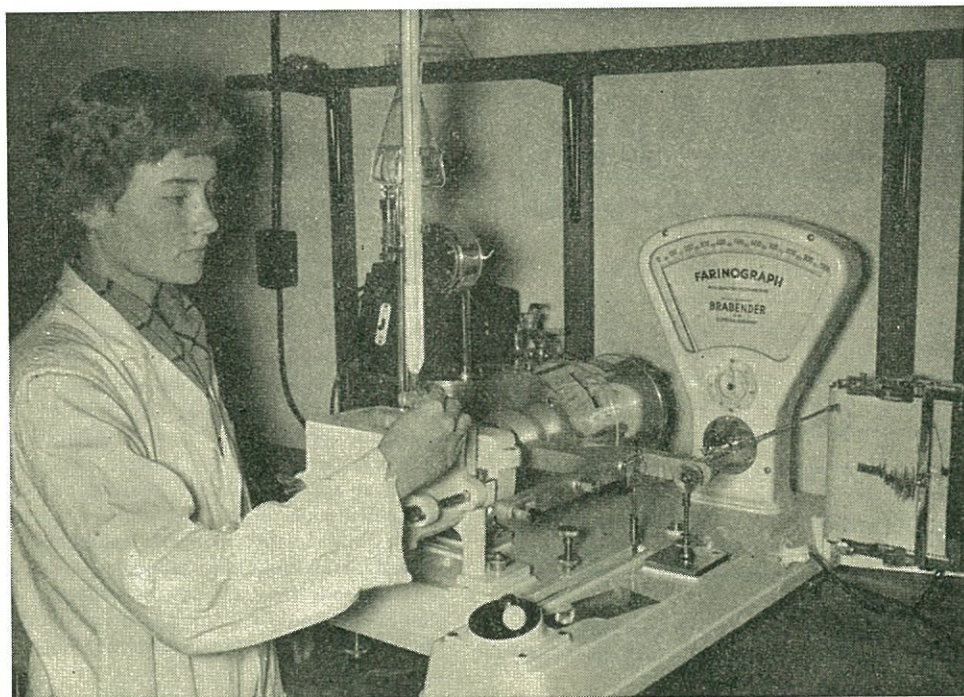
Baie van die werk staan in verband met die Departement van Voeding se program vir die verryking van brood en ander stapelvoedsels. In Suid-Afrika is dit nie soseer 'n saak van 'n tekort aan kalorieë as aan proteïene in die dieet nie en met die oog hierop word die aanvullingswaardes van verskeie toevoegings soos vismeel, melkpoeier en grondboontjiemeel bestudeer.

this subject, but it remains a field of psychology where theories are still more plentiful than facts. An important contribution in this field has been a definition of factors determining the constitutional basis of personality. The Institute has also made an extensive study of the electrical activity of the brain with the aid of the electroencephalograph. This instrument records the minute electrical currents generated in various regions of the brain, and an attempt is being made to correlate this activity with behaviour.

### Nutrition

To cater for the research needs of the Department of Nutrition, the Council established the National Nutrition Research Institute in October, 1954. The new Institute is thus only a year old, but already several important research projects are under way and promise to bring about considerable improvement in the Nation's diet.

Much of the work is concerned with the Nutrition Department's programme for the enrichment of bread and other staple foodstuffs. The South African diet suffers not so much from a lack of calories as from deficiencies in protein and, with this in mind, the supplementary values of various additives such as fishmeal, milk powder and groundnut meal are being studied.



*Die waterabsorpsievermoë van 'n bakmeel word in die Nasionale Voedingnavorsingsinstituut getoets.*

*Testing the water absorptivity of a baking flour in the National Nutrition Research Institute.*



Om die basiese gegewens vir voedingsbeplanning te verkry, word 'n nasionale opname nou gemaak van voedingspeil en dieetgewoontes. Die opname sal alle ouderdoms- en rasse-groepe insluit en sal mediese, fisiologies-chemiese, somatometriese, dieetkundige en sosiologiese studies van statisties verteenwoordigende groepe behels. Terselfdertyd word die samestelling van gewone Suid-Afrikaanse voedsels, insluitende sekere plaaslike plantaardige en dierlike voedsels wat hoofsaaklik deur naturelle geëet word, bestudeer. Spesiale aandag word bestee aan die invloed van opberging, vervoer en gaarmaak op die finale voedingswaarde van wat geëet word.

'n Belangrike aspek van die Instituut se werk in hierdie stadium, is die ontwikkeling en standaardisering van die metodes wat in voedsel- en voedingstudies gebruik word en fasiliteite is reeds beskikbaar vir chemiese, biologiese en histopatologiese ondersoek. 'n Spesiale afdeling is opgerig vir voedsel-tegnologie en voedselverwerking en kliniese studies word gedoen in medewerking met die Pretoriase Algemene Hospitaal en die Universiteit van Pretoria.

#### **ONDERSTEUNDE NAVORSINGSWERK**

Bostaande is die nasionale laboratoriums waarin die Raad sy basiese fasiliteite vir navorsingswerk in Suid-Afrika tot stand gebring het. Hul navorsingsprogramme is hoofsaaklik beperk tot projekte van nasionale belang soos beoordeel deur adviserende komitees wat bestaan uit toonaangewende wetenskaplikes uit die staatsdiens, die universiteite en die nywerheid. Hierbenewens, eger, onderneem die laboratoriums 'n sekere hoeveelheid ondersteunde navorsingswerk op kontrak vir ander organisasies en vir die nywerheid. Terwyl dit altyd die Raad se vaste beleid was en is om toegepaste navorsingswerk van regstreekse belang vir individuele firmas aan private ondernemings oor te laat, is daar min firmas in Suid-Afrika wat sterk genoeg is om die koste aan te gaan om groot laboratoriums uit te rus en met goed gekwalifiseerde wetenskaplikes te voorsien. By die oprigting van sy laboratoriums, het die Raad dus besluit dat sy spesiale fasiliteite beskikbaar gestel sou word op 'n terugbetalingsgrondslag. Dit is 'n weerspieëling van die stygende agting vir die laboratoriums dat daar elke jaar 'n toename was in die bedrag wat die Raad in die verband ontvang het. Hoewel die Raad onder geen wetlike verpligting staan om selfonderhoudend te wees nie, beloop sy huidige inkomste uit dié bron sowat £85,000 p.j. Hierbenewens doen die Raad se laboratoriums heelwat navorsingswerk gratis vir staatsdepartemente. Gedurende die finansiële jaar geëindig 31 Maart 1955, het die waarde van die werk volgens skatting £40,000 beloop.

To provide the basic data for nutritional planning, a national survey of nutritional status and dietary habits is being conducted. This survey, which will embrace all age and racial groups in the Union, will include medical, chemo-physiological, somatometric, dietetic and sociological studies of statistically representative population samples. Simultaneously a study is being made of the composition of common South African foodstuffs including certain local plant and animal foods eaten mainly by the Natives. Particular attention is being paid to the effect of storage, transportation and cooking on the final nutritional value as consumed.

An important feature of the Institute's work at this stage is the development and standardization of the methods used in food and nutritional studies, and facilities are already available for chemical, biological, histo-pathological studies. A special division for food technology and processing has been set up and clinical studies are being undertaken in co-operation with the Pretoria General Hospital and the University of Pretoria.

#### **SPONSORED RESEARCH**

These, then, are the national laboratories through which the Council has built up the basic facilities for research in South Africa. In the main their research programmes have been confined to projects of national importance as assessed by advisory committees consisting of leading scientists drawn from the Government, the Universities and Industry. In addition, however, these laboratories undertake a certain amount of sponsored research on a contract basis for other organizations and for industry. While it is, and always has been, the firm policy of the Council that applied research of direct benefit to individual firms should be left to private enterprise, few firms in South Africa are large enough to contemplate the expense of equipping large research laboratories and staffing them with highly qualified scientists. Therefore, in setting up its laboratories the Council decided that their special facilities should be made available on a repayment basis. It is perhaps an indication of the growing esteem in which the laboratories are held that each year there has been an increase in the amount spent with the Council in this way. Although the Council has no statutory responsibility to be self-supporting, its current income from this source is now of the order of £85,000 per annum. In addition to this, the Council's Laboratories undertake numerous projects for Government Departments free of charge. During the financial year ended 31st March, 1955, the cost of this work was estimated at £40,000.



## KOÖPERATIEWE NAVORSINGSWERK

Dat die nywerheid sy navorsingswerk deur gesamentlike optrede behoort aan te pak is altyd deur die Raad bepleit. In 1946 is verantwoordelikheid aanvaar vir die subsidiëring van die Leernywerheid-navorsingsinstituut in Grahamstad en die volgende jaar is onderhandelinge aangegaan met vissery- en inmaakondernemings vir die oprigting van die Visnywerheid-navorsingsinstituut in Kaapstad. Later is die Verfnywerheid-navorsingsinstituut en die Suikermeule-navorsingsinstituut in Durban gestig. Die vyfde navorsingsvereniging van hierdie soort was die S.A. Woltekstiel-navorsingsinstituut in Grahamstad. Al die institute word geldelik gesteun deur die meeste van die firmas in die nywerheid wat hulle bedien, en hulle ontvang 'n ooreenstemmende bedrag van die Raad. Hulle is selfbesturende liggame en staan onder beheerrade waarop ledefirmas die meeste verteenwoordigers het en wat hul eie navorsingsprogramme kan kies. Die Raad se subsidie aan nywerheidsnavorsingsinstitute het geleidelik gestyg in verhouding tot die toename in die bedrae wat hulle van die nywerhede ontvang het. Vir die finansiële jaar 1954/55 was dit £50,728.

Deur die vorming van die institute, is die betrokke nywerhede voorsien van uitstekende navorsingsgeriewe wat ongetwyfeld baie bygedra het tot die belangrike posisie wat hulle vandag in Suid-Afrika se ekonomie beklee. Dit is seker nie sonder betekenis nie dat vier van die nywerhede wat navorsingsinstitute ondersteun vandag onder Suid-Afrika se grootste uitvoerders tel.

'n Sesde navorsingsinstituut, die Navorsingsingseenheid vir Bitumineuse Bindstof, is soortgelyk, maar daar in dié geval, benewens die industriële ondersteuners, staatsorganisasies die groot geldelike bydraes lewer, word dit deur die W.N.N.R. bestuur met behulp van 'n loods-komitee wat deur die belangrikste bydraers benoem word. Die Eenheid is in 1950 opgerig en het waardevolle navorsingswerk gedoen oor materiale vir padbolae, veral bitumineuse bindstowwe wat in Suid-Afrika vervaardig word. Dit is waarskynlik dat die Eenheid uiteindelik ingelyf sal word as 'n afdeling van die nuwe Nasionale Padnavorsingsinstituut wat in September 1955 deur die W.N.N.R. gestig is. Tans word dit egter nog op dieselfde finansiële grondslag as tevore bestuur.

Nie al die nywerhede in Suid-Afrika is sterk genoeg of passend georganiseer om 'n volwaardige navorsingsinstituut in stand te hou nie. Om vir sulke gevalle voorsiening te maak, het die Raad 'n beurskema ingestel waarvolgens 'n groep firmas gesamentlik 'n bydrae vir 'n navorsingsprojek in die W.N.N.R. se nasionale laboratoriums kan aanbied. Vir die doel word spesiale personeel in diens geneem en die werk word gedoen onder toesig van senior lede van die Raad se eie navorsingspersoneel. Vir elke geval word 'n geskikte ooreenkoms aangegaan, maar in die algemeen is die ondersteunende groep verantwoordelik

## CO-OPERATIVE RESEARCH

The Council has always been a strong advocate of the co-operative approach to research by Industry. The C.S.I.R. became responsible for subsidizing the Leather Industries Research Institute in Grahamstown during 1946, and the following year concluded negotiations with trawling and canning interests for the establishment of the Fishing Industry Research Institute in Cape Town. Later the Paint Industry Research Institute and the Sugar Milling Industry Research Institute were established in Durban. The fifth research association of this kind was the S.A. Wool Textile Research Institute in Grahamstown. In each case these Institutes are supported financially by the majority of the firms in the industry served, with a corresponding contribution from the Council. They are autonomous bodies, each of which is governed by a board of control on which member firms have majority representation, and are free to select their own research programmes. The Council's subsidy to industrial research institutes has risen steadily in proportion to the increased support they have received from Industry and for the financial year 1954/55 amounted to £50,728.

With the formation of these institutes, the industries concerned were provided with first-class research facilities which, without doubt, have contributed much to their commanding position in South Africa's economy today. It is perhaps not without significance that among South Africa's major exporters are four of the industries which support research institutes.

A sixth research institute, the Bituminous Binder Research Unit, is similar but, since State organizations make major financial contributions in addition to the industrial subscribers, it is operated by the C.S.I.R. with the aid of a steering committee nominated by the principal contributors. This Unit was established in 1950 and has undertaken valuable research work into road surfacing materials, particularly the bituminous binders produced in South Africa. It is probable that this Unit will eventually be incorporated as a division of the new National Road Research Institute which was established by the C.S.I.R. during September, 1955, but, for the present, it is being operated on the same financial basis as before.

Not all the industries in South Africa are large enough or suitably organized to support a fully fledged research institute. To provide for such cases the Council has evolved a fellowship scheme, whereby a group of firms can jointly sponsor a research project in the C.S.I.R. national laboratories. For this purpose special staff is employed, and the work is carried out under the supervision of senior members of the Council's own research staff.



vir die salarisse van die spesiale personeelle wat aangesel word, terwyl die W.N.N.R. se bydrae die beskikbaarstelling van laboratoriumruimte en toesig is. Op die wyse kan daar op 'n klein skaal met navorsingswerk begin word, sonder die koste van die oprigting van nuwe laboratoriums. Gedurende die boekjaar 1954/55 was daar sewentien van die beurse in werking teen 'n uitgawe van £18,714. Veral waar sulke navorsingsbydraes deur verenigings van fabrikante gemaak word en die eerste navorsings met sukses bekroon was, bestaan die moontlikheid dat die skema die kern mag vorm waaruit 'n toekomstige nywerheidsnavorsingsinstituut gebore kan word.

### NAVORSINGSTOEKENINGS

Toe die W.N.N.R. in 1945 in die lewe geroep is, het dit die Navorsingstoekeningsraad vervang as die Regering se belangrikste werktuig vir die ondersteuning van ondersoek in die natuurwetenskappe. Daar was 'n gedurige styging in die fondse wat die Raad vir die doel beskikbaar gestel het, van minder as £1,500 in die eerste jaar tot oor die £77,000 in die finansiële jaar geëindig 31 Maart 1955.

Die W.N.N.R. het 'n tweeledige doel voor oë met sy ondersteuning van navorsingswerk aan die universiteite. In die eerste plek hoop die Raad om te verseker dat senior navorsingswetenskaplikes van bewese bekwaamheid die kans kry om op doeltreffende wyse met hul navorsingswerk voort te gaan en, in die tweede plek, is dit sy mikpunt om 'n voldoende aantal jong manne en vroue in navorsingsmetodes op te lei en met geesdrif te vul vir navorsingswerk as 'n loopbaan. Senior wetenskaplikes is gehelp deur toekennings om lopende uitgawes te dek, deur die indiensneming van assistente om hulle met hul roetine-werk te help en deur die leen van spesiale kapitaaltoerusting wat nie gewoonlik in universiteitslaboratoriums beskikbaar is nie. Toerusting ter waarde van £73,000 wat deur die W.N.N.R. aangekoop is, word tans in verskillende universiteitslaboratoriums gebruik. Verskeie klasse van nagraadse navorsingsbeurse is jaarliks aan jonger wetenskaplikes toegeken. Hierdie beurse is beskikbaar vir navorsingswerk aan Suid-Afrikaanse universiteite sowel as aan buitelandse inrigtings.

Oorsese beurse word gewoonlik toegeken met die voorbehoud dat die beursohouers aan die end van die tydperk na die Unie terugkeer. Van besondere belang is die stelsel van beurse vir voorgeskrewe navorsing wat in 1952 deur die Raad ingestel is. Hiervolgens is bepaalde gebiede deur die Raad uitgekies wat voorheen te min aandag ontvang het, sodat Suid-Afrika dus nie genoeg opgeleide navorsers in die vak het nie. Op die wyse hoop die Raad om 'n meer gebalanseerde verdeling van Suid-Afrika se ontoereikende bronne van wetenskaplike mannekrag oor die belangriker gebiede van die wetenskap te kan bewerkstellig.

Appropriate agreements are drawn up in each case but, in general, the sponsoring group is responsible for the salaries of the special staff appointed, while the C.S.I.R. makes available the laboratory space and supervision as its contribution. In this way research can be started on a small scale without the expense of setting up new laboratories. During the financial year 1954/55, seventeen of these fellowships were in operation involving an expenditure of £18,714. In some cases, particularly where the fellowship is supported by an association of manufacturers, this scheme may provide a nucleus around which a future industrial research institute could be built up gradually should the progress of the research warrant it.

### RESEARCH GRANTS

When the C.S.I.R. was established in 1945, it superseded the Research Grant Board as the Government's principal instrument for the support of research in the natural sciences. There has been a steady rise in the funds made available through the Council in this way from under £1,500 in the first year to over £77,000 in the financial year which ended on the 31st March, 1955.

The C.S.I.R. has pursued a two-fold object in its support of research in the universities. In the first place, it hopes to ensure that senior research scientists of proven ability are given the opportunity to continue their researches effectively and, in the second place, it aims at an adequate supply of young men and women trained in research techniques and imbued with an enthusiasm for research as a career. Assistance to senior scientists has thus taken the form of grants to cover running expenses, the employment of technical assistants to help them with the routine aspects of their work, and the loan of special capital equipment not normally available in university laboratories. At present equipment valued at £73,000, purchased by the C.S.I.R., is being used in various university laboratories. Various categories of post-graduate research bursaries have been awarded annually to younger scientists. These bursaries are available for research both at South African Universities and overseas.

Bursaries tenable overseas normally carry the proviso that the recipients return to the Union at the end of their tenure. Of particular interest is a system of directed research bursaries instituted by the Council in 1952. Under this scheme particular fields were selected by the Council because they had hitherto been neglected in South Africa and there were insufficient numbers of trained research workers. In this way the Council hopes to achieve a more balanced distribution of South Africa's all too slender resources in scientific manpower over the more important fields of science.



Vroeg reeds het die Raad 'n skema ingestel waarvolgens universiteite self die individuele toekennings moet administreer uit globale toelaes wat hulle van die W.N.N.R. ontvang. Sedert die W.N.N.R. in 1946 sy eerste toekening gemaak het, is altesaam £356,000 aan Suid-Afrikaanse universiteite beskikbaar gestel vir senior en nagraadse studiebeurse hier en in die buiteland, navorsingsassistentkappe, buitengewone lopende navorsingsonkoste en vir gespesialiseerde toerusting. 'n Totaal van sowat 560 wetenskaplikes het uit die skemas voordeel getrek en in baie gevalle het die persoon vir jare aaneen 'n beurs ontvang.

## MEDIESE NAVORSING

By gebrek aan 'n spesiale liggaam om in die behoeftes van mediese navorsingswerk te voorsien, het die W.N.N.R. ook op dié gebied ondersoek en ontwikkelingswerk gedoen, met die advies en bystand van 'n nasionale Mediese en Tandheelkundige Navorsingsadvieskomitee.

Mediese navorsingswerk in Suid-Afrika word op drie maniere deur die Raad gesteun:

- (1) deur een-derde (tans £7,500 p.j.) van die lopende uitgawes van die Suid-Afrikaanse Instituut vir Mediese Navorsing (wat ook finansiële toekennings ontvang van die Departement van Gesondheid en die Witwatersrandse Vereniging vir Naturellesarbeid) by te dra;
- (2) deur individuele toekennings aan wetenskaplikes in die mediese skole volgens die gewone skema van universiteitsnavorsingstoekennings wat hierbo genoem is, te maak; en
- (3) deur gespesialiseerde mediese navorsingseenhede finansiël te steun.

Die Raad het sy skema van mediese navorsingseenhede in 1949 ingevoer toe klein eenhede operig is vir navorsingswerk oor Amebiase (Durban), Bilharziase (Johannesburg), Kardio-pulmonale Siektes (Johannesburg), Voeding (2 eenhede in Johannesburg), Virussiektes (Kaapstad), Maatskaplike Geneeskunde (Kaapstad) en Tuberkulose (Durban). Die volgende jaar is nuwe eenhede vir navorsingswerk oor Toegepaste Fisiologie en Maatskaplike Geneeskunde in Johannesburg en Durban onderskeidelik in die lewe geroep. In 1953 is 'n Eenheid vir Tandheelkundige Siektes in Johannesburg operig en in 1954 'n Hartnavorsingseenheid in Pretoria. Later is die Eenheid vir Toegepaste Fisiologie deur die Transvaalse Kamer van Mynwese oorgeneem, die eenhede vir Maatskaplike Geneeskunde in Kaapstad en Durban is hernoem tot Kliniese Voeding en Gesinsgesondheid onderskeidelik en een van die voedingsseenhede in Johannesburg het die Navorsingseenheid vir Menslike Biochemie geword. Die Raad ondersteun tans elf mediese eenhede en stel £68,000 jaarliks vir die doel beskikbaar.

By die oprigting van hierdie eenhede het die Raad die beleid gevolg om slegs die gebiede te kies waarop 'n bekende wetenskaplike reeds besig was met navorsings-

The Council early evolved a scheme whereby individual grants are administered by the universities which receive block grants from the C.S.I.R. Since the C.S.I.R. made its first research grant in 1946 a total of £356,000 has been made available to South African Universities for senior and post-graduate study bursaries here and overseas, research assistantships, special running research expenses and for specialized equipment. In all, some 560 scientists have benefited under these schemes, many of them having been C.S.I.R. bursars for a number of years in succession.

## MEDICAL RESEARCH

In the absence of a special body to cater for medical research, the C.S.I.R. has explored and developed this field with the advice and assistance of a national Medical and Dental Research Advisory Committee.

Medical research in South Africa has been supported by the Council in three ways:

- (1) by bearing one-third, currently £7,500 p.a., of the running expenses of the South African Institute for Medical Research which also receives financial grants from the Department of Health and the Witwatersrand Native Labour Association;
- (2) by individual grants to scientists in the medical schools under the normal university research grants scheme mentioned above; and
- (3) by the support of specialized medical research units.

The Council inaugurated its medical research unit scheme in 1949 when small units were established for research in Amoebiasis (in Durban), Bilharziasis (Johannesburg), Cardio-Pulmonary Diseases (Johannesburg), Nutrition (2 units in Johannesburg), Virus Diseases (Cape Town), Social Medicine (Cape Town) and Tuberculosis (Durban). The following year new units for research in Applied Physiology and Social Medicine were set up in Johannesburg and Durban respectively. In 1953 a Dental Diseases Unit was added in Johannesburg, and in 1954 a Heart Research Unit in Pretoria. The Applied Physiology Unit was subsequently taken over by the Transvaal Chamber of Mines, the social medicine units in Cape Town and Durban renamed Clinical Nutrition and Family Health respectively, and one of the nutrition units in Johannesburg became the Human Biochemistry Research Unit. The Council thus currently supports eleven medical units to the extent of £68,000 annually.

In establishing these units the Council adopted the policy of selecting only those fields in which a scientist of established reputation was already under-



werk. In medewerking met die inrigting waarin die wetenskaplike in diens was, het die Raad dan verdere fasiliteite, toerusting en tegniese personeel voorsien, sodat die navorsingswerk uitgebrei kon word. Al die Raad se mediese navorsingseenhede is dus gesamentlike ondernemings. Die skema is nou reeds vir 'n paar jaar in werking en die Raad het grond vir die veronderstelling dat die stelsel besondere byval vind by die mediese professie.

### INLIGTINGS- EN SKAKELDIENSTE

Die Raad het dit altyd as van sy belangrikste pligte beskou om 'n atmosfeer te skep waarin navorsingswerk kan gedy en om die vrye uitruiling van inligting tussen werkende wetenskaplikes te bevorder. Dit is van besondere belang in 'n land soos Suid-Afrika, wat geografies so ver verwyder is van die groot navorsingsentrums van Europa en Noord-Amerika.

Een van sy eerste stappe was dus om 'n omvattende biblioteek tot stand te bring wat kon dien as 'n sentrale wetenskaplike en tegniese verwysingsentrum vir die Unie. Die biblioteek is vinning uitgebou en het nou 'n voorraad van 22,000 gebinde volumes en sowat 100,000 pamflette wat hoofsaaklik oor gevorderde wetenskaplike onderwerpe handel. Die navorser se belangrikste bron van inligting is egter die wetenskaplike tydskrif en meer as 1,600 joernale word gereeld deur die biblioteek ontvang. Dit is egter maar 'n breukdeel van die totale aantal wat gepubliseer word en die Raad het dus 'n fotoduplikasiediens geskep wat deur die biblioteek, met behulp van die Raad se oorsese skakelkantore, beheer word, en enkel-fotodrukke van wetenskaplike verhandelinge uit die wêreld se belangrikste biblioteke kan lewer.

Dit duur lank voordat die resultate van navorsingswerk in die formele literatuur gepubliseer word en die Raad het besef dat as Suid-Afrikaanse wetenskaplikes op die hoogte gehou moes word, permanente kantore in Londen en Washington en moontlik in ander hoofstede, opgerig sou moes word om direkte wetenskaplike kontak met oorsese lande te vergemaklik. Die Londense wetenskaplike skakelkantoor is in 1946 van die Departement van Handel en Nywerheid oorgeneem en die Washingtonse kantoor die volgende jaar. Deur persoonlike besoeke, bywoning van konferensies en diens in staande komitees, het die Raad se amptenare in dié lande baie bygedra om noue voeling tussen aktiewe navorsers hier en in die buiteland tot stand te bring. Boonop help hulle om die Raad op die hoogte te hou van die jongste ontwikkelinge in hul streke. Hul hulp aan besoekende wetenskaplikes van die W.N.N.R. se laboratoriums en ander wetenskaplike inrigtings in Suid-Afrika is besonder waardevol gewees vir die reëling van onderhoude, reisplanne en toegang tot wetenskaplike inrigtings.

'n Vraagstuk wat die aandag van die Raad geniet het, was hoe om te verseker dat die resultate van navorsingswerk toepassing in die praktyk vind. Vir die doel het die

taking research. In co-operation with the institution where the scientist was employed, it provided the facilities, equipment and supporting technical staff to enable the research to be expanded. All the Council's medical research units are thus joint undertakings. This scheme has now been in operation for several years, and the Council has reason to believe that it is proving most acceptable to the medical profession.

### INFORMATION AND LIAISON SERVICES

The Council has always considered it as one of its principal duties to foster an atmosphere in which research can flourish and to maintain the free flow of information between working scientists. This is particularly important in a country like South Africa, geographically separated from the great research centres of Europe and North America.

Thus one of its first actions was to establish a comprehensive library which could act as a central scientific and technical reference centre for the Union. The Library was built up rapidly, and now has a stock of 22,000 bound volumes and some 100,000 pamphlets mainly dealing with advanced scientific subjects. But the research worker's main source of information is the scientific journal, and no less than 1,600 of these are received regularly in the library. This, however, is but a fraction of the total number actually published, and the Council has, therefore, established a photoduplication service operated by the Library with the aid of the Council's overseas offices which can obtain single photographic copies of scientific papers from the world's major libraries.

It takes time for the results of research to be published in the formal literature, and the Council realized that if South African scientists were to be kept up-to-date, it would be necessary to set up permanent offices in London and Washington and, possibly, other capitals to facilitate contact with overseas countries at the scientific level. The London scientific liaison office was taken over from the Department of Commerce and Industries in 1946 and the Washington Office the following year. By personal visits, attending conferences, and serving on standing committees, the Council's officers in these countries have contributed much towards the close contact between active research workers here and overseas and, in addition, have helped to keep the Council informed of the latest developments in their areas. Of particular value has been their assistance to visiting scientists both from the C.S.I.R. laboratories and other South African scientific institutions by arranging appointments and itineraries, and entree into scientific institutions.

A problem to which the Council has given attention is how to ensure the utilization of the



Raad sy Skakelafdeling opgerig, wat baie gedoen het om publisiteit aan die werksaamhede van die W.N.N.R. te verleen en om die fasiliteite wat die Raad aanbied, onder die aandag van nywerars te bring. Gedurende 1950 is streeknavorsingskomitees uit vooraanstaande nywerars in Durban en Port Elizabeth saamgestel om die Raad by te staan en in 1953 het 'n derde komitee in Kaapstad tot stand gekom. Hierdie komitees wat Natal, die Kaapse Middellande en die Westelike Provinsie onderskeidelik bedien, het waardevolle dienste gelewer deur die Raad te help om in aanraking te kom met nywerars in hul onderskeie gebiede.

Patentbeskerming kan belangrik wees om die voordele van die Raad se uitvindings vir Suid-Afrikaanse nywerhede te verseker en om die industriële ontwikkeling van uitvindings aan te moedig, aangesien firmas gewoonlik onwillig is om sonder hierdie beskerming swaar kapitaalbeleggings aan aanvanklike ontwikkeling te waag. 'n Aantal patente is deur die Raad uitgeneem. Eén is gelisensieer vir kommersiële vervaardiging in die Unie en die Verenigde Koninkryk.

Die beslissende toets vir enige navorsingsorganisasie is die nuwe kennis wat uit sy werksaamhede voortvloei. Dit kan beoordeel word volgens die aantal navorsingsverhandelinge wat deur wetenskaplike tydskrifte vir publikasie aanvaar word en die Raad se prestasie, hiervolgens geoordeel, is aansienlik. Uit sy eie laboratoriums en navorsingsinstitute is sowat 510 verhandelinge vir publikasie aanvaar, terwyl van W.N.N.R.-beurshouers 380 en van mediese navorsingseenhede 'n verdere 250 vir publikasie goedgekeur is. Hierbenewens is verskeie monografieë en boeke gepubliseer deur of ten behoeve van die Raad. Sedert 1951 is al hierdie publikasies, saam met uittreksels, in die Raad se kwartaalblad, *Navorsings-oorsig*, vermeld.

Nog 'n saak waarmee die Raad hom besig gehou het, was om te verseker dat verdienstelike navorsingswerk, of dit nou in die W.N.N.R. se laboratoriums of elders gedoen is, gepubliseer word. Hy het dus in die tien jaar van sy bestaan die nodige fondse verskaf vir die publikasie van 'n aantal belangrike wetenskaplike werke deur Suid-Afrikaanse wetenskaplikes en publikasietoekennings ter waarde van £26,500 is reeds gemaak.

## HUISVESTING

Aangesien dit moeilik by die stigting van die Raad voorspel kon word wat die uiteindelijke vereistes van die laboratoriums sou wees, het hy hom gelukkig geag om vir die eerste paar jaar huisvesting te kon vind in geboue wat aan die end van die oorlog ontruim is deur die .303-Ammunisiefabriek van die Suid-Afrikaanse Munt. Teen die end van 1950 het die snelle groei van die laboratoriums egter reeds moeilike huisvestingsvraagstukke geskep en daar is besluit om te begin met die beplanning van 'n nuwe navorsingsentrum op 'n perseel van 100 morg

results of research. For this purpose the Council established its Liaison Division, which has done much to publicize the activities of the C.S.I.R. and to bring the facilities it provides to the attention of industrialists. During 1950 regional research committees of prominent industrialists were established in Durban and Port Elizabeth to assist the Council and, in 1953, a third was founded in Cape Town. These committees serving Natal, the Cape Midlands and the Western Province respectively, have been most helpful in assisting the Council to make contact with industrialists in their respective regions.

Patent protection can be important in securing the benefits of the Council's discoveries for South African industries and in achieving the industrial development of inventions, as without it firms are usually unwilling to risk the heavy capital investments for initial developments. A number of patents have been taken out by the Council, and one has been licensed for commercial manufacture both in the Union and the United Kingdom.

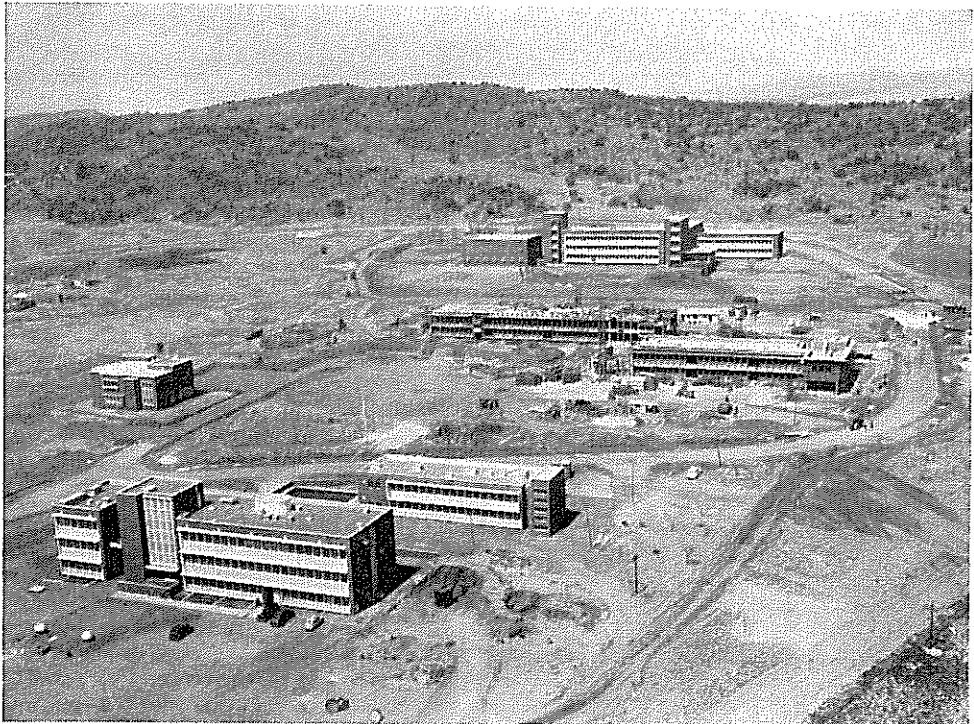
The final test of any research organization is the new knowledge that results from its activities. This may be measured by the number of research papers accepted for publication by scientific journals, and the Council's achievement as judged by this criterion is not inconsiderable. From its own laboratories and research institutes some 510 papers have been accepted, while 380 have been published by holders of C.S.I.R. bursaries and a further 250 have originated in the medical research units. In addition several monographs and books have been published, either by the Council itself or on its behalf. Since 1951 all these publications have been listed with abstracts in the Council's quarterly news journal, *Research Review*.

Another aspect with which the Council has concerned itself is that of ensuring that meritorious research whether done in the C.S.I.R. laboratories or elsewhere is, in fact, published. It has, therefore, provided the funds necessary for the publication of a number of important scientific works by South African scientists. In the ten years of its existence publication grants to the value of £26,500 have been made.

## ACCOMMODATION

As it was difficult when the Council was set up for it to forecast the final requirements of its laboratories, it was fortunate in being able to house its laboratories for the first few years in buildings vacated at the end of the war by the small-arms section of the South African Mint. By 1950, however, the rapid growth of the laboratories had already caused difficult accommodation problems, and it was decided to commence the planning of a new research centre at a 200-acre site seven miles





DOTMAN PRETORIUS.

*Vordering met die aanbou van die W.N.N.R. se nuwe navorsingsentrum, sewe myl oos van Pretoria. Op die voorgrond is die geboue vir Kernfisika en Biofisika, links die Akoestiek-gebou en op die agtergrond die Nasionale Bounavorsingsinstituut. Die groot gebou in aanbou is die Nasionale Fisiese Laboratorium.*

*Progress in the building of the C.S.I.R.'s new research centre seven miles east of Pretoria. In the foreground are the Nuclear Physics and Biophysics Buildings, to the left the Acoustics Building and in the background the National Building Research Institute. The large building under construction is the National Physical Laboratory.*

sewe myl ten ooste van Pretoria, wat deur die Universiteit van Pretoria geskenk is. 'n Bouprogram wat oorspronklik beraam is op £1,300,000 maar later verhoog is tot £1,500,000, is vir die doel deur die Regering goedgekeur. In 1952 is 'n begin gemaak met die bou van die eerste hoof-laboratoriums. Aan die end van die tydperk waaroor die verslag loop, was die geboue vir die Nasionale Bounavorsingsinstituut, vir die Kernfisika-, Biofisika- en Akoestiekafdelings van die Nasionale Fisiese Laboratorium, en vir die Windtonnel van die Nasionale Navorsingsinstituut vir Werktuigkundige Ingenieurswese voltooi. Geboue vir die Biblioteek- en Inligtingsafdeling, vir die Sentrale Werkplaas en vir die res van die Nasionale Fisiese Laboratorium was in aanbou. Die vernaamste hoofkwartiergebou en geboue om die Nasionale Chemiese Navorsingslaboratorium en Nasionale Voedingnavorsingsinstituut te huisves was in die beplanningstadium en die oprigting van nuwe geboue vir die Nasionale Instituut vir Personeelnavorsing en die Telekommunikasienavorsingslaboratorium op die terrein van

east of Pretoria, donated by the University of Pretoria. Approval for a building programme, originally estimated at £1,300,000, was obtained from the Government. This has subsequently been increased to £1,500,000. The building of the first major laboratories commenced during 1952, and to the end of the period covered by this report, buildings for the National Building Research Institute, the Nuclear Physics, Biophysics and Acoustics Buildings of the National Physical Laboratory and the Wind Tunnel Building of the National Mechanical Engineering Research Institute had been completed. Under construction were buildings to house the Library and Information Division, the Central Workshops, and the remainder of the National Physical Laboratory. The main Headquarters Building and buildings to house the National Chemical Research Laboratory and National Nutrition Research Institute were in the planning stage. In addition, new buildings for the



die Universiteit van die Witwatersrand, was in die ontwerpstadium.

## **DIE TOEKOMS**

Die Raad kyk met 'n mate van tevredenheid terug op die eerste tien jaar in die wete dat die grondslag vir 'n doeltreffende organisasie vir die versekering van Suid-Afrika se wetenskaplike toekoms, heg gelê is. Terselfdertyd is hy nie onbewus van sy verantwoordelikheid om die Unie in die voorste ry van die tegnies gevorderde lande van die wêreld te hou nie. Ons leef in 'n wetenskaplike eeu en dit word al hoe duideliker dat geen land wat nie 'n aansienlike deel van sy inkomste aan wetenskaplike navorsing wy nie, kan hoop om voortuigang te maak nie. Wetenskaplike ontdekkings maak die mens meester van sy omgewing, nuwe metale van die land en die see ding mee met yster en staal as boumateriale, nuwe bronne van energie is besig om die fossielbrandstowwe, steenkool en olie, te vervang en uit die chemiese fabriek kom die kunsmissoorte en sintetiese stowwe wat hom onafhanklik maak van natuurlik vrugbare grond as sy belangrikste bron van kos en klere. Die magsbalans tussen volke is nie meer so volkome afhanklik van hul natuurlike hulpbronne nie. Wetenskaplike prestasie word steeds meer en meer die belangrikste wapen van die nuwe diplomاسie.

National Institute for Personnel Research and the Telecommunications Research Laboratory were being designed for erection on the campus of the University of the Witwatersrand.

## **THE FUTURE**

The Council looks back on its first ten years with some satisfaction in the knowledge that the foundations of an effective instrument for ensuring the scientific future of South Africa have been well and truly laid. At the same time it is not unmindful of the responsibility it bears in keeping the Union in the forefront with the technically advanced countries of the world. We live in a scientific age and, more and more, it is becoming obvious that no country which does not devote a substantial proportion of its income to scientific research can hope to prosper. Scientific discovery is making man the master of his environment, new metals from land and sea are competing with iron and steel as structural materials, new sources of energy are replacing the fossil fuels of coal and oil, and from the chemical factory come the fertilizers and synthetics which are making him independent of naturally fertile soil as his main source of food and clothing. No longer is the balance of power between nations so completely dependent on their natural resources. More and more, scientific achievement is becoming the principal weapon of the new diplomacy.



## Skakelafdeling

*Hoof van Afdeling: MNR. D. G. KINGWILL*

### PRETORIASE KANTOOR

#### Navorsingsontwikkeling

Tegniese vraagstukke i.v.m. die ontwikkeling van die houtverwerkings-, katoentekstiel-, melasse-, eteriese olie- en sisalnywerhede het aan daggeniet. Die gietyrnywerheid word ondersoek, met besondere betrekking tot gietsand. 'n Simposium oor vraagstukke i.v.m. keramiekgrondstowwe het plaasgevind en as gevolg hiervan is 'n tegniese komitee vir die porselein- en baksteennywerhede in die lewe geroep. Die afdeling dien as sameroeper van die komitee en is verantwoordelik vir die sekretariële werk. Aandag is geskenk aan die vraagstuk van lugbesoedeling en 'n simposium is vir 31 Oktober 1955 belê.



MARTIN GIBBS.

*Mnr. D. G. Kingwill, Hoof van die Skakelafdeling.*

*Mr. D. G. Kingwill, Head of the Liaison Division.*

## Liaison Division

*Head of the Division: MR. D. G. KINGWILL*

### PRETORIA OFFICE

#### Research Development

Technical problems connected with development of the wood-processing, cotton textiles, molasses, essential oil and sisal industries were reviewed. A reconnaissance is being made of the foundry industry, with special reference to foundry sands. A symposium on problems of ceramic raw materials was arranged and, as a result, a technical liaison committee for the whiteware and brick industries has been formed. The Division is responsible for convening this committee and for providing secretarial services. Some attention was given to the question of air pollution and a symposium was arranged for October 31st, 1955.

#### Regional Liaison

In addition to these reviews of technical problems common to sectors of industry, the rôle of research in relation to regional development has been kept under review by regional research committees in Natal, the Cape Midlands and Western Province. The exchange of ideas between scientists and industrialists has been encouraged by these committees, both by arranging for research scientists to visit factories in their areas and for them to deliver public addresses and lectures. Notable among these have been: a symposium on "Heat Economy in Industry," organized by the Cape Regional Research Committee in Cape Town; a one-day seminar on "Scientific and Technical Information Services," organized by the Natal Regional Research Committee in Durban; lectures delivered in Cape Town, Port Elizabeth and Durban on corrosion; lectures on 'Incentives and human relations in industry' in Cape Town and 'Personnel research in South Africa today' in Port Elizabeth; a public lecture and one-day seminar in Durban, on non-European housing; a lecture in Port Elizabeth on 'Clay problems and research in South Africa'; and a public discussion on 'Physics in relation to Industry' organized in Port Elizabeth to coincide with a visit by senior members of the staff of the National Physical Laboratory, Pretoria.

The Council is glad to have this opportunity of formally thanking members of regional research committees and particularly the chairmen and honorary secretaries, for the time and effort they have devoted to the activities of these committees.



## Streekskakeling

Behalwe die genoemde nagaan van tegniese vraagstukke wat eie is aan sekere vertakings van die nywerheid, het die rol van navorsingswerk in verhouding tot streeksontwikkeling gedurig aandag ontvang van streeksnavorsingskomitees in Natal, die Kaapse Middellande en die Westelike Provinsie. Die komitees het die uitruiling van idees tussen wetenskaplikes en nyweraars aangemoedig deur reëlings te tref vir navorsers om fabriek in hul gebiede te besoek en om openbare vergaderings toe te spreek en lesings te hou. Die belangrikste hiervan was: 'n simposium oor „Hittebesparing in die Nywerheid,” georganiseer deur die Kaapse streeksnavorsingskomitee in Kaapstad; 'n eendaagse seminar oor „Wetenskaplike en Tegniese Inligtingsdienste,” gereël deur die Natalse streeksnavorsingskomitee in Durban; lesings oor korrosie gehou in Kaapstad, Port Elizabeth en Durban; lesings oor aansporingsmiddels en menslike verhoudinge in die nywerheid” in Kaapstad en „Teenswoordige Personeelnavorsing in Suid-Afrika” in Port Elizabeth; 'n openbare lesing en eendaagse seminar in Durban oor nie-blanke behuising; 'n lesing in Port Elizabeth oor „Kleivraagstukke en -navorsing in Suid-Afrika,” en 'n openbare bespreking oor „Fisika in verhouding tot die nywerheid” gereël in Port Elizabeth om saam te val met 'n besoek deur senior personeellede van die Nasionale Fisiese Laboratorium, Pretoria.

Die Raad wil graag van die geleentheid gebruik maak om formeel sy dank uit te spreek teenoor lede van streeksnavorsingskomitees en veral die voorsitters en ere-sekretarisse, vir die tyd en kragte wat hulle aan die werksaamhede van dié komitees gewy het.

## Patente

'n Lisensie is aan 'n firma in Engeland toegestaan om die kristalbeheerde ontvangtoestel te vervaardig wat deur die Telekommunikasie-navorsingslaboratorium ontwikkel is. Die afdeling was ook besig met breedvoerige onderhandelinge in verband met die Raad se deelname saam met die Nederlande, die Verenigde Koninkryk, Australië en Frankryk aan 'n gesamentlike projek vir die verdere ontwikkeling van die elektrodialitiese proses vir die ontsouting van water. Die Nasionale Raad vir Industriële Navorsing, in Nederland (T.N.O.), besit tans die belangrike basiese patente waarvan die ekonomiese sukses van die proses afhang.

## Verdedigingswetenskap

Die Afdeling is nou verantwoordelik vir skakeling op die gebied van verdedigingswetenskap.

## Publikasies

Behalwe die opstel en publikasie van die Raad se *Jaarverslag*, kwartaalse *Navorsingsoorsig* en weeklikse *Keur van Wetenskaplike Nuus*, is inligting aan die pers en handelsblaaie verskaf.



*Mr. H. Schauder, Chairman of the C.S.I.R. Midland Regional Research Committee.*

*Mnr. H. Schauder, Voorsitter van die W.N.N.R. se Middellandse Streeksnavorsingskomitee.*

## Patents

A licence was granted to a firm in England to manufacture the crystal controlled receiver developed by the Telecommunications Research Laboratory. The division was also concerned with the detailed negotiations in connexion with Council's participation with the Netherlands, the United Kingdom, Australia and France in a co-operative project for the further development of the electro-dialytic process for desalting water. The National Council for Industrial Research in Netherlands, (T.N.O.) at present owns the important basic patents on which the economic success of this process depends.

## Defence Science

The Division has now become responsible for liaison in the defence science field.

## Publications

In addition to producing and publishing the Council's *Annual Report*, quarterly *Research Review* and weekly *Science News Selections*, information has been provided for the Press and trade journals.



Die belangrikste werk van die jaar was i.v.m. die opstel van 'n reeks van tien geïllustreerde pamflette oor die Raad, sy nasionale laboratoriums en geassosieerde nywerheidsnavorsingsinstitute, en 'n pamflet getitel *Wetenskaplike Dienste vir die Nywerheid*. 'n *Adresboek van wetenskaplike navorsingsorganisasies in die Unie van Suid-Afrika* (van Schaik, Pretoria, Prys 25/-) het verskyn.

### Internasionaal

Van Oktober 1954 tot Maart 1955 het die hoof van die Skakelafdeling die Raad se wetenskaplike skakelkantore in Londen en Washington besoek. Die „toepassing van wetenskap in die nywerheid” is bespreek met baie toonaangewende persone in staatsinrigtings, universiteite, industriële en ander selfstandige inrigtings wat hy die voorreg gehad het om in Die Verenigde Koninkryk, Holland, Duitsland, die Verenigde State en Kanada te besoek.

Breedvoerige reëlings is getref vir besoeke aan Suid-Afrika deur dr. R. A. E. Galley, direkteur van die Colonial Products Research Council, Londen, en dr. J. P. Chapin, 'n leidende deskundige oor die voëls van Afrika.

Die Raad stuur nie gewoonlik verteenwoordigers na die Algemene Vergaderings en Kongresse van die Internasionale Wetenskaplike Unies wat geaffilieer is met die Internasionale Raad vir Wetenskaplike Unies en waarvan die Raad Suid-Afrika verteenwoordig nie. As dit egter enigsins moontlik is, word toonaangewende Suid-Afrikaanse wetenskaplikes wat ten tye daarvan binne redelike afstand van die vergaderplek is, genooi om Suid-Afrika by die konferensies te verteenwoordig.

'n Suid-Afrikaanse Nasionale Komitee vir die Internasionale Geofisiese Jaar 1957-58 onder voorsitterskap van dr. T. E. W. Schumann, is besig om reëlings te tref vir Suid-Afrika se deelname. Hul werksaamhede is op 17 Augustus 1955 van stapel gestuur deur Sy Edele dr. A. J. R. van Rhijn op 'n vergadering wat bygewoon is deur wetenskaplikes en verteenwoordigers van belanghebbende organisasies.

Die Pretoriase kantoor het die Raad se wetenskaplike skakelkantore in Londen en Washington ondersteun, hoofsaaklik deur as klaringskantoor op te tree vir sake wat meer as een wetenskaplike laboratorium in die land raak of sake wat nie bepaald enige besondere inrigting raak nie.

### WETENSKAPLIKE SKAKELKANTOOR, LONDEN

#### Besoekers

Daar was 'n aanmerklike toename in die aantal Suid-Afrikaanse besoekers. Reisplanne is opgestel vir 39 wetenskaplikes en amptenare en besoeke aan navorsingsorganisasies waarby hulle belang het is gereël. Dit is

The main effort of the year has gone into the production of a series of ten illustrated brochures on the Council, its national laboratories and associated industrial research institutes, and into a pamphlet entitled *Science Services for Industry*. A *Directory of scientific research organizations in the Union of South Africa* (Van Schaik's, Pretoria, Price 25s.) has appeared.

### International

The Head of the Division visited the Council's Scientific Liaison Offices in London and Washington from October, 1954, to March, 1955. The 'application of science by industry' was discussed with many leading personalities in government, university, industrial and independent institutions which he was privileged to visit in the United Kingdom, Holland, Germany, the United States of America and Canada.

Detailed arrangements were made for visits to South Africa by Dr. R. A. E. Galley, Director of the Colonial Products Research Council, London, and Dr. J. P. Chapin, a leading authority on the birds of Africa.

The Council does not normally send representatives to the general assemblies and congresses of the international scientific unions affiliated to the International Council of Scientific Unions, to which the Council adheres on behalf of South Africa. Whenever possible, however, leading South African scientists who happen to be within reasonable reach of the venue at the appropriate time are invited to represent South Africa at these conferences.

A South African National Committee for the International Geophysical Year 1957-58, under chairmanship of Dr. T. E. W. Schumann, has been active in organizing South Africa's participation. Its activities were launched by the Minister of Economic Affairs, Dr. the Hon. A. J. R. van Rhijn, at a meeting on August 17th, 1955, which was attended by scientists and representatives of interested organizations.

The Council's scientific liaison officers in London and Washington have been supported through the Pretoria office, mainly by acting as a clearing house for matters affecting more than one scientific laboratory in this country, or matters which do not specifically concern any one institution.

### SCIENTIFIC LIAISON OFFICE, LONDON

#### Visitors

There has been a significant increase in the number of South African visitors. Travel arrangements and itineraries specifying research organizations related to the interests of the visitor, were prepared for thirty-nine scientists and officials. It is



opmerklik dat vyftien van hulle aan organisasies behoort het wat buite die W.N.N.R. sorteer.

### **Tegniese Navrae**

Talle tegniese navrae word nog steeds van die W.N.N.R.-laboratoriums en ander organisasies ontvang. Sommige navrae was van ondergeskikte aard maar gedurende die jaar is 74 belangrike tegniese navrae afgehandel.

Nie al die navrae kom uit Suid-Afrika nie en die kantoor kon ook hul deel doen om Britse en Vastelandse organisasies in te lig oor die Suid-Afrikaanse navorsings-toneel.

### **Verhouding met Suid-Afrikahuis**

Dit is gepas om hier melding te maak van die hulp wat deur ander departemente by Suid-Afrikahuis verleen is. Daar is steeds saamgewerk met die Militêre Adviseur in verband met wetenskaplike byeenkomste wat indirek oor verdediging betrekking het soos die Oseanografiese Konferensie van die Britse Statebond en onlangse vergadering oor Verdedigingsvoedselkunde.

### **Konferensies**

Die Unie is onder meer op die volgende wetenskaplike konferensies verteenwoordig: die Simposium van die Organisasie vir Europese Ekonomiese Samewerking (O.E.E.C.) oor die organisasie van navorsingswerk, gehou in Nancy, Frankryk, 'n konferensie oor die opleiding en funksie van die chemiese ingenieur, 'n konferensie oor lug- en waterbesoedeling en 'n konferensie oor stolling en uitvlokking. Verskillende vergaderings i.v.m. die werk van die subkomitee vir koöperatiewe navorsing vir die O.E.E.C. en gereelde vergaderings van vyf permanente Statebondskomitees in Londen is ook bygewoon.

### **Administrasie**

Nege vakante wetenskaplike betrekkings in die W.N.N.R. is in geskikte tydskrifte gepubliseer en inligting is verskaf aan 160 aspirant-kandidate. Aan 19 applikante uit vyf lande is onderhoude toegestaan en 15 wetenskaplikes aan wie die W.N.N.R. betrekkings aangebied het, is gehelp met hul reise na Suid-Afrika.

### **Dokumente**

Die volgende syfers is 'n weerspieëling van versoeke ontvang vir afdrukke van publikasies wat nie normaalweg in Suid-Afrika verkrygbaar is nie:

Versoeke vir fotostatiese afdrukke van wetenskaplike verhandelinge .. .. .	111
Versoeke vir herdrukke van verslae .. .. .	89
Versoeke vir konferensieverhandelinge .. .. .	83
Versoeke uit die V.K. vir S.A. verhandelinge .. .. .	34

noteworthy that fifteen of these were from organizations other than the C.S.I.R.

### **Technical Enquiries**

Numerous technical enquiries continue to be received from the C.S.I.R. laboratories and other organizations. Some enquiries are of a minor nature, but during the year 74 major technical enquiries were dealt with.

Not all enquiries originate from South Africa, and the office has also been able to play its part in assisting British and Continental organizations with information on the South African research scene.

### **Relations with South Africa House**

It is appropriate at this stage to acknowledge the assistance rendered by other departments at South Africa House. Co-operation has been maintained with the Military Adviser in respect to scientific gatherings with a defence implication, such as the Commonwealth Oceanographic Conference, and the more recent meeting on Defence Food Science.

### **Conferences**

Representation of the Union at scientific conferences included attending the O.E.E.C. (Organization for European Economic Co-operation) Symposium on the Organization of Research held at Nancy, France, a conference on the Education and Function of the Chemical Engineer, the Air and Water Pollution Conference, and the Conference on Coagulation and Flocculation. Various meetings relating to the work of the Sub-Committees for Co-operative Research for O.E.E.C. and regular meetings of five permanent Commonwealth Committees in London were attended.

### **Administration**

Nine vacant scientific posts in the C.S.I.R. were advertised in appropriate journals and information was supplied to 160 prospective applicants. Nineteen candidates drawn from five countries were interviewed and fifteen scientists who were offered employment in the C.S.I.R. were assisted on their way to South Africa.

### **Documents**

Requests for copies of publications not normally available in South Africa are reflected in the following figures:—

Requests for photostats of scientific papers .. .. .	111
Requests for reprints and reports .. .. .	89
Requests for Conference papers .. .. .	83
U.K. requests for S.A. papers .. .. .	34



## WETENSKAPLIKE SKAKELKANTOOR, WASHINGTON

### Besoeke en Konferensies

Gedurende die jaar is New York besoek om konferensies oor atoomkrag, lugbesoedeling en die standaardisering van skroefdrade by te woon. Die Amerikaanse Chemiese Vereniging se jaarlikse konferensie in Cincinnati, Ohio, is bygewoon en van die geleentheid is gebruik gemaak om drie industriële organisasies en die „Occupational Health Centre” van die Verenigde State se Openbare Gesondheidsdiens te besoek. ’n Uitgebreide reis is onderneem na Texas vir die jaarlikse konferensie van die Amerikaanse Instituut van Chemiese Ingenieurs en onderweg is ’n aantal navorsingsorganisasies besoek in Noord- en Suid-Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Tennessee en Virginia. ’n Baie wye gebied van onderwerpe is bespreek en verslag oor gedoen.

### Besoekers

Agt-en-twintig wetenskaplikes wat die Verenigde State besoek het is in meerdere of mindere mate gehelp met sekuriteitsklarings, voorstellings en reëlings vir reise.

### Dokumente en Verslae

Gedurende die jaar is sowat 2,637 afskrifte van tydskrifte en ander roetinestukke aan die Biblioteek- en Inligtingsafdeling gestuur. Op spesiale versoek is 231 fotostatiese afdrucke, mikrofilms of verslae afgestuur, terwyl 480 aansoeke vir ’n verskeidenheid van dokumente van ander organisasies en individue in Suid-Afrika en die Verenigde State ontvang is. Daar is voortgegaan met die weeklikse versending van koerantuitknipsels van wetenskaplike belang.

Die Skakelbeampte het gehelp met onderhandelinge met die Atoomkragkommissie van die Verenigde State vir die afstuur van ’n volledige atoomkragbiblioteek na Suid-Afrika.

’n Totaal van 60 verslae van die Wetenskaplike Kantoor van die Britse Gemenebes (B.C.S.O.) is na Suid-Afrika gestuur. Dit is hoofsaaklik verslae oor bepaalde onderwerpe of gebiede wat ondersoek word deur deskundiges van die Verenigde Koninkryk se Wetenskaplike Sending wat vir die doel tydelik in die V.S. gestasioneer is.

### Navrae

Dit lyk asof daar gedurende die jaar meer aandag as gewoonlik geskenk is aan voedingsnavorsing, navorsing i.v.m. waterbehandeling en sake i.v.m. atoomkrag. Wat die laasgenoemde betref is besondere pogings aangewend om in voeling te bly met die gesantskap, en om die President van die W.N.N.R. op die hoogte te hou van Amerikaanse toestande. Die toneel het taamlik radikaal verander met die algemene deklassifikasie van inligting wat nou plaasvind.

## SCIENTIFIC LIAISON OFFICE, WASHINGTON

### Visits and Conferences

During the year visits were paid to New York to attend conferences on atomic energy, air pollution, and the standardization of screw-threads. The American Chemical Society’s annual conference was attended in Cincinnati, Ohio, and the opportunity was taken of visiting three industrial organizations and the Occupational Health Center of the U.S. Public Health Service. An extended trip was made to Texas for the annual conference of the American Institute of Chemical Engineers, and a number of research organizations were visited en route, in North and South Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Tennessee and Virginia. Matters discussed and reported on covered a very wide range of subjects.

### Visitors

Twenty eight scientists visiting the United States have been assisted to a greater or lesser degree with security clearances, introductions and travel arrangements.

### Documents and Reports

The Library and Information Division was sent some 2,637 copies of journals and other routine documents during the year. 231 photostats, microfilms or specially requested reports were sent and miscellaneous document requests from other organizations and individuals in South Africa and the U.S. totalled 480. The weekly forwarding of clippings of scientific interest from the daily press has continued.

The Liaison Officer assisted in negotiations with the U.S. Atomic Energy Commission for the despatch of a complete atomic energy library to South Africa.

The total number of British Commonwealth Scientific Office reports despatched to South Africa was 60. These, in the main, are reports on specific subjects or fields investigated by the specialist officers of the United Kingdom Scientific Mission, stationed temporarily for the purpose in the U.S.

### Enquiries

More than usual attention appears to have been devoted during the year to food research, water treatment research, and atomic energy matters. In respect of the latter, particular attempts have been made to keep in touch with the Embassy, and to keep the President of the C.S.I.R. informed of the American scene. This scene has changed rather radically with the general declassification of information which has been taking place.



## Biblioteek- en Inligtingsafdeling

*Hoof van die Afdeling: MEJ. HAZEL MEWS*

Die basiese patroon van die organisasie van die biblioteek het nou sy finale vorm aangeneem. Dit is nie gebaseer op die voorbeeld van enige enkele ander biblioteek nie, maar is 'n kombinasie van die stelsels en funksies van verskillende soorte biblioteke en bibliografiese inrigtings.

Die werk van die Afdeling word in drie onderafdelings ingedeel: Uitleendiens, boekbereidingsdiens en inligtings- en publikasiediens.

### UITLEENDIENS

Die Afdeling is verantwoordelik vir alle werk in verband met die uitleen van publikasies en die nodige rekords



*Mej. Hazel Mews, Hoof van die Biblioteek- en Inligtingsafdeling.*

*Miss Hazel Mews, Head of the Library and Information Division.*

## Library and Information Division

*Head of Division: MISS HAZEL MEWS*

The basic pattern of the organization of the Library, for which there is no actual precedent in the practice of any one other library — only a combination of the practices and functions of several types of libraries and bibliographical institutions — has finally become clear.

The work of the Division is divided into three main sections, Lending Services, Processing Services and Information and Publishing Services.

### LENDING SERVICES

This Section is responsible for all the routines necessary to keep records of the loan of publications. The sending out of overdue notices (3,603 during the year) forms part of this work. The Section also keeps the records of the library's collection of scientific periodicals, of which it opens and records over 1,600 currently; the arrangements and records necessary in connection with the binding of these journals are also made by this Section. Another activity is the unceasing effort to fill the gaps that appear from time to time in any library's sets of periodicals, and the drawing up of lists of duplicate periodicals to exchange with other libraries. Inter-library loans are also handled by Lending Services. During recent months the Section has expanded its work to include supervision of the branches in Pretoria, (National Nutrition Research Institute) and in Johannesburg (National Institute for Personnel Research, Telecommunications Research Laboratory and Water Research Division).

### Publications issued on loan

It is gratifying to see an increase of 4,473 in the number of publications borrowed from the C.S.I.R. Library (Headquarters and Branches) during the past 12 months as compared with the corresponding twelve months of last year, i.e., 27,313 as compared with 22,840. The increase is spread over all categories of borrowers and is partly the reflection of the general growth of the Library's work, partly the reflection of the increased efficiency of the branches.

### Branches

An officer was transferred to Johannesburg from 1st August, 1955, to take charge of the Division's branches there. The Assistant-in-charge of Lending Services now pays a monthly visit to the Johannes-



daarvan. Die uitstuur van aanmanings vir boeke waarvoor die leentyd verstreke is (3,603 gedurende die jaar), vorm deel van die werk. Registers word ook gehou vir die biblioteek se versameling van wetenskaplike tydskrifte, waarvan tans 1,600 ontvang word wat gereeld ooggemaak en ingeskryf moet word; reëlins word getref vir die bind van tydskrifte en die nodige rekords in verband daarmee, word gehou. 'n Ander werksaamheid is die voortdurende poging om gapings te vul wat van tyd tot tyd in enige biblioteek se stelle tydskrifte ontstaan en om lyste van duplikaattydskrifte op te stel vir uitruiling met ander biblioteke. Tussenbiblioteekse lenings word ook deur die afdeling behartig. Onlangs is die afdeling se werksaamhede uitgebrei om toesig oor die takke in Pretoria (Nasionale Voedingnavorsingsinstituut) en in Johannesburg (Nasionale Instituut vir Personeelnavorsing, Telekommunikasie-navorsingslaboratorium en die Waternavorsingsafdeling) in te sluit.

#### **Publikasies wat uitgeleen is**

Dit is aangenaam om te meld dat daar 'n toename van 4,473 was in die aantal publikasies wat gedurende die afgelope 12 maande van die W.N.N.R.-biblioteek (hoofkantoor en takke) geleen is, naamlik 27,313, teenoor 22,840 wat in die ooreenstemmende 12 maande van verlede jaar geleen is. Die toename dek alle kategorieë van leners en is deels 'n weerspieëling van die algemene groei van die biblioteek se werk en deels van die toenemende doeltreffendheid van die takke.

#### **Takke**

Op 1 Augustus 1955 is 'n personeelid na Johannesburg oorgeplaas om toesig te hou oor die afdeling se takke aldaar.

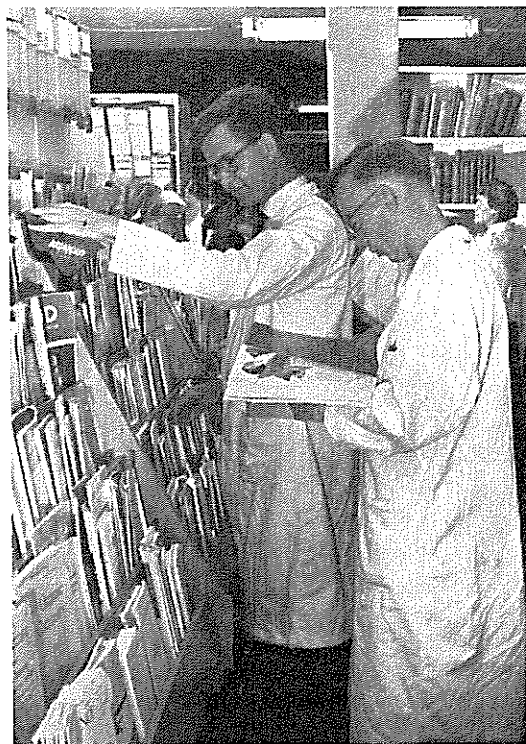
Die assistente in bevel van die uitleendiens bring maandeliks besoeke aan die Johannesburgse takke en aan die biblioteek van die Nasionale Voedingnavorsingsinstituut.

#### **Duplikaattydskrifte**

Die afdeling het voortgegaan met die opstel van lyste van die biblioteek se duplikaattydskrifte: lyste nos. 8, 9 en 10 het vanjaar verskyn en is aan 125 biblioteke hier en in die buiteland gesirkuleer. Met behulp van dié lyste kon ander biblioteke vermiste nommers in hul stelle aanvul in ruil vir soortgelyke hulp wat van hulle ontvang is. Hoe wyd versprei die samewerking tussen die biblioteke van die wêreld werklik is, word duidelik bewys deur die volgende voorbeeld: 'n vermiste nommer van 'n tydskrif is onlangs van die biblioteek van die Atoomkrakkommissie in Los Alamos ontvang.

#### **BOEKBEREIDINGSDIENS**

Weens personeelmoeilikhede was dit vir die onderafdeling onmoontlik om op datum te bly met die hoeveelheid werk en die agterstand word al groter. Ook die



*A few of the 1,600 scientific periodicals received regularly in the C.S.I.R. Library.*

*'n Paar van die 1,600 wetenskaplike tydskrifte wat gereeld in die W.N.N.R. se biblioteek ontvang word.*

burg branches as well as a monthly visit to the library of the National Nutrition Research Institute.

#### **Duplicate Periodicals**

This Section has continued to compile lists of the Library's duplicate periodicals: lists nos. 8, 9 and 10 appeared during the current year and were circulated to 125 libraries here and overseas. These lists have helped other libraries to fill gaps in their sets in return for the similar help received from them. How widespread this co-operation between the libraries of the world actually is, may be seen from just one example: the Division recently received a replacement of a missing periodical from the library of the Atomic Energy Commission in Los Alamos.

#### **PROCESSING SERVICES**

Owing to the staff difficulties it was impossible for this Section to keep up with the amount of work coming in, and the backlog is accumulating. The very necessary revision of the subject index has also had to be delayed. The lag in the number of



baie nodige hersiening van die onderwerpindeks word vertraag. Die volgende syfers toon die verskil tussen die hoeveelheid publikasies ontvang en die hoeveelheid geklassifiseer en gekatalogiseer:

Aantal publikasies ontvang .. .. .	4,621
geklassifiseer .. .. .	2,164
gekatalogiseer .. .. .	2,173
by bestaande kaarte gevoeg	570

Met die oorpasing van 'n opgeleide bibliotekaresse na Johannesburg, word 'n gedeelte van die klassifikasie vir die biblioteek van die Nasionale Instituut vir Personeelnavorsing nou daar gedoen, volgens 'n ooreenkoms wat eenvormigheid verseker. Die personeel van die Telekommunikasie-navorsingslaboratorium is ook besig om, in samewerking met die Afdeling se personeel, publikasies wat in die eerste jare van die laboratorium se bestaan opgehoop het, te klassifiseer.

Sommige van die klassifikasietabelle vir die Universele Desimale Klassifikasie is slegs in Duits verkrygbaar en nie alle klassifiseerders vind dit maklik om met sulke tabelle te werk nie. Die vertaling van tabelle wat dikwels gebruik word deur sommige van die drietalige personeellede van die W.N.N.R., was van groot hulp. Die vertalings kon ook aan die biblioteek van General Motors in Port Elizabeth beskikbaar gestel word.

#### INLIGTINGS- EN PUBLIKASIEDIENS

Dit was die laaste van die onderafdelings wat georganiseer is. Dit handel met versoeke vir inligting van W.N.N.R.-personeellede en andere wat persoonlik die biblioteek besoek asook met die wat per telefoon of brief ontvang word. Dit hanteer ook bestellings vir fotoafdrukke van artikels in tydskrifte (aantal fotoafdrukke van artikels verkry in Suid-Afrika, 353; in die Verenigde Koninkryk, 181; in die V.S.A., 345; totaal 879). Die verantwoordelikheid vir die kaarte vir die „Union Catalogue of Periodicals” (Freer se lys), die „Commonwealth Index of Translations” (5,500 kaarte is gedurende die tydperk geliasseer), die Vertalerspaneel en die herdrukdiens berus ook by die seksie. Die afdeling se publikasiewerk staan in verband met die redigering van *W.N.N.R.—Inligting*, die biblioteek se maandelikse lys van toevoegings, die *Register of Current Research at South African Universities*, die klaslyste en enige bykomende publikasie soos die *W.N.N.R.—Lys van Afskortings* (opgestel op versoek van die Raad).

Gedurende die jaar is oor die vyfhonderd navrae beantwoord, baie waarvan die samestelling van lang bibliografieë en verwysingslyste vereis het.

#### Catalogue of Union Periodicals

Op 1 Januarie 1955 het die W.N.N.R. se Biblioteek- en Inligtingsafdeling verantwoordelikheid aanvaar vir die organisasie en administrasie van die afdeling *Science and Technology* van die *Catalogue of Union Periodicals* (op kaarte), wat voorheen deur mnr. Percy Freer, destyds

publications classified and catalogued is shown by the following figures:—

No. of publications received ... ..	4,621
” ” ” classified ... ..	2,164
” ” ” catalogued ... ..	2,173
” ” ” added to existing cards ... .. .	570

With the transfer of a qualified librarian to Johannesburg, some classification for the library of the National Institute for Personnel Research is being done there under an arrangement which ensures uniformity of practice. The staff of the Telecommunications Research Laboratory have been co-operating with the Division's staff in classifying publications accumulated in the laboratory's early days.

Some of the classification tables for the Universal Decimal Classification are only available in German and not all classifiers find it easy to work with such tables. Some members of the Council's staff who are trilingual have been able to translate tables frequently used, and this has proved a great help. It has also been possible to make the translations available to the General Motors Library in Port Elizabeth.

#### INFORMATION AND PUBLISHING SERVICES

This was the last section of the Division to be organized. It is responsible for dealing with inquiries for information made in person by C.S.I.R. staff and visitors to the Library, and by outside enquirers by telephone and letter. It also handles orders for photographic copies of articles in scientific periodicals. (Number of photographic copies of articles obtained in South Africa 353, in the United Kingdom 181, in the U.S.A. 345 — total 879). Under its care are the cards for the Union Catalogue of Periodicals (Freer's list), the Commonwealth Index of Translations, (5,500 cards were filed during this period), the Translator's Panel and the reprints service. Its publishing work is concerned with the editing of *C.S.I.R. Information*, the Library's monthly list of accessions, the *Register of Current Research at South African Universities*, the Class Lists and any incidental publications such as the *C.S.I.R. List of Abbreviations* (drawn up at the request of the Council).

Over five hundred enquiries were dealt with during the year, many of which involved the compilation of long bibliographies and reference lists.

#### Catalogue of Union Periodicals

On 1st January, 1955, the C.S.I.R. Library and Information Division assumed responsibility for the arrangement and administration of the *Science and Technology* section of the *Catalogue of Union Periodicals* (on cards), which was previously



hoofbibliotekaris van die Universiteit van die Witwatersrand, behartig is. Terselfdertyd is ook die verkoop van die gepubliseerde volumes (vol. 1, 1943; vol. 1, 1ste byvoegsel, 1949; vol. 1, 2de byvoegsel, 1953) oorgeneem. *Band II van die katalogus „The Humanities,”* word nou deur die Pers van die Universiteit van die Witwatersrand, Milner Park, Johannesburg, verkoop. Die doel van die *Catalogue of Union Periodicals* is om so 'n volledige verwysingslys as moontlik te verskaf van wetenskaplike en tegnologiese tydskrifte en publikasiereekse (bv. verhandelinge van genootskappe, ens.) wat voorhande is in Suid-Afrikaanse biblioteke. Een van die doelwitte van die W.N.N.R. met die oornam van die administrasie van 'n deel van die *Catalogue* was om die inskrywings alfabeties te rangskik volgens tydskrifitel. Vroeg in Januarie is omsendbriewe aan alle medewerkende biblioteke gestuur (meer as 100) om hul menings te vra oor die alternatiewe vorms van alfabetiese rangskikkings soos gebruik in die *World List of Scientific Periodicals* en Gregory se *Union List of Serials in Libraries of the United States and Canada*, twee basiese hulpmiddels wanneer tydskrifte geraadpleeg word. Van die 24 antwoorde wat ontvang is, het agt biblioteke hulle ten gunste van die *Union List* se stelsel uitgespreek en ses ten gunste van die *World List*. Die W.N.N.R. het besluit dat die stelsel van die *Union List* meer bevredigend sal wees. In ooreenstemming met die besluit, vind die oorskakeling nou plaas. Gedurende die tydperk 1 Januarie 1955 tot 31 Augustus 1955 is sowat 500 nuwe opgawes van medewerkende biblioteke ontvang oor tydskrifte wat deur hulle gehou word. Baie navrae is ontvang vir inligting wat deur die *Catalogue of Union Periodicals* verskaf word en dit blyk 'n baie goeie reëling te wees om dit in die land se sentrale wetenskaplike biblioteek te hou.

### Publikasies

#### *Register van huidige wetenskaplike navorsing aan Suid-Afrikaanse Universiteite*

Die 1954-band van die register het in Desember 1954 verskyn en bevat 484 afsonderlike navorsingsinskrywings (262 foliobladsye). Die publikasie is hoofsaaklik bedoel vir verspreiding in die buiteland en is baie gesog. Soos die volgende tabel toon was daar 'n geleidelike toename in die antwoorde op vraelyste wat uitgestuur is.

1951	—	388 inskrywings
1952	—	geen Register gepubliseer nie
1953	—	397 inskrywings
1954	—	484 inskrywings
1955	—	545 inskrywings

#### *Uittrekselskrifte*

In April 1955 het 'n nuwe uitgawe van die *Abstracting and Indexing Journal* wat deur die W.N.N.R. se biblioteek ontvang word, verskyn. Dit bevat 199 inskrywings, gerangskik volgens die Universele Desimale Klassifikasie

administered by Mr. Percy Freer, then Chief Librarian of the University of the Witwatersrand. At the same time the sales of the published volumes (volume 1, 1943; volume 1, 1st supplement, 1949; volume 1, 2nd supplement, 1953) were also taken over. The *Catalogue of Union Periodicals, Volume II. The Humanities* is still being sold by the University of the Witwatersrand Press, Milner Park, Johannesburg. The *Catalogue of Union Periodicals* aims at providing as full a finding list as possible of South African library holdings of scientific and technological journals and serial publications (proceedings of societies, etc.); one of the objects of the C.S.I.R. in taking over the administration of a section of this *Catalogue* was to rearrange the entries alphabetically by journal title. Early in January, circular letters were sent to all co-operating libraries (over 100) asking for their views regarding the alternative forms of alphabetical arrangement as used in the *World List of Scientific Periodicals* and Gregory's *Union List of Serials in Libraries of the United States and Canada*, two basic tools used in referring to periodicals. Twenty-four replies were received, eight libraries expressing themselves in favour of the *Union List* practice and six in favour of the *World List*. The C.S.I.R. decided that the *Union List* arrangement would be the more satisfactory. In accordance with this decision the change-over is now taking place. During the period 1st January, 1955, to 31st August, 1955, some 500 new holdings have been received from co-operating libraries. Many enquiries have been received for information provided by the *Catalogue of Union Periodicals*, and it is proving very useful to have this in the country's central scientific library.

### Publications

#### *Register of current scientific research at South African universities*

The 1954 volume of this *Register* was issued in December 1954 and contains 484 separate research entries, (covering 262 foolscap pages). This publication is intended mainly for distribution overseas and in great demand. There has been a steady increase in the response to questionnaires sent out as is evidenced by the following table:—

1951	—	388 entries
1952	—	No Register published
1953	—	397 entries
1954	—	484 entries
1955	—	545 entries

#### *Abstracting journals*

A new issue of the *Abstracting and Indexing Journals* received by the C.S.I.R. Library was brought out in April, 1955. This contained 199 entries arranged according to the Universal Decimal



met 'n alfabetiese indeks. Die volgende inligting word by elke inskrywing verskaf: Universele Desimale Klassifikasienommer, volledige katalogus-inskrywing wat die W.N.N.R. se biblioteekvoorraad aandui, adres van redaksie of drukker, prys, kort beskrywing van onderwerp en funksie. In 1949 en 1951 het die W.N.N.R. se biblioteek soortgelyke lyste uitgereik met 84 en 88 inskrywings onderskeidelik. Die grootte van die jongste lys toon die toenemende groei van die biblioteek se voorraad uitrekselskrifte.

#### *W.N.N.R.-lys van afkortings*

In Januarie 1955 het die afdeling die *W.N.N.R.-lys van Afkortings van Name van Verenigings, Organisasies, ens.* uitgereik wat op versoek van die Raad opgestel is. Nuwe inskrywings word voortdurend bygevoeg as voorbereiding vir die opstel van 'n hersiene uitgawe van die lys.

#### *Klaslyste*

Gedurende die tydperk is die volgende klaslyste uitgereik:—

Biblioteekklaslys no. 3, byvoegsel: *Boeke en pamflette oor grondmeganika.*

Biblioteekklaslys no. 8: *Boeke en pamflette oor lugbesoedeling.*

As gevolg van spesifieke versoeke, word klaslyste oor *Drukkery en publikasie, Keramiek en Gieterye* nou opgestel.

#### **ALGEMENE WERKSAAMHEDE**

Op 4 Mei 1955 is 'n eendaagse seminar oor wetenskaplike en tegniese inligtingsdienste in die mediese skool van die Universiteit van Natal in Durban gehou. Die vergadering is gereël deur die Natalse Streeknavorsingskomitee van die W.N.N.R. en die Natalse Kamer van Nywerheid in medewerking met die Stadsbibliotekaris van Durban en die Bibliotekaris van die Universiteit van Natal. Dit was die vyfde seminar wat deur die afdeling gehou is, maar die eerste in Natal. Hoofsaaklik is dit gereël vir nyweraars wat belang stel in die organisasie van hul eie inligtingsdienste en biblioteke. Dit is deur sowat 50 verteenwoordigers van nywerhede, navorsingsinrigtings, biblioteke, ens. uit die Durbanse en Pietermaritzburgse gebiede bygewoon. Die vergadering is geopen deur dr. G. C. Scully, voorsitter van die Natalse Streeknavorsingskomitee. Hy is gevolg deur vier sprekers, insluitende die hoof van W.N.N.R. se Biblioteek- en Inligtingsafdeling wat twee voordragte gelewer het oor verskeie aspekte van die organisasie van tegniese inligtingsdienste. Dit word gevoel dat die seminar belangstelling aangewakker het by Natalse nywerhede vir die verbeterde organisasie van wetenskaplike biblioteek- en inligtingsdienste en vir die nut van byeenkoms van mense in die omgewing met dieselfde belange.

Classification with an alphabetical index. The following information is given for each entry: Universal Decimal Classification number; full catalogue entry, showing the C.S.I.R. Library's holdings; editorial of publisher's address; price, short description of scope and function. In 1949 and 1951 the C.S.I.R. Library brought out similar lists containing 84 and 88 entries respectively. The size of the most recent list illustrates the steady growth of the Library's holdings of abstracting journals.

#### *C.S.I.R. list of abbreviations*

In January, 1955, the Division brought out the *C.S.I.R. List of Abbreviations of Names and Societies, Organizations, etc.*, which had been compiled at the request of the Council. New entries are constantly being added in preparation for a revised edition of the list.

#### *Class lists*

During the period the following class lists were issued:—

Library class list no 3, supplement: *Books and pamphlets on soil mechanics.*

Library class list no 8: *Books and pamphlets on air pollution.*

In reply to specific requests, class lists on *Printing and publishing, Ceramics, and Foundries* are in preparation.

#### **GENERAL ACTIVITIES**

On 4th May, 1955, a one-day Seminar on Scientific and Technical Information Services was held at the Medical School of the University of Natal in Durban. The meeting was organized by the Natal Regional Research Committee of the C.S.I.R. and the Natal Chamber of Industries in collaboration with the City Librarian of Durban and the Librarian of the University of Natal; it was the fifth seminar that the Division has held and the first held in Natal. It was primarily intended for industrialists interested in the organization of their own information services and libraries. It was attended by about fifty representatives of industrial firms, research institutions, libraries etc., from the Durban and Pietermaritzburg areas. The meeting was opened by Dr. G. C. Scully, Chairman of the Natal Regional Research Committee. He was followed by four speakers, including the Head of the C.S.I.R. Library and Information Division, who lectured on various aspects of the organization of technical information services. It is felt that the seminar stimulated interest amongst Natal industries in the better organization of scientific library and information services and in the usefulness of bringing together people with the same interests in that area.



### **Samewerking in die Gemenebes**

Na aanleiding van 'n brief van die Staande Komitee van die Wetenskaplike Konferensie van die Britse Gemenebes in Londen, het die hoof van die Afdeling direk in verbinding getree met die hoofde van nasionale wetenskaplike inligtingsentrums in ander Gemenebeslande. As gevolg daarvan vind daar nou uitruiling van publikasies plaas.

### **Raadgewende Werk**

Ander inrigtings het weer gedurende die jaar by die Afdeling om raad aangeklop, en onder andere is besoeke ontvang van die bibliotekaresse van die Wolraad, die bibliotekaresse en assistente van die biblioteek van New Consolidated Goldfields en die hoof van die inligtingsdiens van African Explosives.

### **Geskenke**

Die Afdeling ontvang dikwels geskenke, veral van die Departement van Wetenskaplike en Industriële Navorsing in Engeland en die verskillende navorsingsinrigtings wat daaraan behoort. Terwyl dit nie alles genoem kan word nie, moet melding gemaak word van vier besondere donasies wat gedurende die jaar ontvang is: 29 wetenskaplike boeke van die Akademie van Wetenskappe van die U.S.S.R., 'n stel van eie publikasies van die „Aluminium Company of South Africa” (as gevolg van die Durbanse Seminaar), die biblioteek van wyle dr. Annecke en 'n versameling van 'n aantal wetenskaplike en tegniese werke uit die Duitse Boekuitstalling wat deur die Duitse Ambassade in Pretoria oorhandig is.

### **Huisvesting**

Die beperkte ruimte in die Biblioteek het moeilikheid vir lesers oplewer en hinder die werk van die personeel.

'n Begin is gemaak met die oprigting van die nuwe Biblioteekgebou op die nuwe terrein.

### **Commonwealth co-operation**

As a result of a letter from the British Commonwealth Scientific Conference Standing Committee in London, the Head of the Division got into direct touch with the Heads of national scientific information centres in other Commonwealth countries and an exchange of publications is now taking place.

### **Consultation Work**

Other institutions continue to come to the Division for consultation; during the year such visits were received from the Librarian of the Wool Board, the Librarian and an assistant from the Library of New Consolidated Goldfields and the Head of the intelligence Section of African Explosives.

### **Gifts**

The Division is continually receiving gifts, particularly from the D.S.I.R. in England and its research institutions, but it is not proposed to list them all. During this year, however, four rather unusual donations were received, the first a gift of 29 scientific works from the U.S.S.R. Academy of Sciences, the second (as a result of the Durban Seminar) a gift of a set of their own publications from the Aluminium Company of South Africa, the third the library of the late Dr. Annecke and the fourth a collection of some of the scientific and technical books displayed at the German Book Exhibition and passed on by the German Embassy in Pretoria.

### **Accommodation**

Owing to the cramped conditions in the Library, readers have been hampered in their work and the staff's own work has been slowed down.

Construction of the new library building on the new site has begun.



# Nasionale Chemiese Navorsingslaboratorium

*Direkteur: DR. W. S. RAPSON*

Gedurende die jaar onder oorsig was die ontstaan van 'n hersiene beleid vir die keuring van navorsingsprojekte, van aansienlike belang. In die tydperk sedert 1948, wat as die eerste paar jaar van werking van die laboratorium beskou kan word, was dit die beleid om navorsingsprojekte te ontwikkel, gebaseer op die benutting van grondstowwe. Gedurende hierdie tydperk het die aktiwiteite van 'n aantal institute gemeoid met die meer tegnologiese aspekte van navorsing egter stadig toegeneem en dit het al duideliker geword dat 'n geleidelike hersiening van die funksies van die laboratorium nodig was.

Die minder fundamentele navorsingsinstitute van die W.N.N.R. en die industriële navorsinstitute verskaf nou, met sekere uitsonderings, 'n raamwerk vir die ondersoek van tegnologiese probleme vir die nywerhede. In teenstelling hiermee egter, is die fasiliteite wat hierdie institute kan aanbied vir meer fundamentele skeikundige navorsing op hul afsonderlike gebiede, beperk. Ter erkenning van die feite sal 'n toenemende aantal projekte gekies word na raadpleging met die bovermelde institute. Die doel hiervan sal wees om die fundamentele aspek van die studie van praktiese probleme waarby die institute belang het, te versterk. Met betrekking tot die prosesontwikkelingsafdeling is 'n dergelike erkenning verleen aan sy aktiwiteite as 'n diensafdeling op die gebied van skeikundige ingenieurswese aan die W.N.N.R.-organisasie as 'n geheel.

Kontrakondersoeke vir ander liggame en die nywerhede het aansienlik toegeneem—gedurende die jaar het die aantal kontrakte met 17 tot 109 toegeneem, en die waarde van hierdie kontrakte het meer as verdubbel. Kenmerkend was die toenemende aanvraag na die dienste van die Waternavorsingsafdeling.

Ondersoeke uitgevoer deur middel van beurse en skenkings het ook toegeneem. Die kontrak met die S.A. Wolraad, waarvolgens navorsingsbeurshouers vir fundamentele werk op wol en sy neweprodukte aangestel word, is vermeerder en vir 'n verdere vyf jaar verleng. Die navorsingsbeurse op visolie, suiwelafvalwater en Natalse riviere is voortgesit en vier nuwe ooreenkomste is getref.

Die eerste hiervan is aangegaan met die Administrasie van Suidwes-Afrika en maak voorsiening vir die uitrusting van 'n laboratorium in Windhoek en vir die voorsiening van personeel vir navorsing op waterprobleme in hierdie gebied. Dit word verwag dat die laboratorium gedurende die tweede helfte van 1955 in werking sal tree.

# National Chemical Research Laboratory

*Director: DR. W. S. RAPSON*

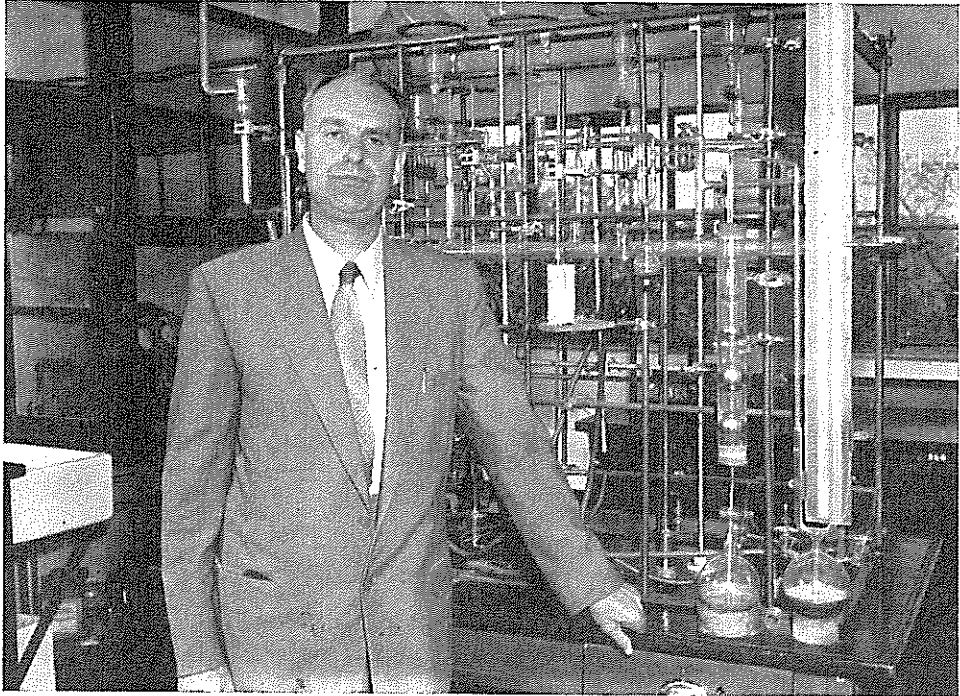
Of considerable importance during the year under review has been the emergence of a revised policy in respect of the selection of research projects. Since 1948, during what may be regarded as the first few years of operation of the laboratory, the policy has been to develop research projects based on the utilisation of raw materials. During this same period, however, the work of a number of institutes concerned with the more technological aspects of research has been gaining momentum, and it has become increasingly evident that a gradual revision of the functions of the laboratory was called for.

The less fundamental research institutes of the C.S.I.R. and the industrial research institutes now provide, with certain exceptions, a framework for the investigation of technological problems for industry. In contrast, however, the facilities which they can offer for more fundamental chemical research in their respective fields are limited. In recognition of this fact an increasing proportion of projects will be chosen in consultation with the institutes referred to above and aimed at providing reinforcement of the fundamental side for the study of practical problems with which they are concerned. In regard to the Process Division, a similar recognition has been given of its functions as a service division in the field of chemical engineering to the C.S.I.R. organization as a whole.

Contract work for the other bodies and Industry has increased considerably—the number of contracts entered into during the year has increased by 17 to 109, and the value of these contracts has more than doubled. A feature has been an increasing demand for the services of the Water Research Division.

Investigations carried out in terms of fellowships and grants have also increased. The contract with the S.A. Wool Board, in terms of which research bursars are appointed for fundamental work on wool and its by-products, has been increased and extended for a further five years. The Marine Oil, Dairy Effluent and Nafal River Research Fellowships have continued, and four new arrangements have been concluded.

The first of these is with the South West African Administration, and provides for the equipping of a laboratory in Windhoek and for the provision of staff for the investigation of water problems in the territory. It is expected that the laboratory will be in operation during the latter half of 1955. Another



*Dr. P. C. Carman, Hoofnavorsingsbeampte van die N.C.N.L., by die apparaat wat vir navorsing oor die diffusie van gasse deur poreuse vaste stowwe gebruik word.*

*Dr. P. C. Carman, Chief Research Officer of the N.C.R.L., poses in front of the apparatus used for research into the diffusion of gases through porous solids.*

'n Ander ooreenkoms is met die Instituut van Administrateurs vir Nie-Blanke Aangeleenthede van Suidelike Afrika, aangegaan. Hierdie instituut het fondse ingesamel van belangstellende groepe en het dit beskikbaar gestel vir navorsing in verband met die brou van kafferbier. Die kontrak maak voorsiening vir die aanstelling van 'n navorsingsbeurshouer en assistente. 'n Derde ooreenkoms is aangegaan met die Grondbewaringsraad, wat optree namens munisipaliteite en ander liggame wat geïnteresseerd is in die maak van kompos van munisipale afval, en 'n vierde met die Wattelkwekersunie van Natal wat voorsiening maak vir die aanstelling van 'n navorsingsbeurshouer en 'n assistent vir navorsing in verband met die benutting van wattelhout. 'n Verdere groot kontrak is aangegaan met die Transvaalse Provinsiale Administrasie in verband met rivieropnames in Transvaal.

Afgesien van die bogenoemde is ongeveer 84 ondersoeke gedoen, gedeeltelik vir Staatsdepartemente en gedeeltelik vir ander institute.

Hierdie toenemende aantal buitemuurse verpligtinge, het die verdeling van personeel beïnvloed met die gevolg dat die gedeelte van die personeel wat fundamentele navorsing doen na verhouding aansienlik verminder het. Die relatiewe gebrek aan assistente in verhouding tot

is with the Institute of Administrators of Non-European Affairs of Southern Africa. The Institute has collected funds from interested parties for investigations into the brewing of kaffir beer and the contract makes provision for the appointment of a research fellow and assistants. A third arrangement is with the Soil Conservation Board, acting on behalf of municipalities and other organisations interested in the composting of municipal wastes. A fourth is with the Wattle Growers' Union in Natal and provides for the appointment of a research fellow and assistant to conduct investigations into the utilization of wattle wood. In addition, a major contract has been entered into with the Transvaal Provincial Administration in respect of river surveys in the Transvaal.

Apart from the above, some 84 investigations were carried out, partly for Government Departments and partly for other institutions.

These increasing outside commitments have not been without their effect on staff allocations and, as a result, the proportion of staff engaged on fundamental research has tended to diminish sharply. The relative lack of assistants in relation to research



navorsingspersoneel het voortgeduur en neig om hierdie toestand te vererger.

Die beplanning van nuwe laboratoriums het steeds aansienlike aandag geniet. Intussen het huisvesting groot moeilikheid opgelewer, veral vir die Waternavorsings- en Prosesontwikkelingsafdelings.

Gedurende die jaar het 'n beampte wat in Kaapstad gestasioneer is, verantwoordelikheid aanvaar vir industriële skakelaktiwiteite in dié gebied as 'n hulp vir die Skakelafdeling. Tesame met hierdie werksaamhede word oorweging geskenk aan die ontwikkeling van aktiwiteite op 'n gebiedsbasis in hierdie en ander gebiede.

## MINERAALSTOWWE

### Klei

Daar is begin aan 'n opname van die mineralogiese samestelling en keramiese eienskappe van die klei- en skaliesoorte wat gebruik word by die vervaardiging van boustene. Dit mag dan tot nut wees vir die ontwikkeling van betreklik goedkoop kontrolemetodes om die produksie van boustene met deurgaans hoë gehalte te verseker.

'n Paar belowende voorlopige resultate is reeds verkry, en heelwat belangstelling is onder die Transvaalse fabrikante gewek. Verskeie baksteenvervaardigers het reeds kleimonsters aangestuur om op 'n kontrakgrondslag

staff has continued and has tended to aggravate this situation.

The planning of new laboratories has continued to receive considerable attention. Meanwhile accommodation presents acute difficulties, particularly for the Water Research and Process Divisions.

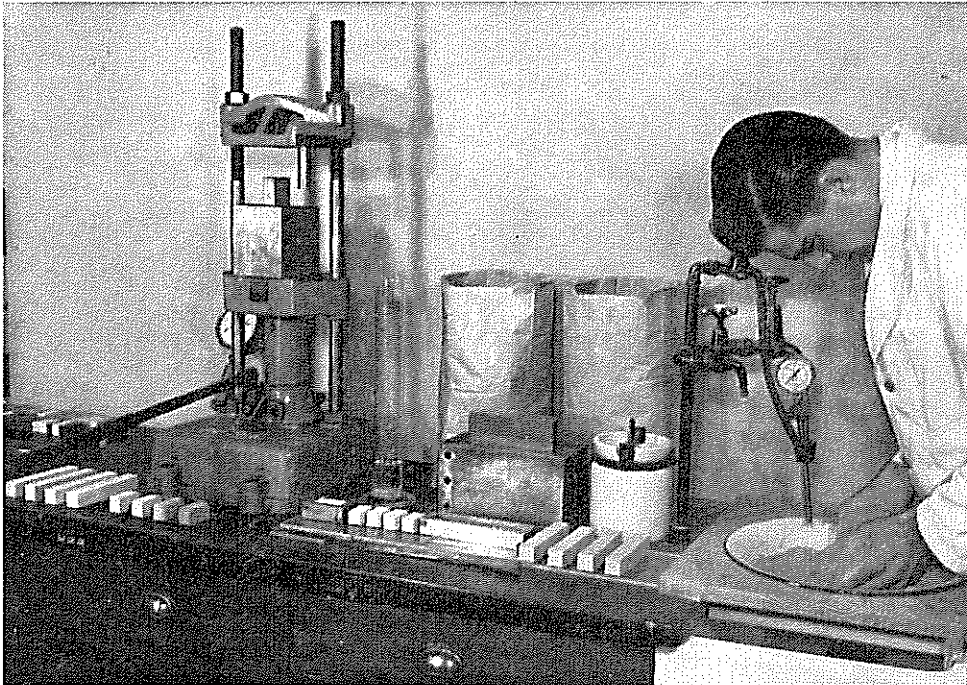
During the year, an officer stationed at Cape Town has taken over responsibility for industrial liaison activities in the area as an aid to the Liaison Division. In parallel with this activity, consideration is being given to the development of activities on a regional basis in this and other areas.

## MINERAL PRODUCTS

### Clays

A beginning has been made with a survey of the mineralogical composition and ceramic properties of clays and shales used in the production of building bricks. This may assist in development of simple and relatively cheap control methods to ensure the production of consistently high quality building brick.

Some of the preliminary results are very promising, and a great deal of interest has been aroused with producers in the Transvaal. Several brick manufacturers have sent in their clays for examination as



*Navorsing oor die eienskappe van Suid-Afrikaanse baksteenkleie.*

*Research into the characteristics of South African brick clays.*

ondersoek te word. Dit was moontlik om aan die hand te doen hoe hul produk verbeter kan word, en hoe om sekere probleme wat met die besondere kleie ontstaan, te oorkom.

'n Program van hierdie aard is, afgesien van die spesifieke belang vir baksteenklei, ook van waarde vir die opsporing van kleinere slae met bruikbare eienskappe. In een geval, byvoorbeeld, is gevind dat 'n klei uit die Randse gebied by 'n lae temperatuur smelt sonder om op te swel. So 'n klei vorm 'n uitstekende, natuurlike, bruin glasuur van die tipe wat oorsee op hoogspanningsisolatore aangewend word.

'n Studie van die Burgersdorpse gemengde-laagneerslag, reeds in vorige verslae beskrywe, het getoon dat dit tot 'n digte, wit massa vuur, wat besonder geskik is vir die vervaardiging van glasagtige vloerteëls.

Die werk op Suid-Afrikaanse illiete is voorlopig gestaak. 'n Opname van hierdie illiete, waarin die aspekte van algemene wetenskaplike belang toegelig is, is ingedien vir publikasie.

Die program i.v.m. die kolloïedfraksies van verskeie grondtipes, wat in samewerking met die Afdeling Skeikundige Dienste van die Landboudepartement uitgevoer is, is afgesluit. 'n Tweede publikasie, oor subtropiese swart kleisoorte, het gedurende die jaar verskyn. Twee ander verhandelinge is in die pers.

Verskeie identifikasies van kleiminerale is vir die Nasionale Bounavorsingsinstituut gedoen en daar is begin met die bepaling van die mineralogiese samestelling van die aggregraat wat krimpings in beton veroorsaak.

Daar is voortgegaan met die werk oor die bleiking van roomkleurige kaolien en daar is sterk aanduidings dat dit ekonomies suksesvol sal wees. Besoeke aan die kaolienvervaardigers toon dat die posisie in die Unie geweldig verbeter het in die afgelope paar jaar. Dit blyk dat die neerslae voldoende is, en gewaste kaolien vervang deesdae ru kaolien.

Besprekings met die tegniese verteenwoordigers van firmas wat belang het by keramiese en vuurvaste materiale het gelei tot die stigting van 'n Tegniese Skakelkomitee vir die Keramiese Nywerheid.

## **Sout**

Volgens die aantal navrae wat ontvang is, word aansienlike belang gestel in die produksie van soute uit plaaslike panne, wat natriumkarbonaat en -bikarbonaat sowel as -chloried en -sulfaat bevat. Die fase-studies wat in die vorige verslag vermeld is, is gevolglik uitgebrei om karbonaat en bikarbonaat te behels.

## **Fosfate**

Die kontrakwerk waarna in die vorige verslag verwys is, het gelei tot die nadere ondersoek van die produksie van

contract investigations. It has proved possible to advise them how to improve their product, and how to overcome problems arising with their specific clays.

Apart from its interest specifically for brick clays, a programme of this type is of value in showing up clay deposits with useful properties. As one instance, a clay from the Reef was found to melt at a low temperature without bloating. Such a clay forms an excellent natural, brown-coloured slip glaze, a type of material used overseas on high tension insulators.

A study of the Burgersdorp mixed-layer deposit described in previous reports showed that it fires to give a dense, white body excellently suited for vitreous floor tile.

Work on South African illites has been brought to an end for the time being. A survey of these illites, bringing out points of general scientific interest observed with them has been submitted for publication.

The programme on colloid fractions from various soil groups, carried out in collaboration with the Division of Chemical Services in the Department of Agriculture, has also been brought to an end. A second paper on sub-tropical, black clays appeared during the year, and two other papers are in the Press.

Several identifications of clay minerals were made for the National Building Research Institute, and work has been initiated on the mineralogical composition of an aggregate which produces shrinkage in concrete.

Work has been continued on the bleaching of a cream-coloured kaolin, and there are strong indications that it should be economically successful. Visits to kaolin producers indicate that the position in the Union has enormously improved in recent years. Deposits appear to be ample, and washed kaolins are now displacing crude kaolins.

Discussions with technical representatives of firms interested in ceramics and refractories have led to the formation of a Technical Liaison Committee of the Ceramics Industry.

## **Salt**

Judging from the number of enquiries received, the production of salts from local pans containing sodium carbonate and bicarbonate in addition to chloride and sulphate, is attracting considerable interest. Accordingly the phase studies mentioned in the previous report have been extended to include carbonate and bicarbonate.

## **Phosphates**

Originating from previous contract work, the production of sodium and calcium phosphates from



natrium- en kalsiumfosfaat uit yster-aluminiumfosfaat-rots. Die proses berus op die vertering van die erts met kokende bysodaoplossing.

### **Olie uit Steenkool**

In oorleg met die Suid-Afrikaanse Steenkool-, Olie- en Gaskorporasie Bpk. en die Brandstofnavorsingsinstituut is ooreengekom dat katalisatornavorsing in die Nasionale Chemiese Navorsingslaboratorium toegespits behoort te word op fundamentele studies soos die meganisme van versnellerwerking in katalisatore van die Fischer-Tropsch-tipe.

Behalwe hierdie werk op katalisatore word die studie van die autoxidasië van 5-metielnonaan voortgesit. Hierdie verbinding word gebruik as 'n model-koolwaterstof, soortgelyk aan dié wat teenwoordig is in die wasse uit die Fischer-Tropsch-proses verkry.

### **WATER**

#### **Ontsoouting van Gemeneraliseerde Waters deur Elektrodialise**

Hierdie navorsingsprojek vorm nog steeds die belangrikste werksaamhede van die Afdeling vir Prosesontwikkeling. Die omvang van die werk brei aansienlik uit.

As gevolg van die resultate behaal met die proefinstallasie soos vermeld in die vorige verslag, is 'n tweede ooreenkoms aangegaan met die goudmynmaatskappye wat in hierdie saak belang stel. Die ooreenkoms maak voorsiening vir die ontwerp en oprigting van 'n groter loodsinstallasie te Welkom in die Vrystaat met die doel om die proses verder uit te toets as 'n moontlike suiweringsmetode vir groot hoeveelhede brakwater wat tans daaglik uit die myne gepomp word. Personeel is in Pretoria opgelei om behulpsaam te wees met die proefnemings op Welkom wat teen die einde van Augustus 1955 'n aanvang geneem het.

Terselfdertyd is die kleiner loodsinstallasie 24 uur per dag vir feitlik die hele jaar in Pretoria aan die gang gehou. 'n Verskeidenheid van membrane is in samewerking met buitelandse fabrikante in die praktyk uitgetoets.

Die ontwikkeling van eie membrane het fluks gevorder en membrane is gemaak met eienskappe ten minste net so goed, en in sommige gevalle beter, as dié wat in die handel beskikbaar is.

Ondersoek na metodes vir die tipering van selektief-deurdringbare membrane is nog aan die gang.

#### **Hergebruik van Riooluitvloeiels**

Riooluitvloeiels, wat 75% van die totale waterverbruik van die groter dorpe en stede van Suid-Afrika

iron-aluminium phosphate rock has been further investigated. The process under consideration is based on digestion of the ore with boiling caustic lye.

### **Oil from Coal**

A study of some typical Fischer-Tropsch catalysts by means of gas adsorption has been completed. In consultation with the South African Coal, Oil and Gas Corporation Limited and the Fuel Research Institute, it has been agreed that catalyst research within the National Chemical Research Laboratory should be directed towards fundamental studies such as the mechanism of promoter action in Fischer-Tropsch type catalysts. This work has been commenced.

In addition to this work on catalysts, the study of the autoxidation of 5-methylnonane used as a model hydrocarbon, typical of those present in waxes from the Fischer-Tropsch process, has been continued.

### **WATER**

#### **Desalting of Mineralised Water by Electrodialysis**

This project has continued as the main commitment of the Process Division. Its scope has widened considerably.

Following on the operation of the pilot plant unit as described in the last report, a second contract was entered into with the gold mining companies interested in the development of the process. This contract was for assistance in the design and operation of a larger pilot plant to be erected at Welkom, in the Orange Free State. The object of the project is to test out the process as a means of purifying the very large volumes of brackish water which are pumped daily from mines in the area. Staff were trained in Pretoria for the operation of the Welkom pilot plant, which came into operation at the end of August, 1955.

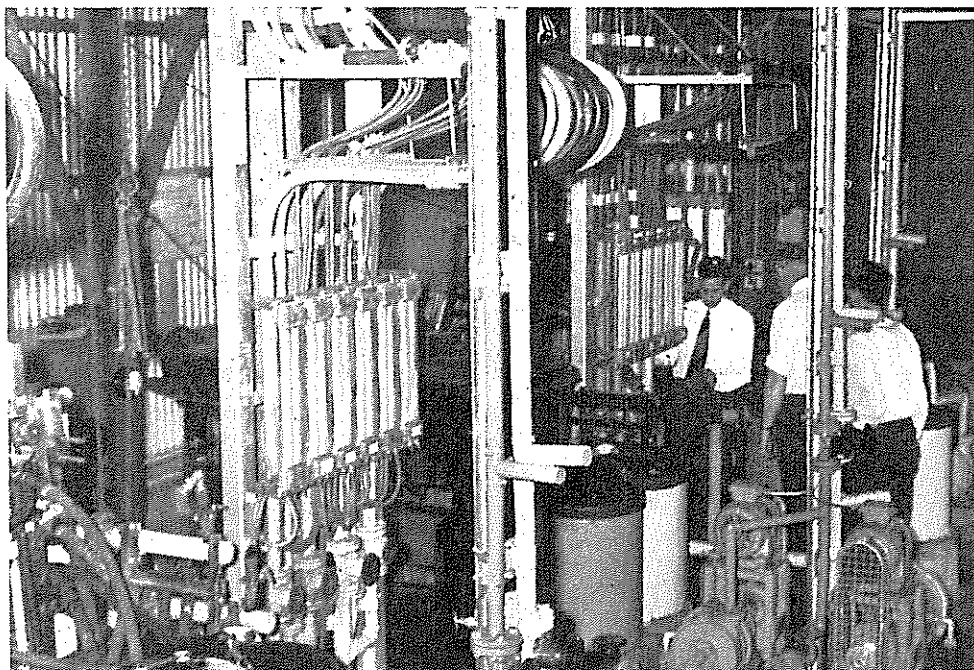
Concurrently, the smaller pilot plant in Pretoria continued to operate on a 24-hours a day basis for most of the year, and with the co-operation of manufacturers overseas, a variety of membranes was tested out in practice.

Work on the development of membranes has, however, proceeded very satisfactorily, and membranes were prepared with characteristics as good—and in some cases better—than those available commercially.

Studies of methods for characterizing permselective membranes have continued.

#### **Re-use of Sewage Effluents**

Sewage effluents which constitute about 75 per cent. of the total water consumption of major



*'n* *Blik op die proefinstallasie waarmee brakwater van die Oranje-Vrystaatse goudvelde met sukses ontsout word as gevolg van werk deur die Nasionale Chemiese Navorsingslaboratorium.*

*A view of the pilot plant which is successfully desalting saline waters from the Orange Free State gold mines as a result of research carried out by the National Chemical Research Laboratory.*

beloop, word beskou as 'n potensiële bron van watervoorsiening vir verskeie doeleindes, indien genoegsaam gesuiwer. Strenger en doeltreffender suiwing is egter nodig alvorens riooluitvloeiels vir onbeperkte hergebruik beskikbaar gestel kan word. Ondersoek na die verdere suiwing van riooluitvloeiels met die oog op sulke onbeperkte hergebruik, word dus voortgesit.

Resultate het andermaal bewys dat, van 'n bakteriologiese standpunt gesien, die gehalte van uitvloeiels van vleie baie beter is as dié van sandfilters.

Bestaande natuurlike vleie in die gebied van die Witwatersrand bied uitstekende suiwing van uitvloeiels wat organiese materiaal, ammoniak en bakterieë bevat, afkomstig van rioolwater. Die biologiese suiwerings-eienskappe van hierdie vleie word ondersoek om sodoende vas te stel in watter mate sulke eienskappe aangewend kan word om verdere suiwing van riooluitvloeiels te bewerkstellig.

Olifantsvlei is vir die doel van hierdie ondersoek gekies. Die vlei word gevoed met riooluitvloeiels wat bakterieë, organiese materiaal, nitrate, nitriete en ammoniak bevat. Die finale uitloop van die vlei is feitlik deurgaans van baie goeie gehalte. 'n Volledige studie van die flora en fauna van die vlei is ook onderneem. In hierdie verband is 'n voorlopige verslag opgestel.

towns and cities in South Africa, are potential sources of raw water supply which can be purified for a number of uses. Stringent purification is, however, required if sewage effluents are to be made available for unrestricted re-use. Investigations of the further purification of sewage effluents for such unrestricted re-use have therefore been continued.

The results obtained again stressed the superior bacteriological quality of effluents from vleis as compared with sand-filter effluent.

Existing natural vleis in the Witwatersrand area have been found to effect excellent purification of effluents charged with organic material, ammonia and bacteria of sewage origin. The biological purification agencies operating in these vleis are under investigation in order to evaluate their application to the further purification of sewage effluent.

The Olifantsvlei was selected as the most suitable for this study. This vlei receives sewage effluent containing bacteria, organic matter, nitrates and ammonia. For most of the time, the effluent from the vlei was of high quality. A detailed study of the fauna and flora of the vlei was also undertaken. A preliminary report on this work has been prepared.



Gelyktydig met bostaande ondersoekwerk, is metodes van chemiese behandeling, gevolg deur snelle biologiese filtrasie, ook uitgetoets, en is doeltreffend bevind om ammoniak-konsentrasie te verminder.

Daar bestaan reeds algemene belangstelling vir die hergebruik van riooluitvloeiels en verskeie munisipaliteite is voornemens om natuurlike suiweringsbeddings by hul rioolwerke aan te bring.

### Rivierondersoeke

Oorspronklik was die werksaamhede in hierdie afdeling beperk tot die Bergrivier in Kaapland en dié riviere in die gebied van die Witwatersrand wat afloop na die Vaalrivier bokant die Randse Waterraad se studam. Resultate van die Witwatersrandse ondersoek, saamgevat in 'n reeks van vier verslae, toon dat beide die Klip- en Suikerbosrandriviere minerale-ladings in die reënseisoen dra, wat die ladings verweg van industriële bedrywighede, aansienlik oorskry. 'n Studie word gemaak van hierdie buitengewoon hoë mineraal-ladings, wat die kwaliteit van die water wat aan die Witwatersrandse gebied voorsien word, aansienlik beïnvloed.

In Natal word die Tugelarivier-ondersoek voortgesit oor die hele lengte van die rivier. Dit was moontlik om die rivier gerieflikheidshalwe in drie streke te verdeel, elk waarvan weer in sones onderverdeel word volgens topografiese en fisiese kenmerke. Chemiese ontledings het die gewone vermeerdering van opgeloste soute met die loop van die rivier aangetoon asook skommeling al na gelang van die jaargety.

Ontwikkende plantegroei wat in noue verband staan met die rivier is almal aangeteken en die distribusie daarvan bereken. Die hidrografiese sones van die rivier toon ook bepaalde biologiese eienskappe; verskillende sones en broeiplekke toon bepaalde spesies en kombinasies van spesies. Uitbreiding van die opnames van riviere in Oos-Transvaal en die Oranje-Vrystaat word beplan.

### Waterbronne

Een van die algemene bestanddele van soutbevattende waters in Suid-Afrika is fluoor wat skadelik is vir die gestel, veral vir kinders, in hoeveelhede meer as 1.5 d.p.m. Ontfluoring van drinwaters geniet dus nog steeds aandag.

Vars water kan in klein hoeveelhede verkry word van soutagtige of selfs seewater deur sondistillasie. Navorsing met 'n klein sondistilleerapparaat het tot die einde van 1954 voortgeduur. Die resultate dui aan dat gemiddeld 0.76 Imp. gallon per dag verkry is van 'n panoppervlakte van 16 vk. vt. en dat 30% van die sonenergie op die pan vir distillasie gebruik is.

### Aërobiese Behandeling van Riooluitvloeiels

Die stabilisasie van rioolwater gedurende biologiese

In parallel with the above experiments, chemical treatment methods followed by rapid biological filtration were carried out, and have been found effective in reducing ammonia concentrations.

Widespread interest in the re-use of sewage effluents has been stimulated, and several municipalities are now proposing to construct natural purification beds at their sewage works.

### Stream Surveys

The initial projects under this heading were concerned with the Berg River in the Cape, and those rivers in the Witwatersrand area which drain into the Vaal above the Rand Water Board barrage. The results of the Witwatersrand survey, embodied in a series of four reports, indicate that the Klip and the Suikerboschrand Rivers carry mineral loads in the rainy season which very greatly exceed those to be expected as a result of industrial activity. The origins of these unexpectedly high mineral loads, which materially affect the quality of water supplied to the Witwatersrand area, are under study.

In Natal the survey of the Tugela River has been continued along the whole length of the main stream. It has been found possible to divide the river conveniently into three main regions, each divisible into zones characterized by specific topographical or physical features. Chemical analysis showed the usual type of increase in dissolved solids down-stream as well as seasonal variations. Higher plants intimately connected with the river have been listed and their distribution worked out. The hydrographic zones of the river have been found to have quite distinct biological features, different zones and niches having distinct species and combinations of species.

The extension of these surveys to rivers in the Eastern Transvaal and the Orange Free State is being planned.

### Water Supplies

One of the common constituents of saline waters in South Africa is fluorine which has been shown to be harmful, especially for children, in concentrations of more than 1.5 p.p.m. Defluoridation of drinking water was thus given continued attention.

Fresh water may be produced in small quantities from saline or even sea water, by solar distillation. Operational research with a small experimental solar still was continued until the end of 1954. The results indicated that an average of 0.76 Imp. gallons was obtained daily from a pan area of 16 sq. ft., and that 30 per cent. of that radiant energy impinging on the still was utilized for distillation.

### Aerobic Treatment of Effluents

The stabilization of sewage during biological

sypeling is in groot mate 'n funksie van die toeganklikheid van suurstof. Aangesien slegs opgeloste suurstof bruikbaar is, ontstaan daar die belangrike probleem hoe om te bewerkstellig dat die maksimum suurstof in oplossing gaan. Onderzoek na hierdie probleem openbaar tans baie interessante feite aangaande die werking van biologiese filters.

Gelyktydig met bostaande word ook ander metodes van belugting, soos die Kessner-stelsel, i.v.m. geaktiveerde slyksuiwering van rioolwater, uitgetoets.

Die suiwering van melkeryuitvloeisels deur biologiese sypeling is verder uitgebrei by 'n Bloemhofse suiwel-fabriek. Die suiweringsinstallasie is opgerig in same-werking met die Afdeling vir Waternavorsing wat ook gereeld toesig hou oor die werkverrigting daarvan. Doeltreffende suiwering van die suiwelafloopwaters word verkry.

#### **Anaërobiese Suiweringsprosesse van die Wynbedryf-uitvloeisels**

Soos voorheen beskrywe, en met die ondersteuning van die Stadsraad van Stellenbosch wat namens die wyn-bedryf en ander belanghebbende munisipaliteite optree, is 'n klein proefinstallasie in Stellenbosch opgerig wat reeds drie jaar in werking is en bevredigende resultate lewer.

In 'n vroeë stadium is gevind dat sekere bestanddele

filtration is largely dependent upon the availability of oxygen. Since only dissolved oxygen can be utilized, the question of ensuring maximum dissolution of oxygen is important. An investigation of this problem is revealing many interesting facts concerning the operation of biological filters.

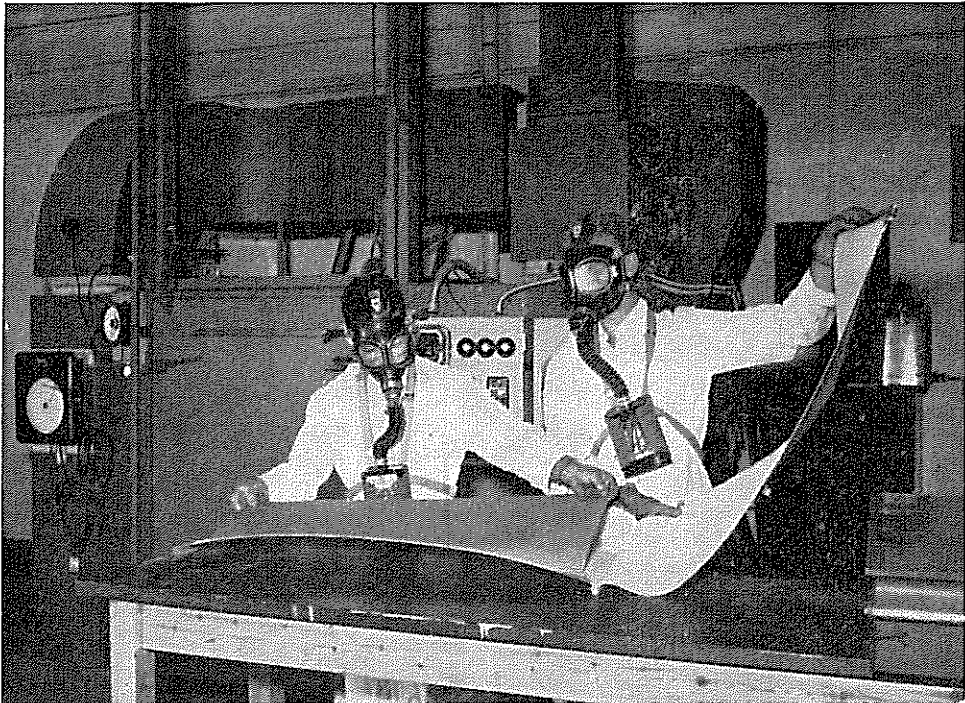
In parallel with the above, various methods of aeration by the Kessner method, such as are used in activated sludge treatment of sewage, were examined.

Dairy effluent disposal by biological filtration was further developed at a Bloemhof creamery. A regular check was kept on the performance of the plant which had been constructed under guidance of the Water Research Division. Satisfactory effluent purification was effected by the installation.

#### **Anaerobic Treatment of Wine Distillery Effluents**

As described earlier, and with the support of the Town Council of Stellenbosch, acting on behalf of the distilling industry and other interested municipalities, a small pilot plant was erected at Stellenbosch. This plant has now been operating for three years with promising results.

It was early found that certain constituents of



*Vervaardiging van eksperimentele ioon-selektiewe membrane vir die ontsouting van water.*

*Production of experimental permselective membranes for water demineralization.*



van die sinslop vergiftiging van die organismes veroorsaak wat werksaam is in die reinigingsproses en 'n vertraging van die proses meebring. Latere laboratoriumtoetse het egter bewys dat die bakterieë aan hierdie bestanddele geakklimatiseer kan word. Dit is ook gevind dat die sinslop suksesvol gesuiwer kan word deur dit aan 'n rioolslykverteringseenheid te voed. Hierdie oplossing tot die probleem van die behandeling van sinslop in munisipale gebiede word aktief ondersoek.

#### **Die Aanwending van Munisipale Afval en Komposproduksie**

Op versoek van Suid-Afrikaanse Munisipaliteite en die Grondbewaringsraad is die Komitee vir die Aanwending van Munisipale Afval aangestel om die moontlikhede van komposproduksie van organiese afvalmateriaal te ondersoek. Die Waternavorsingseenheid het 'n kontrak aangegaan om by wyse van navorsing te probeer om doeltreffende installasies en prosesse te vind vir die verwerking van huisvuil, rioolslyk en nagvuil. Die herwinning van bruikbare goedere en die biologiese verwerking van die organiese bestanddele, is die oogmerke van hierdie navorsing. 'n Opname van die afvalmateriaal van ons stede en groter dorpe is reeds gemaak en 'n verslag opgestel.

#### **Ander Onderzoekwerk en Konsulerende Dienste**

'n Aansienlike aantal ondersoeke is gedurende die loop van die jaar vir nywerhede en ander organisasies gedoen. Industriële uitvloeiels wat ondersoek is, sluit in uitvloeiels van wynkelders, fabriek vir gekondenseerde melk, fabriek vir saamgeperste suurdeeg, houtverwerkingsfabriek, goudmyne en steenkoolverwerkingsbedrywe. Watervoorsieningsprobleme van verskeie munisipaliteite, plaaslike owerhede en nywerhede is ook ondersoek.

#### **DIEREPRODUKTE**

##### **Wolweselskeikunde**

Soos verlede jaar beskryf is, is wollengtes verkry waarvan 'n deel normaal en 'n deel 'n tekort aan koper getoon het. Gedurende die afgelope jaar is aandag veral bestee aan dié soort wol. Belangrike skeikundige verskille is tussen die twee soorte wol gevind, en hierdie kennis het gelei tot 'n verklaring van die nog onopgeloste probleme wat betref die elastisiteit en plastisiteit van die wolwesels.

'n Studie word gemaak van die skeikundige veranderinge wat plaasvind wanneer groeiende wol aan die weer blootgestel word. Vorige ondersoek het getoon dat die was self afgebreek is by blootstelling aan die weer en dat hoogs aktiewe peroksied-tussenprodukte ontstaan het. Voorlopige proefnemings het reeds 'n mate van steun verskaf vir die teorie dat die wasperoksiede minstens een van die faktore is wat weselafbreek bewerkstellig wanneer groeiende wol aan die weer blootgestel word.

the distillery effluents poisoned the organisms involved in the purification process and slowed down the process. In subsequent laboratory tests, however, it was found that the organisms can be acclimatized to these substances. It has also been found that distillery effluents can be successfully purified by feeding them to a sewage sludge digestion unit, and this solution to the problem of treating distillery effluents in municipal areas is being actively explored.

#### **Municipal Waste Utilization and Compost Production**

At the request of municipalities in South Africa, the Soil Conservation Board appointed a Committee for the Utilization of Municipal Wastes to find ways and means of converting organic wastes to compost. The laboratory accepted responsibility under contract for carrying out the research necessary to establish satisfactory plant and process to handle refuse, sewage sludge and night soil. Recovery of saleable items and biological conversion of all organic constituents are the main objectives behind this project. A survey of the waste potential of the country was made and a report compiled.

#### **Other Investigational and Consultant Services**

A considerable number of investigations was carried out for industries and public bodies during the year. Industrial effluents investigated included effluents from wine cellars, condensed milk factories, compressed yeast factories, wood processing plants, gold mines and coal processing plants. Problems concerned with water supply were also investigated for a number of municipalities, local authorities and industries.

#### **ANIMAL PRODUCTS**

##### **Wool Fibre Chemistry**

As described in the previous report, wool staples have been obtained which are partly normal, and partly copper deficient. Work during the past year has centred on the study of this wool. Important chemical differences have been found between the two types of wool and, from the knowledge gained in this way, it has been possible to give an explanation for long-outstanding problems of the elasticity and plasticity of wool fibres.

A study is being made of the chemical changes which take place when growing wool fibres are exposed to the weather. Earlier investigations had shown that the wax itself was degraded on weathering via highly reactive peroxide intermediates. Preliminary experiments have now provided some evidence for the theory that the wax peroxides are at least one factor in the fibre breakdown.

## Wolwas

Studies van die afbreking van wolwas by blootstelling aan die lug het getoon dat die alkohole van die was omgesit word in 'n komplekse mengsel van suuragtige stowwe. Aangesien dit nie moontlik was om die produkte vir indentifikasie te skei nie word modelproefnemings uitgevoer met aparte wasbestanddele.

Om die ware samestelling van wolwas te bepaal, is was, wat betreklik vars uitgeskei is naby die vel, ontleed, aangesien dit bekend is dat wolwas wat van die hele wolvesel verkry is 'n groot aantal bestanddele bevat wat ontstaan het by blootstelling aan die weer.

'n Nuwe reeks hidroksisure is gevind in die suurfraksie wat afgelei is van wolwas. 'n Metode is ontwerp om hierdie sure te skei van die ander teenwoordige sure en aansienlike vooruitgang is gemaak met die opheldering van hulle struktuur.

As gevolg van 'n tekort aan personelede was vooruitgang i.v.m. die verwerking van wolwas stadig, maar groot vordering is gemaak in die ontwikkeling van 'n metode om die kalsiumsepe te skei van die onverseepbare materiaal wat ontstaan by die kalkverseping van ru wolwas.

## Suiwelprodukte

Werk i.v.m. kaseienproduksie wat in samewerking met 'n navorsingsbeurshouer, aangestel deur die Suiwelraad van Suidwes-Afrika, uitgevoer is, word voortgesit. In besonder is 'n vergelyking in die ultrasentrifuge en deur elektroforese getref tussen 'n groot aantal kaseienmonsters onder verskillende eksperimentele toestande berei. Die gegewens verkry sal help met die keuse van 'n geskikte metode vir die bereiding van kaseien op plase.

In die vroeëre werk op die waterstofperoksiedbewing van melk is opgemerk dat  $\beta$ -laktoglobulien drastiese veranderings ondergaan. Die ondersoek na die invloed van waterstofperoksied op suiwer proteïene nl.  $\beta$ -laktoglobulien en serumalbumien, is voortgesit.

Die vervaardiging van suiwelprodukte in Suid-Afrika geskied onder ongunstige toestande, want grondstowwe moet dikwels voor die verwerking daarvan oor groot afstande en in warm toestande vervoer word. Dit is welbekend dat spore van metale die ontwikkeling van oksidatiewe galsterigheid in botter versnel.

Op versoek van die Suiwelafdeling van die Departement van Landbou, word 'n ondersoek beplan na die mate waarin sulke metaalbymenging bydra tot die bederf van verskillende bottersoorte met bewaring.

As deel van 'n langer studie word die fosfolipiede van melkvet ondersoek. Dié is van belang aangesien hulle byna sekerlik die eerste stap van afbreek gedurende die vergalstering van botter is.

## Wool Wax

Studies of the degradation of wool wax on exposure to air have shown that the wax alcohols are converted to a complex mixture of acidic products. As it has not proved possible to separate these products for identification, model experiments are being carried out with single wax constituents.

Since it was found that wool wax obtained from the whole wool fibre contained a large proportion of substances which are produced by weathering, an analysis is being made of relatively freshly secreted wax near the skin in order to find out the true composition of wool wax.

A new series of hydroxy acids has been found in the acid fraction derived from wool wax. A method of separating these acids from the other acids present has been worked out, and considerable progress has been made in the elucidation of their structure.

Progress on the processing of wool wax has been slow, due to lack of staff, but a major advance has been made in developing a method for separating the calcium soaps from the non-saponifiable matter resulting from the lime saponification of crude wool grease.

## Dairy Products

Work on casein production carried out in collaboration with a research fellow appointed by the South West African Dairy Board has continued and, in particular, a large number of casein samples prepared under different experimental conditions were compared in the ultracentrifuge and by electrophoresis. The data obtained will assist in deciding upon a suitable method of preparing casein on farms.

In the work previously carried out on hydrogen peroxide preservation of milk, it was noted that  $\beta$ -lactoglobulin underwent severe alteration. Further studies were made on the effect of hydrogen peroxide on the pure proteins,  $\beta$ -lactoglobulin and serum albumin.

The manufacture of dairy products is carried out in South Africa under adverse conditions, raw materials having often to be transported long distances under warm conditions before they are processed. Traces of metals in butter are well known to accelerate the development of oxidative rancidity and, at the request of the Division of Dairying of the Department of Agriculture, it is planned to investigate the extent to which such metallic contamination contributes to deterioration of different butters in storage.

As part of a longer range study, the phospholipids of milk fat are being examined. These are of interest as they are almost certainly a first point of breakdown during deterioration of butter.



Die relatiewe voor- en nadele van botter toegedraai in perkamentpapier of aluminiumfolie is ook in 'n reeks toetse vir die Raad van Beheer oor die Suiwelnywerheid ondersoek.

Bystand is verleen aan 'n firma wat werksmoelikhede in die vervaardiging van gekondenseerde melk ondervind het. Die moeilikhede is oorkom.

#### Visolies

Die studie van visolies is voortgesit met finansiële steun deur Gebr. Marine Oil Refiners of Africa. Deur die gebruik van tegnieke wat reeds beskryf is, is 'n tweede hoogsonversadigde bestanddeel uit Kaapse sardiensolie in suiwer toestand geïsoleer en sy struktuur vasgestel.

#### Breinlipiede

Die studie van die hidroksisure uit breinlipiede is voortgesit. Verdere gegewens aangaande die struktuur van die hidroksisure is verkry en pogings is aangewend om dit te sintetiseer.

### PLANTPRODUKTE

#### Suikerrietwas

'n Proefinstallasie vir die herwinning van suikerrietwas is deur 'n suikermeulefirma in Natal opgerig en die fynere besonderhede omtrent die metode is nou in die finale stadium van ondersoek. Monsters van die produkte wat verkry is, is reeds ontvang vir ondersoek en 'n studie is reeds gemaak van die bestanddele van die waardevolle harde kutikulawasfraksie.

#### Sisal

Die skeikunde van die kutien van *Agave americana* (wat nou verwant is aan die sisalplant, *Agave sisalana*) is verder ondersoek. Dit skyn moontlik te wees dat die bestudeerde kutien 'n natuurlike poli-ester hoë polimeer is, maar tot dusver is daar geen besonderhede aangaande sy struktuur beskikbaar wat moontlik sy waterdeurdringseienskappe kan bepaal nie. Sommige van die hidroksisure, gevorm by verseping van die kutien, is geskei en hul afsonderlike strukture is bepaal.

#### Struktuur van Sterkuliensuur

Dr. J. C. Smith van die Dyson Perrins-laboratorium Oxford, houervan 'n Royal Society- en Nuffield-reisbeurs het geruime tyd in die laboratorium aan bogenoemde onderwerp bestee.

Die struktuur wat Nunn as gevolg van werk in die laboratorium vir sterkuliensuur voorgestel het, is onlangs deur 'n groep Indiese werkers in twyfel getrek. Die struktuur van Nunn se sleutelverbinding (9:11-diketononadekaansuur) is in nuwe eksperimente bevestig.

The relative advantages and disadvantages of butters wrapped in parchment and in aluminium foil have also been examined in a series of tests for the Dairy Industry Control Board.

Assistance has been rendered to a firm experiencing operating difficulties in the production of condensed milk. The difficulties were overcome.

#### Marine Oils

Studies of marine oils have continued under sponsorship by Messrs. Marine Oil Refiners of Africa. Using the techniques which have already been described, a second highly unsaturated component of pilchard oil has been isolated in a pure state and its structure established.

#### Brain Lipids

The studies of the hydroxy acids derived from brain lipids have been continued. Further information has been obtained concerning the composition of the hydroxy acids, and attempts have been made to synthesize them.

### PLANT PRODUCTS

#### Cane Wax

A pilot plant for the recovery of cane wax has been constructed in Natal by a sugar milling firm and the detailed working out of the process is now in its final stages. Samples of the products produced have been received for examination, and a study of the constituents of the more valuable hard cuticle wax fraction is being made.

#### Sisal

The chemistry of the cutin of *Agave americana* (a close relation of the sisal plant, *Agave sisalana*) has been investigated further. It appears likely that the cutin studied is a natural polyester high polymer but there is, as yet, no information available as to its detailed structure, which is likely to determine its properties in relation to water penetration. A number of hydroxy acids, formed on saponification of the cutin, have been separated and their individual structures determined.

#### Structure of Sterculic Acid

Dr. J. C. Smith, of the Dyson Perrins Laboratory, Oxford, holder of a Royal Society and Nuffield travelling fellowship, spent some time in the laboratory working on the above subject.

Nunn's structure for sterculic acid put forward as a result of work in the laboratory had recently been questioned by a group of Indian workers. The structure of Nunn's key compound (9:11-diketononadecanoic acid) was confirmed in new experiments.

## Bitterstowwe van die Cucurbitaceae (komkommerfamilie)

Die ondersoek is in samewerking met die Afdeling Tuinbou, Departement van Landbou, voortgesit.

Afbou-reaksies deurgevoer op Cucurbitasien A, dui die verwantskap tussen hierdie stof en sekere bekende diterpene en triterpene, aan. Die leidraad tot die struktuur van hierdie bitterstowwe word nagevolg. Sommige bitterstowwe in hierdie plantfamilie is amorf, maar kan na kristallyne produkte gehidroliseer word deur hoogs-spesifieke ensieme wat uit ander lede van hierdie familie geïsoleer is. Hierdie ensiembereidings is ondersoek.

## Die Ondersoek van Giftige Plante

Reëlings is getref met die Afdelings Plantkunde en Veeartsenydiens van die Departement van Landbou vir die studie in die N.C.N.L. van die chemie van plante wat giftig is vir vee. Die eerste plant wat volgens hierdie skema bestudeer sal word, is *Tribulus terrestris* (dubbeltjie) wat die geeldikkopsiekte in skape veroorsaak.

Geeldikkop is een van 'n groep hepatogene fotosensitasie-siektes wat wyd verspreid voorkom en waarvan die chemiese studie oor die algemeen besonder moeilik blyk te wees. Die onstabiele karakter van die verantwoordelike lewergifstowwe is waarskynlik die oorsaak hiervan.

## Saadproteïene

*Lupine.* Die twee globuliene van blou-lupiene (*L. angustifolius*) wat in die vorige verslag beskrywe is, is nou ten volle gekarakteriseer en die resultate gepubliseer. Geel-lupiene (*L. luteus*)-saadproteïen is geëkstraheer en vry van kleurstowwe gewas deur gebruik te maak van dieselfde metode as dié vir blou-lupiene. Die sade bevat drie globuliene, twee waarvan geïdentifiseer is met die twee globuliene van blou-lupiene, terwyl die derde 'n baie laer molekulêrgewig besit. Op soortgelyke wyse is daar in hoofsaak 'n enkele globulien, die komponent van hoë molekuleêre gewig wat omkeerbaar dissosieer, uit die saadproteïen van wit lupiene (*L. albus*) geïsoleer.

*Sonneblom.* Die skeiding en fisiese karakterisering van die twee globuliene van sonneblomsaadproteïen is gedurende die afgelope jaar voltooi en die resultate gepubliseer.

*Naras (Acanthosicyos horrida, Hook).* Die ondersoek van narassaadproteïen is in die 8ste Jaarverslag beskryf. Verdere werk op die komplekse wat met natriumdodecielsulfaat gevorm word, is uitgevoer.

*Oesterneut (Telfaria pedata).* Dit is 'n eetbare neut wat in Kenia en Suid-Rhodesië verbou word en mag van belang word in die Unie. Dit bevat 'n hoof globulien-komponent wat geïsoleer en gekarakteriseer is.

## Bitter Principles of the Cucurbitaceae (cucumber family)

This collaborate investigation with the Division of Horticulture, Department of Agriculture, has been continued.

Degradation experiments on cucurbitacin A have demonstrated its relationship to certain known diterpenes and triterpenes, this clue to the structures of these bitter substances is being followed up. Certain of the bitter substances occurring in this plant family are amorphous but can be hydrolysed to give crystalline products by highly specific enzyme(s) isolated from other members of the same plant family. These enzyme preparations have been examined.

## Investigations of Plant Poisons

Arrangements have been made with the Divisions of Botany and Veterinary Services of the Department of Agriculture for the study in the National Chemical Research Laboratory of the chemistry of plants poisonous to stock animals. The first plant to be studied in this way is *Tribulus terrestris* (devil's thorn) which is the causative agent of "geeldikkop" disease in sheep.

Geeldikkop is one of the group of hepatogenous photosensitization diseases which are of widespread occurrence and which have, in general, proved extremely difficult to study chemically. The difficulty chiefly arises from the apparently unstable character of the responsible liver toxins.

## Seed Proteins

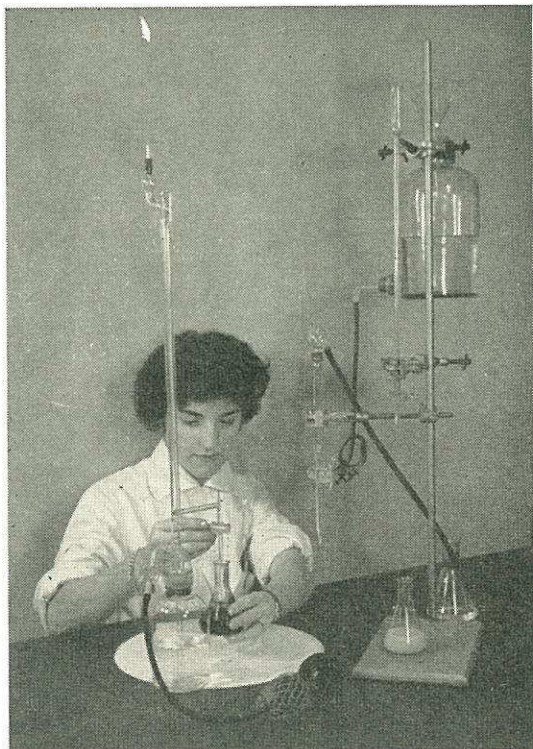
*Lupins.* The two globulins of blue lupin (*L. angustifolius*) described in the last report have been fully characterized and a paper on the results has been published. Yellow lupin (*L. luteus*) seed protein has been extracted and washed free from colouring matter by the same procedure as for blue lupin. This proved to have three globulins, two of which could be identified with the two globulins of blue lupin, while the third was of very much lower molecular weight. White lupin (*L. albus*) seed protein, after applying the same procedure as above, consisted predominantly of a single globulin of high molecular weight which undergoes reversible dissociation.

*Sunflower.* Separation and physical characterization of the two globulins of sunflower seed protein was completed during the past year.

*Naras (Acanthosicyos horrida, Hook).* Work on the naras seed protein was described in the 8th Annual Report. Some further work was carried out on complexes formed with sodium dodecyl sulphate.

*Oyster-nut (Telfaria pedata).* This is an edible nut cultivated in Kenya and Southern Rhodesia, which may become of interest in the Union. It





*Die ontleding van kafferkoringmout in navorsing na die brou van beter kafferbier.*

*The analysis of kaffircorn malts in the course of research into the brewing of better kaffir beer.*

### **Kafferkoring**

Die ondersoek na die moutery van kafferkoring en die brou van kafferbier is met entoesiasme deur die nywerheid ontvang. Om meer personeel vir dié werk aan te stel is 'n beurs deur die Instituut van Administrateurs vir Nie-Blanke Aangeleenthede beskikbaar gestel.

Gedurende die jaar is die eerste skof van die mikrobiologiese ondersoek na die brou van kafferbier afgesluit. Meer aandag word nou aan die moutery van kafferkoring bestee. 'n Metode vir die bepaling van die diastasewerking van kafferkoringmout, wat voorlopig deur die industrie as 'n standaardmetode aangeneem is, is ontwerp. 'n Interessante verskynsel wat, sover bekend, nog nie by garsmout gevind is nie, is teëgekomen in die geval van moute gemaak van die voëlproefvariëteit van kafferkoring. Wanneer dit volgens die standaardmetode ondersoek word, toon dié mout weinig of geen diastasewerking nie, alhoewel dit onder praktiese omstandighede in staat is om stysel net so vinnig soos die ander moute in suiker

showed one major globulin component, which was isolated and characterized.

### **Kaffircorn**

The investigations carried out on the malting of kaffircorn and the brewing of kaffir beer have been welcomed enthusiastically by the industry, and a fellowship has been established by the Institute of Administrators of Non-European Affairs to provide extra staff for this work.

During the year the first phase of the microbiological investigations into the brewing of kaffir beer was completed and the emphasis has now shifted to the study of the malting of kaffircorn. A method has been developed for the determination of the diastatic power of kaffircorn malt which has been tentatively accepted by the industry as a standard method. An interesting phenomenon which, as far as is known, is without parallel in the case of barley malts, has been found in the case of malt made from the Birdproof variety of kaffircorn. This malt shows little or no diastatic activity when examined by the standard method, although it is capable of converting starch into sugar as rapidly as other malts when used under practical conditions. The reason for this is being studied, and a method for testing Birdproof malt is being developed. A survey showed that the diastatic power of commercial kaffircorn malts varied very considerably. As a result of this finding many breweries are now specifying a minimum diastatic power for malt purchased. The necessary analyses are being carried out for both brewers and maltsters.

The factors influencing the diastatic power of kaffircorn malt are being studied. Malts have been produced in the laboratory from short red kaffircorn with twice the diastatic power of the best commercial malt examined to date and three to four times that of the average commercial malt. These studies are being extended to include the other principal varieties of kaffircorn.

The nutritional characteristics of kaffircorn and derived products have been studied. A number of samples of beer, malt and kaffircorn, including the principal varieties grown in the Union, have been fully characterized in respect of their content of riboflavin, nicotinic acid, thiamin, ascorbic acid, proteins, sugars, etc.

### **Kenaf ("Stockroos" or *Hibiscus cannabinus*)**

The Government is encouraging the growing of wilde stokroos (Kenaf) in the Union as a jute substitute. One of the chief obstacles to the success of this campaign is the difficulty associated with the recovery of the fibre from the plant. Under an agreement with the Department of Agriculture, the C.S.I.R. has undertaken responsibility for the development of machinery for harvesting, rib-

om te sit. Die rede hiervoor word ondersoek en 'n metode om voëlproefmout te toets, word ontwikkel. 'n Oorsig het getoon dat die diastasewerking van kommersiële kafferkoringmoute aansienlik verskil. As gevolg hiervan spesifiseer baie brouerye nou 'n minimum diastasewerking vir die mout wat hulle aankoop. Die nodige analyses vir beide die brouers en die mouters word uitgevoer.

Die faktore wat die diastasewerking van kafferkoring beïnvloed, word bestudeer. Moute, met dubbel die diastasewerking van die beste kommersiële mout wat nog tot dusver ondersoek is en drie- tot viermaal dié van die gemiddelde kommersiële mout, is in die laboratorium van kort rooi kafferkoring vervaardig. Hierdie studies word uitgebrei om ook die ander hoofvariëteite van kafferkoring in te sluit.

Die voedingskenmerke van kafferkoring en afgeleide produkte is bestudeer. 'n Aantal monsters van bier, mout en kafferkoring, insluitende die hoofvariëteite in die Unie gekweek, is wat betref hulle inhoud aan riboflaven, nikotiensuur, tiamien, askorbiensuur, proteïene, suikers, ens. ten volle beskryf.

#### Kenaf (Stokroos of *Hibiscus cannabinus*)

Die Regering moedig die aanplanting van wilde stokroos (kenaf) as 'n goeie plaasvervanger vir juut in die Unie aan. Die moeilikhede wat met die herwinning van die vesel uit die plant gepaard gaan, is een van die grootste hindernisse vir die sukses van die veldtog. Volgens 'n ooreenkoms met die Departement van Landbou, het die W.N.N.R. verantwoordelikheid aanvaar vir die ontwikkeling van masjinerie, vir die insameling, die sny in stroke, die ontbasting van die plant en die ondersoek na die roting van stokroosstroke. Eersgenoemde sal die verantwoordelikheid van die Navorsingseenheid vir Werktuigkundige Ingenieurswese wees en laasgenoemde dié van die Nasionale Chemiese Navorsingslaboratorium.

Gedurende die jaar is met 'n voorlopige ondersoek van die rotingsproses begin. 'n Aantal rotingsorganismes is uit die houers van 'n kommersiële rotingstasie te Nelspruit geïsoleer en geïdentifiseer. Die belangrikheid van die rotingstemperatuur is getoon. By 'n temperatuur van 35° was 'n laboratoriumrotingsproef voltooi in 5 tot 6 dae in vergelyking met die 1½ tot 2 maande wat nodig was in Nelspruit waar die houers nie verhit word nie. Planne word beraam vir die konstruksie van 'n proefdemonstrasierotingsseenheid voor die begin van die volgende seisoen.

#### Seegrasse

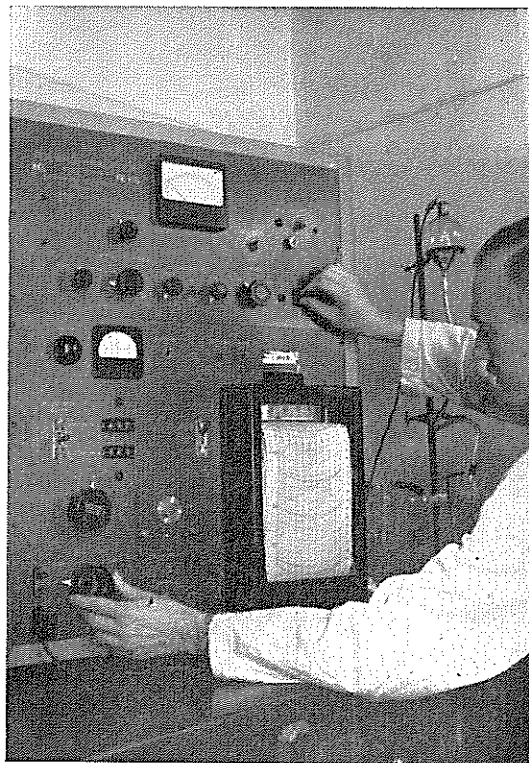
Die ondersoek na die struktuur van agar uit *Gracilaria confervoides* is voortgesit. Dit is getoon dat die oligosakkaride, verkry deur suurhidroliese van die agar, nie deur

boning and decorticating the plant, and for an investigation of the retting of stokroos ribbons. The former will be the responsibility of the Mechanical Engineering Research Unit, the latter of the National Chemical Research Laboratory.

Preliminary studies on the retting process were started during the year. A number of retting organisms were isolated from the tanks at a commercial retting station at Nelspruit and identified. The importance of the retting temperature was demonstrated. A laboratory retting trial carried out at 35° C. was complete in 5-6 days, as compared with the 1½-2 months needed at Nelspruit where the tanks are unheated. Plans are being made to set up a pilot demonstration retting unit before the commencement of the next season.

#### Seaweeds

Studies on the structure of agar from *Gracilaria confervoides* have continued. It has been demonstrated that the oligosaccharides obtained by acid



A polarograph being used for the estimation of trace quantities of copper in the study of the effect of copper deficient diets on wool fibre.

'n Palarograaf word gebruik vir die bepaling van spoorhoeveelhede koper in 'n studie van die uitwerking op wolvesels van diëte met 'n tekort aan koper.



kromatografiese metodes in 'n suiwer toestand verkry kan word nie. 'n Indirekte benaderingsmetode is aangeneem om die moeilikheid te oorbrug. Die werk op die glikosiede verkry van *Gracilaria confervoides* en *Gelidium pristoides* is gepubliseer en geen verdere werk in hierdie rigting word op die oomblik beplan nie.

'n Polisakkariede materiaal is geïsoleer van *Porphyra capensis*, 'n onkruid wat van belang is vanweë sy hoë proteïeninhoud (omtrent 25% op droë gewig bereken). Voorlopige eksperimente dui aan dat die polisakkaried van groot belang sal wees.

### **Piesangs**

'n Uitgebreide reeks spuitdroogtoetse is uitgevoer om 'n bevredigende piesangpoeier te vervaardig en om monsters te berei vir die bepaling van die markwaarde.

### **Pynappelafval**

Toerusting vir die kleinskaalse droogmaak van pynappelafval, wat as 'n bestanddeel in diervoer gebruik sal word, word ontwerp.

### **Gepolimeriseerde Olies**

Daar is verder bygedra tot die kennis van die polimerisasieaksies wat plaasvind in die droënde olië, wat in die verfnrywerheid gebruik word.

## **MIKROBIOLOGIESE CHEMIE**

### **Pekeluitjies**

Daar is getoon dat die geel vlekke wat tydens die pekelproses ontstaan, die gevolg van die werking van mikro-organismes is. Tot dusver was dit nog nie moontlik om die verantwoordelike organisme te identifiseer nie, aangesien daar tot nog toe geen bevredigende metode om uie te steriliseer anders as deur verhitting, gevind is nie. Metodes om die ontwikkeling van geel vlekke te voorkom is ondersoek. Toevoeging van die esters van p-hidroksibensoësuur het 'n mate van beskerming gebied. Ander preserveermiddels word ondersoek.

### **Aantasting van Yster deur Sulfaatreducerende Bakterieë**

Proewe is opgestel om die meganisme van stimulasie deur die bakterieë op hierdie aantasting na te gaan. Resultate wat tot op datum verkry is, is ten gunste van die algemeen aanvaarde opvatting dat die aantasting as gevolg van katodiese depolarisasie deur die bakterieë versnel word.

### **Swawelstofwisseling deur Bakterieë**

Hierdie ondersoek het voortgevloei uit die ondersoek in verband met die bakteriële aantasting van betonriole. Na 'n oorsese ontdekking van 'n nuwe *Thiobacillus*-soort wat die vermoë besit om kaliumtiosianaat te verbruik as

hydrolysis of the agar could not be separated in a state of purity by chromatographic methods. In order to overcome this difficulty an indirect method of approach has been adopted. The work on the glycosides obtained from *Gracilaria confervoides* and *Gelidium pristoides* has been published, and at present no more work along these lines is contemplated.

A polysaccharide material has been isolated from *Porphyra capensis*, a weed which is of interest because of its high protein content (ca. 25 per cent. on a dry weight basis). Preliminary experiments have indicated that the polysaccharide should prove of great interest.

### **Bananas**

An extended series of spray drying tests were carried out to investigate the conditions necessary to produce a satisfactory banana powder and to supply quantities for market evaluation.

### **Pineapple Waste**

Equipment is being designed to study on the pilot scale the conditions for the drying of pineapple waste for use as a component of animal feeds.

### **Polymerized Oils**

Further contributions to knowledge of the polymerization processes occurring in the drying oils used by the paint industry have been made.

## **MICROBIOLOGICAL CHEMISTRY**

### **Pickled Onions**

It has been shown that the development of yellow spots during brining is the result of microbial action. As yet it has not been possible to determine which organisms are responsible because of the difficulty of sterilizing the onions satisfactorily without heating. Methods of preventing the development of the yellow spot have been studied. Some protection is given by the addition of esters of p-hydroxybenzoic acid to the brine. Other preservatives are being tested.

### **Corrosion of Iron by Sulphate-reducing Bacteria**

Experiments have been set up to study the mechanism of the bacterial stimulation of corrosion. The results to date support the generally accepted theory that the bacteria accelerate corrosion by cathodic depolarization.

### **Metabolism of Sulphur Compounds by Bacteria**

This is a problem which arose out of the sewer corrosion work. Following the announcement overseas of the discovery of a new species of *Thiobacillus* capable of utilizing potassium thiocyanate as sole source of oxidizable sulphur, it was

enigste bron van oksideerbare swavel, is dit aangetoon dat verskeie *Thiobacilli* hierdie vermoë besit. Die sogenoemde *Thiobacillus thiooxydans* is na alle waarskynlikheid geen nuwe soort nie, maar slegs 'n *Thiobacillus denitrificans*stam.

#### **Die Oksidasie van Koolstofmonoksied deur 'n Hidrogenomonassoort**

Die mikro-organisme onder bespreking besit die interessante eienskap om die energie benodig vir sy groei, uit die oksidasie van koolstofmonoksied na koolsuurgas, te verkry. Die meganisme van hierdie omsetting word ondersoek.

#### **Mikrobiologiese Bederf in die Nywerheid**

Ondersoek na die bederfsoorsaak in lemoensap-konsentraat, smeerkaas, gekondenseerde melk en vloerpolitoer is onder kontrak vir fabrikante uitgevoer.

#### **Voeding van Herkouers**

Daar is reeds begin met 'n ondersoek in samewerking met die Veeartsenykundige Navorsingsinstituut te Onderstepoort, in verband met die biochemiese aspekte van die herkouers.

Baie skape vrek jaarliks aan „Domsiekte” of swangerskaptoksemie. Dit is reeds op Onderstepoort aangetoon dat 'n domsiekte-tipe ketosis verkry kan word, deur diere op 'n dieet van hoë proteïengehalte of op 'n dieet van lae proteïengehalte te plaas of te verhonger. Dit is bewys dat die mikroflora van die rumen in alle waarskynlikheid 'n belangrike rol speel in die totstandkoming van hierdie toestand. Daar is begin met 'n reeks dieetproewe om die aard van die mikrobiologiese en biochemiese veranderinge wat onder die bepaalde omstandighede in die rumen optree na te gaan en met die fisiologiese verandering wat in die diere optree, in verband te bring. 'n Mikrobioloog is deur die Nasionale Chemiese Laboratorium aangewys om hierdie probleem op Onderstepoort te ondersoek in samewerking met die span ondersoekers aldaar.

'n Gekombineerde ondersoek na die verbruik van ureum deur herkouers, is beplan. Hierdie probleem is van groot praktiese belang en een waaraan nog weinig fundamentele ondersoek gewy is.

### **BIOCHEMIE**

#### **Studies in verband met Vitamien A-stofwisseling en die Voorkoms van die Vitamien in Dierlike Vette**

Dit is 'n program in samewerking met professor J. Gillman van die Voedingsnavorsingseenheid aan die Universiteit van die Witwatersrand.

Dit is voorgestel om die vitamien A-stofwisseling in die rot na te gaan deur toevoeging van geskikte hoeveelhede radio-aktiewe vitamien A tot die dieet van die dier

shown that a number of species of *Thiobacilli* possess the ability to oxidize thiocyanate and that the so-called *Thiobacillus thiooxydans* is probably not a new species but a strain of *Thiobacillus denitrificans*.

#### **Carbon Monoxide Oxidation by a Hydrogenomonas Species**

The organism in question possesses the interesting property of being able to grow by deriving its energy from the oxidation of carbon monoxide to carbon dioxide. The mechanism of the reaction is being studied.

#### **Microbiological Spoilage in Industry**

Investigations were carried out for industrial firms on a contract basis on the cause and prevention of spoilage of various types of product, including orange juice concentrate, processed cheese, condensed milk and floor polish.

#### **Ruminant Nutrition**

A collaborative study of the biochemistry of ruminant nutrition in which the laboratory is joining forces with the Veterinary Research Institute, Onderstepoort, has been initiated.

“Domsiekte,” or pregnancy toxæmia, is a disease which causes the deaths of numerous sheep every year. It has been shown at Onderstepoort that a “domsiekte” type of ketosis may be induced experimentally by switching animals on a high protein diet to a low protein diet or starvation. Evidence has been accumulated to show that the microflora of the rumen is probably involved in the development of this condition. A series of animal experiments has been started to study the nature of the microbiological and biochemical changes occurring in the rumen under these conditions and their relation to the physiological changes in the animal. A microbiologist has been assigned by the National Chemical Research Laboratory to work on the problem at Onderstepoort in collaboration with the team there.

A joint study of the utilization of urea by ruminants has also been planned. This is a problem of great practical importance on which little fundamental work has been done up to now.

### **BIOCHEMISTRY**

#### **Studies relating to the Metabolism of Vitamin A and to its Occurrence in Animal Fats**

This is a collaborative programme with Professor J. Gillman, of the Nutrition Research Unit at the University of the Witwatersrand.

It is proposed to study the metabolism of vitamin A in the rat by incorporating a suitable amount of radioactive vitamin A into its diet and



en om die verblyf van die vitamien te volg. Die sintese vir die radio-aktiewe vitamien A is ver gevorder. Die minimum vitamien A-voedingspeil nodig vir die normale ontwikkeling van rotte, is ondertussen deur prof. Gillman vasgestel. Verder is daar ook van hierdie diere afgestaan vir die voorlopige bepaling van gewone (d.w.s. nie-radio-aktiewe) vitamien A in weefsels, deur chemiese werks-wyses. Heelwat ondervinding in verband met praktiese probleme is hierdeur reeds opgedoen.

Die „vitamien A-verplasende faktor” wat teenwoordig is in die bees- en skaapvetmengsel wat deur prof. Gillman gebruik word in die voedingsproewe, is deur twee onafhanklike metodes aangetoon as vitamien A te wees. Die hoeveelheid vitamien A teenwoordig, bepaal volgens chemiese werks wyses en dié verkry deur biologiese bepalingsmetodes, is in goeie ooreenoms. Die chemiese isolasie van vitamien A sluit ’n molekulêre distillasie in. Die vraag ontstaan egter of die vet vitamien A as sulks bevat of ’n ander stof waaruit vitamien A gedurende distillasie ontstaan. Proewe word uitgevoer om hierdie moontlikheid nader te ondersoek.

## FISIESE, ANORGANIESE EN ANALITIESE CHEMIE

### Amalgaamchemie

Die sisteem mangaan-kwik is nader ondersoek in die loop van ’n breër navorsingsprogram op die binêre sisteme, genoem „amalgame,” wat gevorm word tussen kwik en die metale van die eerste transisiegroep. Die volledige struktuur-ontleding van  $Mn_2Hg_5$ -kristalle, wat in die vorm van naalde geïsoleer is, is onderweg.

### Gasadsorpsie

In die loop van die studie van katalisatore in diffusie in vaste stowwe, is dit nodig gevind om betreklik klein spesifieke oppervlaktes te bepaal, van die orde van ’n paar honderd  $cm^2/g$ . Die kryptonadsorpsiemetode is vir hierdie doel toegepas. Aangesien daar onsekerheid bestaan oor die oppervlakte van ’n kryptonatoom ge-adsorbeer op verskillende stowwe, is die metode nader ondersoek.

### Diffusie in Vaste Stowwe

Werk in verband met die diffusie van koolstofdioksied in kalsiet waarby betreklik groot en uitgegloeide kristalle gebruik is vir die isotoopuitwisselingsproewe, is voltooi. Dit was moontlik om waardes te verkry vir die rooster-diffusiekoëffisiënt by verskillende temperature. Op grond van laasgenoemde is verskillende moontlike diffusie-meganismes oorweeg en ge-evalueer. Die metode gebruik in die bogenoemde ondersoek word tans uitgebrei vir die ondersoek van ander nie-metaalkristalle.

studying the fate of the vitamin. The synthesis of the radioactive vitamin A is well advanced, and in the meantime Professor Gillman has determined the level of vitamin A feeding which will keep his stock rats at a maintenance level only, and has supplied some of these rats for preliminary vitamin A determinations using the ordinary (non-radio-active) chemical assay methods. In this way experience of the practical issues involved has been built up.

The “vitamin A sparing factor” present in the beef fat/mutton fat mixture used in Professor Gillman’s rat feeding experiments has been identified by two independent methods as vitamin A. The amount of vitamin A found chemically agrees with that found by bio-assay. The chemical isolation involves a molecular distillation step, and the question has been raised as to whether the original fat contains not vitamin A itself but a precursor of it which yields vitamin A during the molecular distillation step. Experiments are now in hand to check this point by omitting the molecular distillation step in the overall concentration procedure.

## PHYSICAL, INORGANIC AND ANALYTICAL CHEMISTRY

### Amalgam Chemistry

Within the framework of an investigation of the binary systems, termed “amalgams,” formed between mercury and the metals of the first transition group, the system manganese-mercury has been studied in greater detail. The detailed structure analysis of  $Mn_2Hg_5$  crystals, which have been isolated in the form of needles, is in progress.

### Gas Adsorption

In the course of studies on catalysts as well as diffusion in solids, it was found necessary to determine relatively small surface areas, in the order of some hundred  $cm^2/g$ . The krypton adsorption method was applied for this purpose. Since uncertainty exists as to the area of a krypton atom adsorbed on various substances, the method has been examined in more detail.

### Diffusion in Solids

The work on the diffusion of carbon dioxide in calcite has been completed, using relatively large and annealed crystals for the isotope exchange experiments. It was possible to arrive at values for the lattice diffusion coefficient at various temperatures, on the basis of which possible diffusion mechanisms were evaluated. The method used in the course of this investigation is at present being extended to other non-metallic crystals.

## Radioskeikunde

Seisoenwerk in verband met die aanwending van fosfaat kunsmis op tabakplante is gedurende die somer van 1954/55 in medewerking met die Sentrale Tabaknavorsingstasie uitgevoer. Die eerste doelstelling was om die resultate verkry in die vorige seisoen, te bekragtig, waarin vasgestel is dat die opname van fosfaat alleen goed-gedefinieer is in die geval van rou grond.

In verband met pogings om tiroksien in bloed met 'n radiometriese metode te bepaal, is die ondersoek van die uitwisseling tussen di-jodotirosien en 'n draer-vry oplossing van gemerkte jodium voortgesit. Die resultate verkry by die nodige lae konsentrasies het teleurstellend geblyk, en die ondersoek is gestaak.

Radio-aktiewe merking van mostersaad is ondersoek en 'n bevredigende metode om 'n saad met voldoende aktiwiteit te verkry, is ontwikkel.

'n Reeks toetse in verband met sirkulasie in slyksel-verteringsstels is uitgevoer in 'n kontrakondersoek. Ysterfosfaat wat neergeslaan is in die slyksel is gebruik in die ondersoek. Die ysterfosfaat is gemerk met  $p^{32}$ .

Die studie van self-diffusie in homoloë alkielbromiede en -jodiede, is voltooi. 'n Verdere reeks eksperimente is uitgevoer om die self-diffusie in mengsels van etieljodied en normale butieljodied te dek.

Die moontlikheid om gesteelde kopertelefoondraad op te spoor deur dit gedurende die trekproses met radio-kobalt te merk is ondersoek, maar geen stappe is gedoen nie.

As deel van 'n program om die verspreiding van vitamien A in die liggaam te bestudeer, het dit nodig geword om baie klein hoeveelhede  $C^{14}$  te bepaal. Ondersoek na die mees geskikte bepalingmetodes is onderneem. Die tegniek van telling in die gastoestand is ontwikkel deur gebruik te maak van  $C^{14}O_2$  met koolstofbisulfied as uitdoofgas. Telling in die vaste toestand is meer voordelig en die gebruik van 'n vensterlose eweredige teller is bestudeer.

## Korrosie

'n Groot aantal navrae van Staatsdepartemente, munisipaliteite en die nywerhede is afgehandel. Gewoonlik word 'n sekere mate van eksperimentele werk vereis in elke geval. Die Korrosie-afdeling word gereeld geraadpleeg deur die Departement van Verdediging en die Poskantoor (in laasgenoemde geval meesal in verband met die korrosie van loodbedekte kables). Die Nasionale Behuisingskommissie en die Suid-Afrikaanse Uitsaaikorporasie het van tyd tot tyd advies ontvang.

'n Taamlik uitgebreide ondersoek is vereis in verband met die korrosie van sprei-apparate wat deur die Afdeling vir Sprinkaanbeheer van die Departement van Landbou vir insekdodende middels gebruik word. Stremstowwe is bygevoeg, en hulle het geblyk baie suksesvol te wees onder laboratoriumsomstandighede. Hulle moet egter nog in

## Radiochemistry

Seasonal work on the application of phosphate fertilizer to tobacco plants was carried out in collaboration with the Central Tobacco Research Station during the summer of 1954/55. The primary object was to confirm the results obtained in the previous season, in which it had been established that the uptake of labelled phosphate was only well marked in the case of virgin soils.

In connection with attempts to evaluate thyroxine in blood by a radiometric method, work was continued with investigation of exchange between diiodotyrosine and carrier-free solution of labelled iodide. Results at the low concentrations required proved to be disappointing, and the investigation was stopped.

Labelling of mustard seed was investigated, and a satisfactory method of getting a seed with an activity of sufficient intensity was developed.

A series of tests on circulation in sludge digestion tanks was carried out in a contract investigation, using iron phosphate precipitated in the sludge. The iron phosphate was labelled with  $P^{32}$ .

The study of self-diffusion in homologous alkyl bromides and iodides was completed. Also, a further series of experiments was carried out to cover self-diffusion in mixtures of ethyl iodide and normal butyl iodide.

The possibility of tracing stolen copper telephone wire by labelling with radio-cobalt during drawing was investigated, but no action has been taken.

In order to assist with a programme on vitamin A distribution in the body, it has become necessary to estimate very small amounts of  $C^{14}$ , and a study of the most suitable method for doing this has been made. Gas counting techniques were developed using  $C^{14}O_2$ , with carbon bisulphide as quenching gas. Solid counting is more convenient, and the use of a windowless proportional counter has been studied.

## Corrosion

A large number of queries from Government departments, municipalities and industry has been dealt with. Usually some experimental work is required in each case. The Corrosion Section is consulted regularly by the Department of Defence, and by the Post Office (mostly for corrosion of lead-covered cables in the latter case). The National Housing Commission and the South African Broadcasting Corporation have received advice from time to time.

A rather extensive investigation was required on corrosion of insecticide spraying equipment used by the Locust Control Section of the Department of Agriculture. Inhibitors were added and proved very successful under laboratory conditions, but have still



die veld getoets word. Verdere werk sal waarskynlik nog nodig wees vir hierdie probleem.

Voorlopige proewe dui aan dat katodiese beskerming van geweefde draadband in visinmaakfabrieke prakties uitvoerbaar mag wees, en die Visnywerheidsnavorsingsinstituut is daarvan in kennis gestel.

Twee beurse is in die W.N.N.R. beskikbaar gestel in verband met die korrosie van versterkende staal in beton. Die een word gesteun deur die S.A. Spoorweë en Hawens en die ander deur die Instituut van Siviele Ingenieurs. Beide beurshouers is aangestel. Een van hulle sal aandag bestee aan die sake rakende beton, en die ander aan die korrosieaspek, met spesiale verwysing na die faktore verantwoordelik vir korrosie, en aan die omstandighede wat korrosie mag teëwerk. Voor die aanstelling van die beurshouers, is 'n aansienlike hoeveelheid werk in die Korrosie-afdeling gedoen om die moontlikheid te bestudeer om die stremstowwe op die oppervlakte van die versterkende staal aan te wend. Werk is ook gedoen in verband met die toestande wat veroorsaak dat sout geabsorbeer word deur die betonmonster en na die staaloppervlakte vervoer word. Hierdie tipe ondersoekwerk sal voortgesit word, terwyl die werk beheer deur die beurs meer gemoeid sal wees met die sistematiese bereiding en toets van 'n lang reeks monsters onder toestande wat so streng moontlik gekontroleer word.

#### **Analitiese Laboratorium**

Steeds toenemende eise is geplaas op die dienste van die Analitiese Laboratorium. Van die groot aantal ontledings wat gedoen is, verdien die volgende spesiale vermelding. Op versoek van die Nasionale Fisiese Laboratorium is verdere analyses uitgevoer vir die geochronologiese projek. Werk in verband met mineraalprodukte het analyses van kleie, chromiete, magnetiete en fosfate nodig gemaak. Die waterontsoutingsprojek het 'n aansienlike getal water- en membraanalises vereis. 'n Groot verskeidenheid organiese produkte soos melkvet, nikotien, kafferkoring, mout, wol en botter is geanaliseer.

Gedurende die jaar het die W.N.N.R. 'n ondersoek van lugbesoedeling begin. Aangesien chemiese analise 'n belangrike rol speel in die oorweging van lugonsuiwerhede, het die Analitiese Laboratorium in hierdie projek nou saamgewerk met die Nasionale Fisiese Laboratorium. 'n Verdere belangrike werksaamheid was die ontwikkeling en uittoets van metodes vir die bepaling van onwelriekende stowwe in die atmosfeer vir 'n plaaslike industrie.

to be tested in the field. Further work will probably be required on this problem.

Preliminary work has indicated that cathodic protection of woven wire belting in fish canning factories may be feasible, and the Fishing Industry Research Institute has been advised accordingly.

Two fellowships have been set up in the C.S.I.R. on the corrosion of reinforcing steel in concrete, one sponsored by the S.A.R. and H. and one by the Institution of Civil Engineers. Both fellows have been appointed. One will attend to the concrete side, and one to the corrosion side, with special reference to the factors responsible for corrosion, and to conditions likely to decrease corrosion. Prior to the recruitment of the fellows, a considerable amount of work was carried out in the Corrosion Section to study the possibility of applying inhibitors at the reinforcing steel surface. Work was also done on the conditions causing salt to be absorbed by a concrete specimen and carried into the steel surface. This exploratory type of work will be continued, while work done under the fellowship will be more concerned with systematic preparation and testing of a long series of samples under conditions as closely controlled as possible.

#### **Analytical Laboratory**

A steadily increasing demand has been made on the Analytical Laboratory's services. Among the great variety of analyses performed, the following merit separate mention. At the request of the National Physical Laboratory further analyses were carried out for the geochronology project. Work on mineral products necessitated analyses of clays, chromites, magnetites and phosphates. The project for desalting water required numerous water and membrane analyses. A wide variety of organic products such as milk fat, nicotine, kaffircorn, malt, wool and butter were analysed.

During the year the C.S.I.R. initiated an investigation on air pollution. As chemical analysis plays a vital part in assessment of air pollutants, the Analytical Laboratory has been working in close co-operation with the National Physical Laboratory on this project. Another major activity has been the development and testing of methods for the estimation of malodorous agents in the atmosphere for a local industry.



## Nasionale Fisiese Laboratorium

*Direkteur:* DR. A. J. A. ROUX

Die jaar onder oorsig het 'n aantal hoogtepunte vir die Nasionale Fisiese Laboratorium opgelewer wat spesiale vermelding verdien. Die nuwe kernfisiese en akoestiese geboue is voltooi en betrek; die nuwe biofisikagebou nader voltooiing, terwyl daar reeds in Januarie 1955 'n aanvang geneem is met die bou van die hoof-fisikagebou wat in die loop van 1956 voltooi behoort te wees.

Wat die navorsings- en ontwikkelingsprogram van die laboratorium betref, moet daar veral aandag gevestig word op die afronding van die geokronologiese en paleomagnetiese navorsingsfasiliteite. Eerste publikasies en voorlopige bekendmakings van die navorsingsresultate in hierdie belangrike navorsingsgebiede het nie alleen groot plaaslike belangstelling geniet nie, maar het gunstige buitelandse kommentaar uitgelok.

Mooi vordering is gemaak met die uitbouing van die fasiliteite in die Afdeling Wiskunde, wat 'n bietjie meer as 'n jaar gelede gestig is. Die aanbou van 'n analoog-rekenmasjien, wat die eerste belangrike stap in die daargestelling van 'n rekenseksie in die N.F.L. is, verdien die aandag van wetenskaplike, industriële en kommersiële instansies, wat hopelik grootliks gaan baat by hierdie belangrike ontwikkeling.

Die totstandkoming van 'n kernfisiese opleiding-sentrum in die laboratorium op 1 April 1955 vul 'n belangrike behoefte. Die personeel van die laboratorium is versterk met 'n aantal ervare fisici uit die buiteland.

Dit is in die aard van 'n fisiese laboratorium dat dit nie 'n besondere nywerheid dien nie, maar dat sy navorsings-program fisiese gesigspunte van nywerheidsprosesse behels. Dit het al hoe duideliker geword dat die laboratorium dikwels belangrike bydraes kan doen tot die oplossing van probleme wat verskillende gesigspunte het, waarvan nie almal fisies van aard is nie. In die afgelope jaar is daar dus stappe gedoen ten einde te verseker dat nouer integrasie van aktiwiteite met ander laboratoriums en institute van die W.N.N.R. bewerkstellig word en ook beter inenskakeling en samewerking met universiteits- en ander navorsingsinrigtings verkry word.

Op 1 Oktober is dr. A. J. A. Roux op eie versoek onthef van sy verantwoordelikheid van die direksie van die Laboratorium, sodat hy sy volle aandag kon skenk aan die ontwikkeling van die nuwe Nasionale Navorsings-instituut vir Werktuigkundige Ingenieurswese. Dit is dus die laaste verslag oor die N.F.L. wat onder sy naam verskyn. Dr. E. J. Marais, wat gedurende dr. Roux se uitgebreide reis in die buiteland sy plek gevul het, volg hom op as direkteur van die Nasionale Fisiese Laboratorium.

## National Physical Laboratory

*Director:* DR. A. J. A. ROUX

During the year under review there were several occurrences which merit special mention. The New nuclear physics and acoustics buildings were completed and occupied; the new biophysics building was approaching completion, while in January, 1955, a start was made with the main physics building which should be finished during the course of 1956.

In respect of the research and development programme of the laboratory, attention should be drawn to the fact that the geochronological and paleomagnetic research facilities are now well established. First publication and preliminary announcements of the research results in these important fields or research not only aroused considerable local interest, but also elicited favourable comment overseas.

Good progress has been made in the development of the facilities in the Mathematics Division, which was established a little over a year ago. The construction of an analogue computer, which is the first important step in the establishment of a com-



MARTIN GIBBS.  
*Dr. A. J. A. Roux.*





*Dr. E. J. Marais*

## **KERNSPEKTROSKOPIE**

### **Siklotron**

Die konstruksiewerk aan die siklotron het sodanig gevorder dat daar gedurende Mei 1955 met toetse begin kon word, elf maande nadat die werk 'n aanvang geneem het. Vir die grootste gedeelte van die tyd het die siklotron-groep uit slegs 5 persone bestaan. Aanvanklik is 'n bundel van 20 mikroampère deuterone tot 4 miljoen elektronvolt versnel en teen die end van Mei is dit verhoog tot 6 miljoen elektronvolt met 'n bundel van 200 mikroampère.

### **Toerusting**

Met die voltooiing van die Kernfisika-gebou was dit moontlik om die tussenbeeldenspektrometer te installeer en 'n aanvang kon gemaak word met navorsing in verband met die vervalpatrone wat 'n aantal radioaktiewe isotope volg.

### **Kernemulsies**

'n Personeelid van die afdeling is tans in Engeland, waar hy die tegniek vir die bepaling van die kernenergievlakke van isotope bestudeer aan die Universiteit van Bristol onder leiding van professor Powell.

puting centre in the N.P.L., deserves the interest of scientific, industrial and commercial organizations and institutions which, it is hoped, will benefit considerably through this development.

The establishment of a training centre for nuclear physics on 1st April, 1955, has filled a definite need and the staff of the laboratory has been strengthened by the appointment of a number of experienced nuclear physicists from overseas.

It is in the nature of a physical laboratory that it does not serve a particular industry, but that its research programme is concerned with the physical aspects of industrial processes. The conviction has gained ground that the laboratory can often make important contributions to the solution of problems which may have different facets, not all of which are purely physical in nature. In the past year, therefore, steps were taken to develop a closer integration of activity with other laboratories and institutes of the C.S.I.R. and also to effect better liaison with universities and other research institutions.

On the 1st October Dr. A. J. A. Roux was, at his own request, relieved of his responsibility of the direction of the Laboratory in order to enable him to devote his full attention to the building up of the new National Mechanical Engineering Research Institute. This is thus the last report of the N.P.L. to appear under his name. His place as Director of the National Physical Laboratory was taken by Dr. E. J. Marais who acted in this capacity during Dr. Roux's extended visit overseas.

## **NUCLEAR SPECTROSCOPY**

### **Cyclotron**

Work on the cyclotron progressed to such an extent that it was possible to start the first test run during May, 1955, three years and eleven months after work was started. For the greater part of this period the cyclotron group consisted of only five persons. Initially a 20 microampere beam of deuterons was accelerated to 4 million electron volts and by the end of May this had been increased to 6 million electron volts with a 200 microampere beam.

### **Equipment**

The completion of the Nuclear Physics building made it possible to install the intermediate image lens spectrometer, and research into the disintegration pattern of a number of radioisotopes was started.

### **Nuclear Emulsions**

A member of the staff is at present in England studying photographic emulsion techniques for the determination of isotope energy levels under Professor Powell at Bristol University.



## BIOFISIKA EN TOEGEPASTE RADIOAKTIWITEIT

### Standaardisering van Radioaktiwiteit

Die  $4\pi$ -teller waarna in die vorige verslag verwys is, is in die nuwe gebou opgestel en proefnemings daarmee het getoon dat dit die deeltjies wat deur radioaktiewe stowwe uitgestraal word, met 'n doeltreffendheid van 95% waarneem. Heelwat is geleer oor die gedrag van sintillatore waarin die radioaktiewe materiaal opgelos word vir bepalings van hul vervalspoed. Daar word gehoop dat hierdie navorsing mag lei tot 'n doeltreffende metode om die konsentrasie van uraan in oplossings vinnig te bepaal.

### Opname van Radioaktiewe Jodium deur die Menslike Liggaam

Die werk is voortgesit. Die jodiumopname deur 'n hele aantal normale persone is waargeneem vir kontroledoelindes in toekomstige proefnemings. 'n Verdere verbetering is aangebring in die uitrustingsetegniese vir die bepaling van skildklierhormone in die bloed.

### Uraanprospektering

Die Eenheid van die Raad op Atoomkrag het die metodes vir die bepaling van uraan en torium in ertse

## BIOPHYSICS AND APPLIED RADIOACTIVITY

### Standardization of Radioactivity

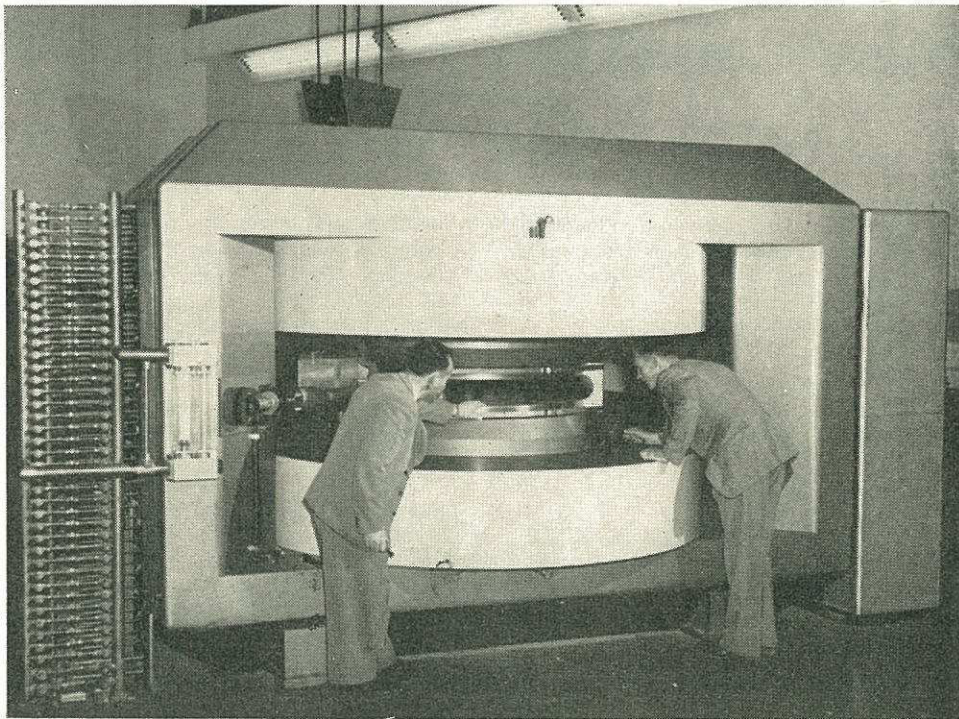
The  $4\pi$  counter mentioned in the last report was installed in the new building, and proved to be capable of detecting all particles emitted by radioactive substances with an efficiency of 95%. Much was learned about the behaviour of liquid scintillators in which radioactive material is dissolved for determinations of their disintegration rates. It is hoped that this research may lead to an efficient method for the rapid determination of the concentration of uranium in solution.

### Uptake of Radioiodine by the Human Body

This work has been continued. The iodine uptake of a number of normal people was determined for use as controls in future experiments. Further improvements were made in the exchange reaction technique for the determination of thyroid hormones in the blood.

### Uranium Prospecting

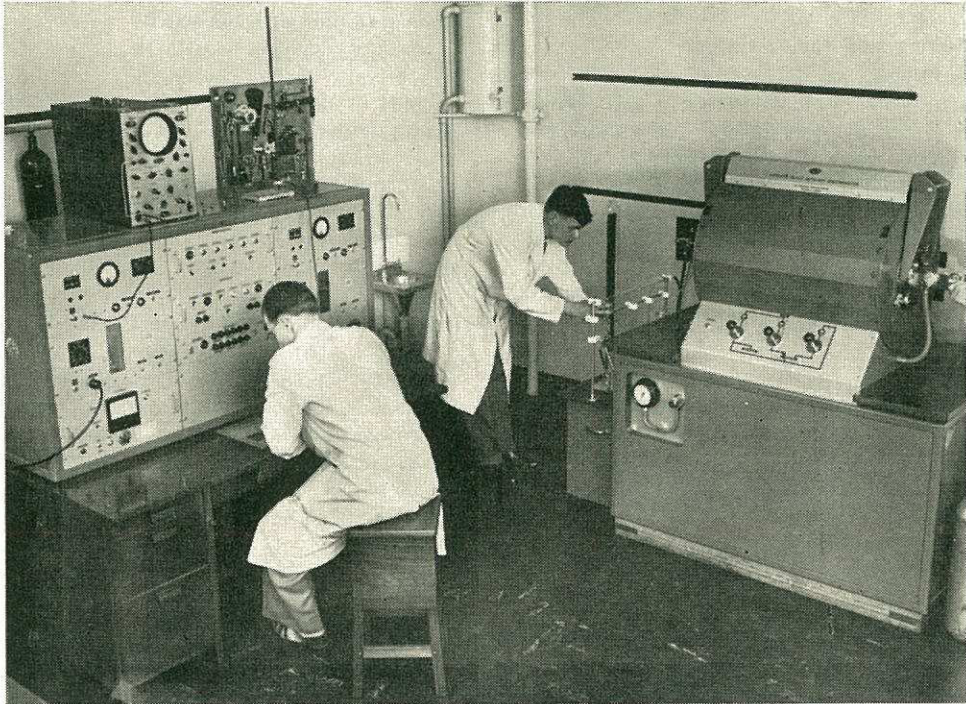
The Atomic Energy Board Physics Unit investigated and improved upon the methods for determining



*Dr. S. J. du Toit, Hoof van die N.F.L. se Afdeling Kernfisika, en mnr. C. A. J. Kritzinger, ingenieur in bevel van siklotronkonstruksie, ondersoek die poolstukke van die siklotron wat voltooiing nader.*

*Dr. S. J. du Toit, Head of the N.P.L. Nuclear Physics Division, and Mr. C. A. J. Kritzinger, Engineer in Charge of construction, examine the pole pieces of the cyclotron nearing completion.*





*Die betastraalspektrometer wat onlangs in die N.F.L. geïnstalleer is vir die noukeurige bepaling van die uitstraling van radioisotope.*

*The Beta-ray spectrometer recently installed in the N.P.L. for the precise determination of the radiation from radioisotopes.*

waarin beide stowwe voorkom, bestudeer en aansienlik verbeter. 'n Opname is gemaak van die metodes wat vir uraanontginning aangewend word met die oog op die moontlike aanwending van fisiese metodes vir die oplossing van probleme wat ondervind word.

#### **Beskerming teen Straling**

Die afdeling onderhou 'n steeds groeiende filmwapendiens: gedurende die jaar is meer as 4,000 filmwapens ontwikkel en ondersoek.

#### **Verskaffing van Radioisotope**

Daar was 'n effense afname in die hoeveelhede radioisotope wat gedurende die jaar ingevoer is (£6,400 in vergelyking met £6,500 verlede jaar). 'n Belangrike deel van die afdeling se werksaamhede was weereens die advies in verband met en in sommige gevalle opleiding in die gebruik van isotope. Die aantal gemagtigde verbruikers het gestyg van 33 tot 46.

#### **MASSASPEKTROMETRIE**

##### **Geologiese Ouderdomsbepalings**

Die publikasie van ouderdomsbepalings op die uraninite van die Witwatersrand-sisteem (waarna in die

uranium and thorium in ores in which both elements occur. A survey of the methods used for the extraction of uranium was conducted with a view to the possible application of physical methods for the solution of problems that have been encountered.

#### **Radiation Protection**

The Division's film badge service continues to be well patronized: during the year more than 4,000 films were developed and inspected.

#### **Supply of Radioisotopes**

There was a slight reduction in the quantities of radioisotopes imported during the year (£6,400 compared with £6,500 last year), but an important part of the Division's activities continues to be advice on and in some cases training in the use of isotopes. The number of authorized users has increased from 33 to 46.

#### **MASS SPECTROMETRY**

##### **Geological Age Determinations**

The publication of age determinations on the uraninites of the Witwatersrand system (mentioned



vorige jaarverslag verwys is) het aansienlike belangstelling by plaaslike sowel as oorsese geoloë gewek. Die sisteem is egter geografies geïsoleer en die studie is dus uitgebrei tot ander groot stollingsgesteente-formasies. Vir die doel is 'n hoogs gevoelige massaspektrometer gebou. Ouderdomsbepalings is ook uitgevoer op minerale in Suid-Rhodesië, Swaziland, en die Maleise Skiereiland.

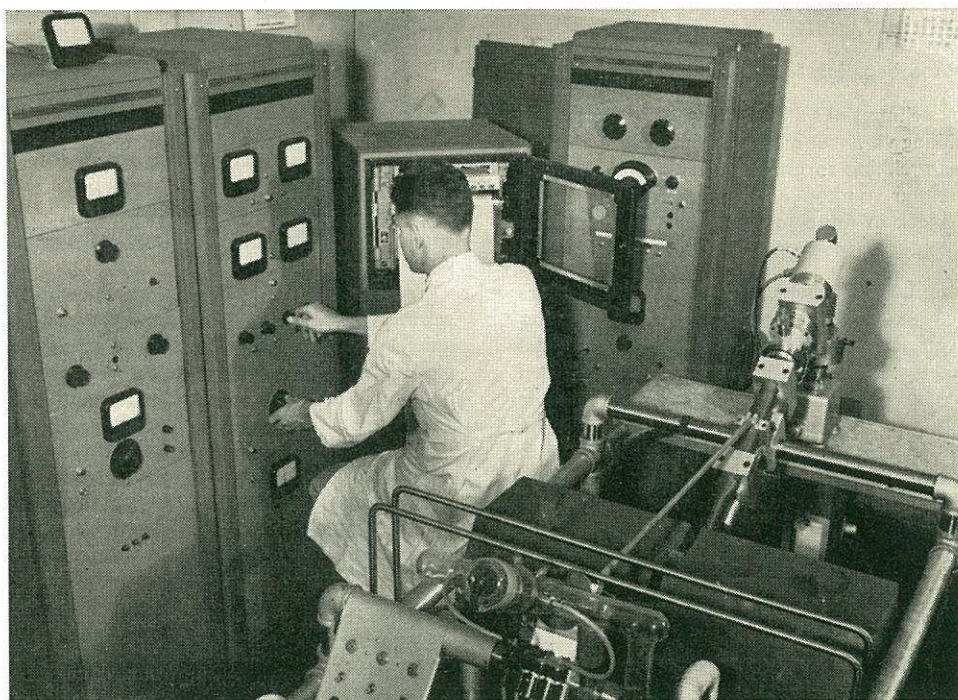
#### **Toepassings van Massaspektrometriese Tegnieke**

Die beskikbaarheid van fasiliteite vir massaspektrometrie het gelei tot 'n toenemende toepassing van die metodes vir doeleindes soos die ontleding van koolwaterstofverbindinge, die bepaling van stikstof in organiese stowwe en die studie van verdagte onsuiverhede in mynatmosfere. Aandag word ook gewy aan die toepassing van massaspektrometriese metodes vir mikrochemiese ontledings van sekere elemente.

in the last annual report) has attracted considerable interest from both local and foreign geologists. The system is, however, geographically isolated and the study has therefore been extended to other important igneous rock intrusions. For this purpose a new ultra-sensitive mass spectrometer has been constructed. Age determinations have also been made on minerals from Southern Rhodesia, Swaziland and the Malay Peninsula.

#### **Applications of Mass Spectrometer Techniques**

The availability of facilities for mass spectrometry has led to an increasing use of these methods for such purposes as the analysis of hydrocarbon mixtures, the estimation of nitrogen in organic material and the study of suspected impurities in mine atmospheres. Attention is also being given to the application of mass spectrometric techniques for microchemical analyses of certain elements.



*Die massaspektrometer wat in die N.F.L. gebou is vir navorsing in geochronologie, die studie van die ouderdomme van rotsformasies.*

*The mass spectrometer built in the N.P.L. for research in geochronology, the study of the ages of rock formations.*

#### **ELEKTRONMIKROSKOPIE**

##### **Studie van Oppervlaktestrukture**

Die elektronmikroskoop is veral gebruik in 'n voortsetting van die ondersoek van die oppervlaktestrukture van plasties vervormde metale en legerings.

#### **ELECTRON MICROSCOPY**

##### **Study of Surface Structures**

The electron microscope was used extensively in a continuation of the investigation of the surface structures of plastically deformed metals and alloys.



Met die oog daarop om 'n verklaring te vind vir groot variasies in energie-verliese van transformatorplate wat in Suid-Afrika vervaardig is, is 'n elektronmikroskopiese ondersoek op die plate uitgevoer. Geskikte eksperimentele tegnieke is ontwikkel en interessante voorlopige resultate wat dui op die formasie van ongewenste nitriedstrukture in die staal, is verkry.

#### **Roetine-ondersoeke**

In samewerking met die Westfort Instituut, is Melaatsbakterieë, afkomstig van beide behandelde en onbehandelde pasiënte, by vergrotings wat varieer het tussen vyftienduizend en vyftigduizend maal, ondersoek. Die resultate wat verkry is, is bevredigend, en word gekorreleer met die behandeling wat aan die pasiënte toegedien word.

Monsters van stofdeeltjies geneem uit „wolke” wat gedurende sekere industriële prosesse ontstaan, is ondersoek ten opsigte van die grootte en vorm van die deeltjies.

#### **X-STRAALDIFFRAKSIE**

##### **Kristalstruktuurbepalings**

Die samestelling sinksulphide weerspieël 'n merkwaardige aantrekking vir ander metale. In die geval van yster is hierdie aantrekking so groot dat sinkblende-kristalle wat in die natuur voorkom altyd yster bevat. Besluit is om te ondersoek in watter mate Fe in die ZnS-rooster ingaan en hoe dit die roosterkonstantes beïnvloed.

Vir hierdie doel is mengsels van ZnS en Fe sinteties voorberei en die roosterkonstantes van elke monster noukeurig bepaal. Deur die resultate grafies voor te stel is 'n verband tussen die persentasie toegevoegde yster en die toename in roosterkonstantes blootgelê. Hierdie ondersoek het dit moontlik gemaak om by wyse van hierdie nievernietigende metode die hoeveelheid yster in enige ZnS-kristal vinnig te bepaal.

##### **X-Straalondersoeke van Plasties-ervormde Metale**

Proefnemings op silwervylsels is voortgesit en die ondersoek is uitgebrei tot 'n direkte ondersoek van die gevulde oppervlakte self, met bevestigende resultate.

Aangesien beide greinspannings en klein deeltjies die diffraksiepatrone op dieselfde wyse beïnvloed, word daar nou pogings aangewend om afsonderlik die bydrae van elkeen te bepaal. Vir dié doel is suiwer tantalummetaal gekies aangesien voorlopige proefnemings bewys het dat hierdie metaal waarskynlik isotropies is, 'n eienskap wat die interpretasie van die resultate baie sal vergemaklik.

##### **Ontwikkeling en Toepassing van X-Straaltegnieke**

'n Direkte metode is ontwikkel vir die kwantitatiewe

In an effort to explain the large variations in wattage losses, transformer laminations manufactured in South Africa were studied with the aid of the electron microscope. Suitable experimental methods were developed and interesting preliminary results, which indicate the formation of undesirable nitride structures in the steel, were obtained.

#### **Routine Investigations**

In collaboration with the Westfort Institute, Pretoria, leprosy bacteria from both treated and untreated patients were examined at magnifications ranging between fifteen and fifty thousand. The results obtained were satisfactory, and are being correlated with the treatment administered.

Samples of dust particles collected from “clouds” that form during certain industrial operations were examined from the point of view of their size and shape.

#### **X-RAY DIFFRACTION**

##### **Crystal Structure Determinations**

The compound zinc sulphide shows a remarkable affinity for taking up other metals in its crystal lattice. Its affinity for iron is so great that naturally occurring zincblende crystals invariably contain iron. It was decided to investigate to what extent Fe enters the ZnS lattice and how it affects the lattice parameters.

For this purpose known mixtures of ZnS + Fe were prepared synthetically, and for each sample the unit cell dimensions were accurately determined. By plotting the percentage Fe added against the lattice parameter, a relationship between lattice parameter and percentage Fe uptake was found. This investigation has made it possible to determine rapidly by means of a non-destructive method the amount of iron present in naturally occurring zincblende crystals.

##### **X-Ray Studies of Plastically Deformed Metals**

Experiments on silver filings were continued, and the investigation was subsequently extended to direct examination of solid silver specimens with confirmatory results.

Attempts are now being made to differentiate between and evaluate separately the effects of lattice strains and small particles, as these in general affect diffraction patterns in the same way. For this purpose super-pure cold-worked tantalum has been chosen, as preliminary tests have shown that this substance is probably isotropic and will therefore greatly facilitate the interpretation of the results.

##### **Development and Application of X-Ray Techniques**

A direct method for estimating quantitatively the

bepaling van vrye kwarts in rots-, sand- en stofmonsters om die samestelling van „krimpende aggregate” te bepaal. (Sien afdeling van die verslag wat handel oor die Nasionale Bounavorsingsinstituut.)

Die snelheid, greingrootte en gehalte van mediese en industriële X-straaflms is vergelyk.

Roetine-ondersoeke ten behoeve van buiteliggame, het ontleidings op sinteties-voorbereide sementsoorte, fabriekslakke, korrosieprodukte, mineraalertse en langketting koolwaterstowwe behels.

## SPEKTROCHEMIE

### Spektrochemiese Ligbronne

In spektrochemiese ontleidings word dikwels 'n hoë spanningswisselstroomkrag van 2,000 tot 4,000 volts

percentage of free quartz in rock, sand and dust samples was developed for determining the composition of “shrinking aggregates” (see section of this report dealing with National Building Research Institute).

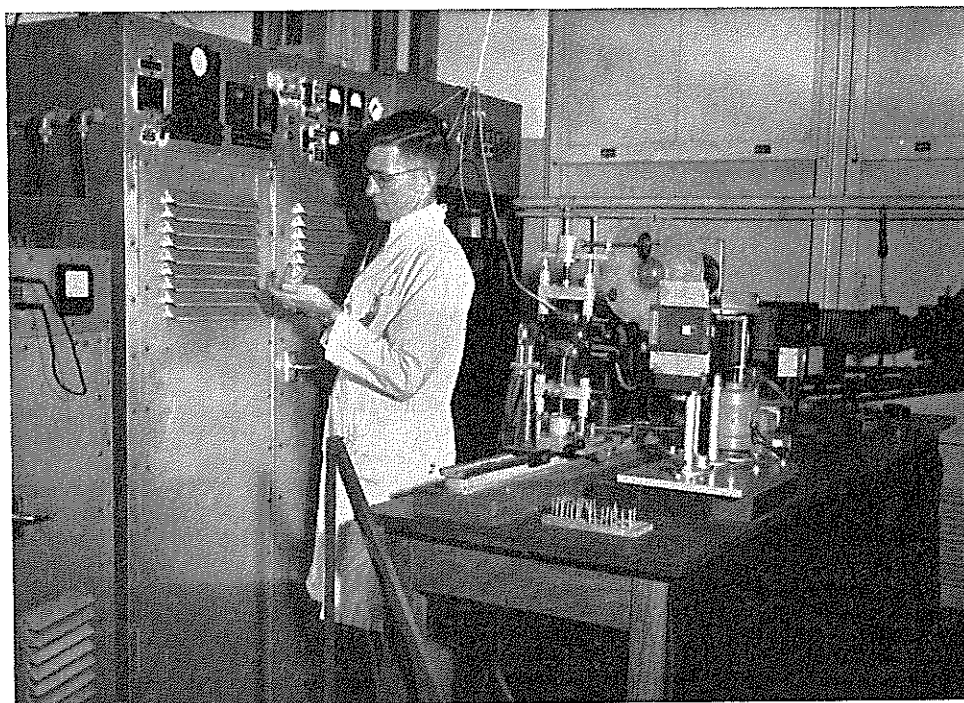
A comparison of the speed, grain size and quality of medical and industrial X-ray films was made.

Routine investigations on behalf of outside bodies included synthetic cements, factory slags, corrosion products, mineral ores and long-chain hydrocarbon compounds.

## SPECTROCHEMISTRY

### Spectrochemical Light Sources

In spectrochemical analysis an alternating current arc of from 2,000 to 4,000 volts is often



*Die „Multisource” vonkeenheid waarmee die mees uiteenlopende vonkontledings-toestande opgewek kan word.*

gebruik. Ondersoeke het nou getoon dat met 'n 230-volt wisselspanningsboog 'n ontlading opgewek kan word met 'n soortgelyke spektrale karakter, gevoeligheid en betroubaarheid. Die gevaarlike hoë spanningswisselstroomboog is dus nie meer 'n noodsaaklike ligbron vir die spektrochemiese laboratorium nie.

### Direklesende Metodes

Die direklesende instrument waar die fotografiese plaat deur 'n fotovermenigvuldigerbuis as fotosensitiewe

*The “Multisource” spark unit which can be used to excite the spectra of samples under the most varied conditions.*

used. Investigations have now shown that an A.C. arc with similar spectral characteristics, sensitivity and reproducibility can be obtained with 230 volts. This means that the dangerous high voltage A.C. arc no longer constitutes an essential light source in a spectrochemistry laboratory.

### Direct Reading Methods

The direct reading instrument in which a photographic plate is replaced by a photomultiplier has



element vervang is, is voltooi en fungeer bevredigend met 'n aansienlike vermindering in die tyd wat nodig is vir die ontwikkeling van spektrochemiese ontledingsmetodes. Met behulp van die instrument is gevind dat die tipe vonkontlading wat gewoonlik vir die ontleding van antimoon en tin in batterylood gebruik word, nie genoegsame noukeurige resultate gee nie

### **Spoorelementnavorsing**

Die noukeurigheid van spektrochemiese metodes vir die ontleding van plantmateriaal is verbeter deur die gebruik van 'n konstante stroom gelykstroombog.

Aangesien die sukses van analitiese metodes vir spoorelemente hoofsaaklik afhang van die snelheid waarmee die spoorelemente wat in die oorspronklike monster teenwoordig is, gekonsentreer kan word, is die doeltreffendheid van verskillende organiese reagentse vir die doel uitgetoets.

### **Roetine-ontledings**

Honderd-en-twintig roetine-ontledings is vir die nywerheid uitgevoer, waarvan die volgende voorbeelde spesiale vermelding verdien: die bepaling van elemente in stronsiumkarbonaat, spoorelemente in botter, en germanium in 'n verskeidenheid van materiale.

## **OPTIKA**

### **Fotometriese- Standaardisasie**

Die ontwikkeling van 'n foto-elektriese fotometerkop het die noukeurigheid van standaardisasie van lampe vir ligstroom en ligintensiteite verhoog en terselfdertyd meting bespoedig en die aantal waarnemers wat nodig is, tot twee verminder. 'n Nuut ontwerpte goniofotometer word gebou en 'n stel van 18 standaardlampe vir ligstroom (100 watts 100 volts) is aangeskaf.

### **Spektroradiometriese Ondersoek van Daglig**

Spektroradiometriese metings van son- en daglig in Suid-Afrika is sover slegs uit 'n meteorologiese standpunt uitgevoer. Vir baie wetenskaplike en industriële doeleindes word noukeuriger gegewens vereis, en met die oog hierop is voorlopige metings wat oor 'n maand gestrek het, uitgevoer met behulp van 'n Hilger-monokromator met fotovermenigvuldiger-waarnemingstoerusting en 'n outomatiese registreerder. Die resultate wat verkry is was so bemoedigend dat daar besluit is om 'n reeks metings met 'n dubbelmonokromator te neem vir 'n tydperk van drie jaar.

### **Daglig in Geboue**

Doeltreffende dagligverligting van skole, hospitale en fabriek hang af van die keuse van vensterglas met die regte deurlatingseienskappe. Gegewens vir Suid-Afrikaans-vervaardigde glas van die toebroodjietipe wat

been completed and is operating satisfactorily with a considerable reduction in the time necessary to carry out a spectrochemical analysis. With the aid of this instrument it was discovered that the type of discharge generally used for the estimation of antimony and tin in the analysis of battery lead, does not give results sufficiently accurate for a satisfactory analysis.

### **Trace Element Research**

The accuracy of spectrochemical methods for the analysis of plant materials has been improved by the use of a constant current arc.

As the success of analytical methods for trace elements depends largely on the speed with which the trace elements present in the original samples can be concentrated, the efficiency of different organic reagents used for the purpose was investigated.

### **Routine analysis**

One hundred and twenty analyses were carried out on behalf of Industry. The following examples warrant special mention: the determination of elements in strontium carbonate, trace elements in butter, and germanium in various materials.

## **OPTICS**

### **Photometric Standardization**

The development of a photo-electric photometer head has increased the accuracy of standardization of lamps for luminous flux and luminous intensity while at the same time speeding up measurement and reducing the number of operators required to two. A newly designed gonio-photometer is being built and a set of 18 standard lamps for luminous flux, rated 100 watts at 100 volts, has been acquired.

### **Spektroradiometric Investigation of Daylight**

Spektroradiometric measurements of sun and daylight in South Africa have so far only been made from a meteorological point of view. For many scientific and industrial purposes more accurate data are required, and with this in view preliminary measurements extending over one month were undertaken, using a Hilger monochromator, with photo-multiplier detection equipment and automatic recorder. The results obtained were so encouraging that it was decided to make a series of measurements with a double monochromator over a period of three years.

### **Daylight in Buildings**

Efficient use of daylight in schools, hospitals and factories depends on the choice of window glass of the right transmission characteristics. Data for South African manufactured glasses of the sandwich



glasvesels insluit tussen twee of meer glasplate, is verkry met behulp van 'n instrument wat spesiaal vir die doel gebou is. Die totale deurlating van hierdie glassoorte het van 36 tot 83% gestrek.

### Lensontwerp

Gedurende die jaar is die ondersoek van hoogs gekorrigeerde lense voortgesit. Deur uitbreiding van die metode om die glas van 'n apokromaat te bepaal, is 'n metode gevind vir die sistematiese keuse van die glas vir 'n Cooke Triplet. Die metode is uitgebrei vir die keuring van glas vir hoogs gekorrigeerde spektrometerlense.

### Ander Dienste

'n Aansienlike hoeveelheid toetswerk in verband met ligstandaarde is onderneem en werkstandaarde is verskaf aan buite-organisasies. Ses ligmeters is geëyk. Die spektrale deurlatingseienskappe van 'n aantal filters en glassoorte is bepaal, en twee spektrofotometers is herstel en geëyk. 'n Aantal lense is getoets ten opsigte van sferiese en kromatiese aberrasies. In die Optiese Werkplaas, is, benewens bogenoemde lense, die volgende onderneem: vervaardiging van 'n telemikroskoopobjektief, teleskoopobjektiewe, enkel glas- en kwartslense, spieëls, filters, proefoppervlaktes, fluoriet- en kwartsvensers, 'n kristalhouer, en die sny en slyp van 120 rotsmonsters. Baie optiese spieëls is gealuminiseer en 'n groot aantal lense is behandel met anti-refleksielaagies.

## HITTE

### Standaarde van Temperatuur

Nieteenstaande die feit dat heelwat toetswerk gedoen is, hoofsaaklik vir nywerhede (yking van termometers, termokoppels en optiese piometers), was dit moontlik om 'n begin te maak met die verbetering van die laboratorium se fundamentele temperatuurstandaarde. Noudat lugdrukke meer noukeurig met die nuwe barometer gemeet kan word, is dit moontlik om al die vaste punte op die Internasionale Temperatuurskaal wat van druk afhanklik is, noukeuriger vas te stel.

Toetsfasiliteite by lae temperature is verbeter deur die aanbou van 'n paraffienbad wat tot  $-15^{\circ}\text{C}$  verkoel kan word.

### Bepaling van Warmtegeleidingsvermoë

Verbeterings is aangebring aan die apparaat wat gebruik word om die geleidingsvermoë van stowwe naby kamertemperatuur te bepaal. 'n Nuwe verbeterde warmplaat is gebou op grond van ondervinding wat oor die afgelope paar jaar opgedoen is. 'n Nuwe apparaat vir hoë temperatuurmetings is gebou. Materiale wat byvoor-

type incorporating glass fibres between two or more sheets of glass were obtained with the aid of an instrument specially built for the purpose. The overall transmission of these glasses varied from 36 to 83 per cent.

### Lens Design

Investigations into the design of highly corrected lenses were continued. By extending the method of selecting the glass for an apochromat, a method which makes possible the systematic choice of the glass for a Cooke triplet has been found. The method has been extended for the selection of glass for highly corrected spectrometer lenses.

### Other Services

A considerable amount of test work was undertaken in connection with light standards, and many working standards were issued to outside bodies. Six light meters were calibrated. The spectral transmission characteristics of numerous filters and glasses were determined, and two spectrophotometers were repaired and calibrated. A number of lenses have been tested with regard to spherical and chromatic aberrations. In the Optical Workshop, in addition to the above-mentioned lenses, a telemicroscope objective, telescope objective, single glass and quartz lenses, mirrors, filters, proof plates, fluorite and quartz windows, a crystal holder, and the cutting and grinding of 120 rock specimens have been undertaken. Many optical mirrors were aluminized and a great number of lenses coated with anti-reflection layers.

## HEAT

### Standards of Temperature Measurement

Notwithstanding the considerable volume of testing work undertaken mainly for industrial concerns (calibration of thermometers, thermocouples and optical pyrometers), it has been possible to start a programme of improvement on the laboratory's fundamental standards of temperature measurement. The greater accuracy of pressure measurement now available with the new standard barometer, makes possible a more accurate realization of those fixed points on the International Temperature Scale which are pressure dependent.

Facilities for low-temperature thermometer testing were improved by the completion of a paraffin bath for use down to  $-15^{\circ}\text{C}$ .

### Measurement of Thermal Conductivity

The apparatus for the measurement of thermal conductivity of thin slabs of material in the neighbourhood of room temperature has been improved by the installation of a new hotplate incorporating all the refinements suggested by several years' experience with the apparatus.



beeld gebruik word om stoommasjiene te isoleer kan tot by temperature van 450°C getoets word. Die grootte van die monsters is 15" × 15" × 2".

Die aanvraag vir toetse op isolasiemateriale wat in Suid-Afrika vervaardig is, het aansienlik vermeerder, en die aanbou van die nuwe hoëtemperatuur-apparaat is onmiddellik geregverdig.

Die verhouding tussen warmtegeleidingsvermoë en die mineraalsamestelling van verskeie Suid-Afrikaanse gesteentes is bestudeer.

#### **Ondersoek van Kondensasie- en Vriesprosesse**

'n Begin is gemaak om die vriesprosesse van suiwer waterdruppels van deursnee 0.1 tot 0.01 mm. te bestudeer. Wolke wat in die natuur voorkom bestaan uit druppels van hierdie grootte orde, en dit word vermoed dat die vriesprosesse wat sulke druppels deurgaang, 'n groot rol speel by die formasie van reëndruppels. Voorlopige resultate het aangetoon dat sulke druppels maklik tot -35°C onderverkoel kan word.

### **GEOFISIKA**

#### **Magnetiese Studies van Stollingsgesteentes**

Deur die rigtings van magnetisme in stollingsgesteentes te bepaal is dit moontlik om veranderinge in die aarde se magnetiese veld oor die eeue heen op te spoor. Sulke gegewens is belangrik by die verklaring van teorieë in verband met die dryf van kontinente, poolverskuiwings en die oorsprong van die aarde se magnetiese veld. Gedurende die afgelope jaar is georiënteerde rotsmonsters uit die Pilansbergsisteem en uit drie Wesrandse myne geneem en hulle magnetiese intensiteit is gemeet op 'n draaitipe magnetometer wat in die onderafdeling opgebou is. Monsters wat vroeër uit drie Sentraal- en Oosrandmyne geneem is, is ook weer gemeet. Die resultate van hierdie ondersoek dui op 'n magnetiese Noordpool naby Etiopië tydens die afkoeling van hierdie gange, mits die magnetisme te wyte is aan 'n geokonsentriese dipoolveld. Om die magnetiese stabiliteit van die toetsmonsters op die proef te stel is demagnetiserende toetse uitgevoer.

'n Verdere reeks monsters is onlangs geneem uit die Stormbergreeks naby Lady Grey en sal verder magneties ondersoek word.

#### **Hittevloei in die Aardkors**

Die hoeveelheid hitte wat deur eenheidsoppervlakte van die aardkors per sekonde vloei is 'n geofisiese maatstaf wat van groot belang is vir ondersoek in verband met die interne struktuur van die aarde. Die hittevloei kan bereken word deur temperatuurmetings op verskillende dieptes in diep boorgate te maak en dan hierdie

A new apparatus has been built for measurements at higher temperatures, for example on insulation materials used in steam plant. The thermal conductivity of samples 15" × 15" × 2" in size, can be measured at hot face temperatures up to 450° C.

There has been a noticeable increase in the demand for tests of insulation materials of South African manufacture, and the new high-temperature apparatus has immediately justified its construction.

Research has also been done on the relation between thermal conductivity and mineral content of several types of South African rocks.

#### **Study of Condensation and Freezing Processes**

A suitable microscope technique has been developed for studying the freezing of droplets of clean water of diameters 0.1 to 0.01 mm. Natural clouds consist of droplets in this size range and the freezing of such drops is thought to be of great importance in initiating rain. Preliminary results confirm that such drops can easily be supercooled to below -35° C.

### **GEOPHYSICS**

#### **Palaeomagnetic Studies of Igneous Rocks**

From the directions of magnetization "fossilized" in rocks it is possible to study the changes in the magnetic field of the earth in past geologic time. Studies of this kind are important in studying the origin of the earth's magnetic field, and also problems of polar wandering and continental drift. During this year, oriented rock specimens were drilled from dykes of the Pilansberg system in three mines on the Far West Rand. The directions and intensities of magnetization of these specimens were measured in the spinner type magnetometer built in the subdivision. The specimens taken from earlier three mines in the Central and East Rand were remeasured. The results give evidence of a North magnetic pole near Ethiopia at the time of cooling of these dykes, if they were magnetized by cooling in a geocentric dipole field. Demagnetizing tests have been made on selected specimens to test the stability of their magnetizations.

A set of samples, secured from lava flows of the Stormberg series near Lady Grey, will be subjected to further magnetic studies.

#### **Heat Flow Through the Earth's Crust**

The quantity of heat flowing outwards through the Earth's crustal rocks, per unit area, per second, is a geophysical datum of importance for the study of the interior of the Earth. The heat flow may be found by measuring temperatures at various depths in a deep borehole and combining the tem-

gegewens saam te vat met die termiese geleidingsvermoë van die boorgatkerne. Monsters wat geskik is vir geleidingsvermoëbepalings is voorberei uit die rotskerne van vier boorgate in die Suid-Karoo, waarin temperatuurmetinge reeds vroeër uitgevoer is. Verder is temperatuuropnames in 'n boorgat op die Wesrand gedoen.

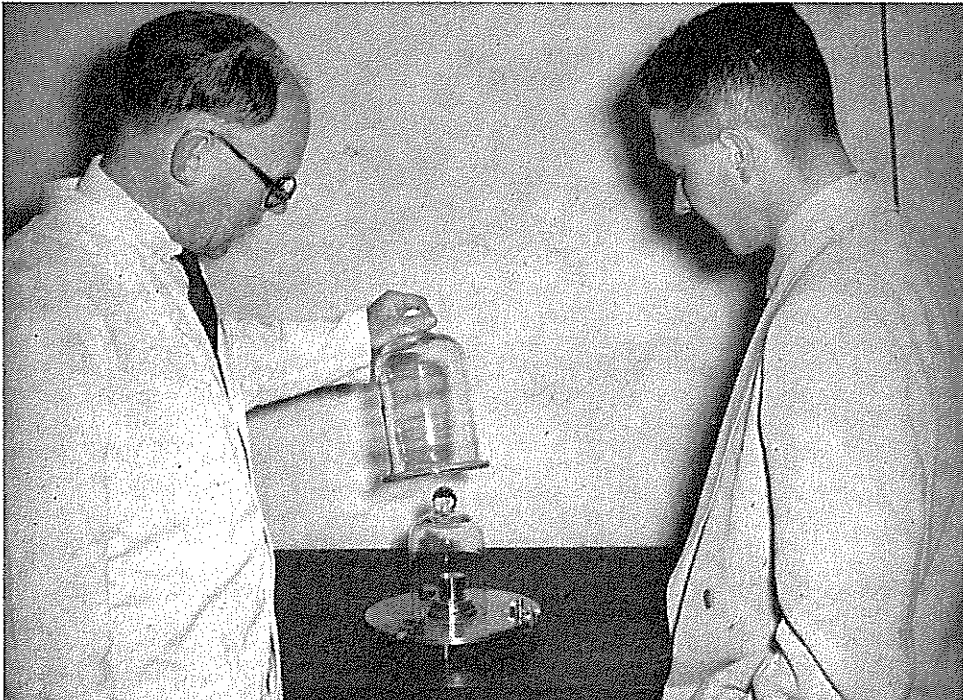
#### **Kortafstand Seismiese Ondersoeke**

Vir die vinnige en ekonomiese vasstelling van die gronddiepte borotsformasies by voorgenome persele vir brûe, damme of ander strukture, is 'n nuwe tipe seismiese instrument ontwikkel. Hierdie instrument is onlangs gebruik om 'n opname te maak van die diepte van dryfsand in drie rivierbeddings in Suidwes-Afrika, ten einde hulle kapasiteit om water te stoor vas te stel. By al drie die persele is goeie resultate verkry wat bewys dat hierdie metode suksesvol aangewend kan word by probleme van so 'n aard. Dié werk is onder kontrak onderneem vir die Departement van Werke, Suidwes-Afrika.

perature data with thermal conductivities measured on samples of the rock core from the borehole. During the year, suitable discs have been prepared for conductivity measurements, from the cores of four boreholes in the Southern Karoo, in which temperatures had been measured previously. In addition, temperatures were measured in a borehole on the Far West Rand.

#### **Short-range Seismic Exploration**

A new type of seismic instrument was developed in this subdivision for the rapid and inexpensive investigation of such problems as the depth of sand or soil cover over rock at the sites of dams, bridges or other structures. During this year a pilot survey has been made in three river beds in South West Africa with the view to evaluating their water storage capacity. At all sites the instrument was successful, and it was demonstrated that this method should prove applicable to problems of dam construction and river water schemes generally. The work was done under contract to the South West African Department of Works.



*Prototipekilogram No. 56, die Suid-Afrikaanse standaardkilogram in die N.F.L.*

*Prototype Kilogramme No. 56, the South African standard kilogramme in the N.P.L.*



## FISIKA VAN MATERIE

### Fundamentele Standaarde

Vier kopieë van die internasionale kilogram-gewig is ontvang. Hierdie gewig is deur die Internasionale Buro vir Gewigte en Mate in Frankryk getoets en gesertifiseer met die gevolg dat die standaardiseringsaktiwiteite van die Nasionale Fisiese Laboratorium nou direk gekoppel is aan die internasionale standaard.

Indien onlangse voorstelle in Engeland en Amerika om die pond wettiglik in terme van die kilogram te definieer ook deur die Suid-Afrikaanse regering aanvaar word, sal die W.N.N.R. onmiddellik in staat wees om standaardiseringsdienste vir die Afdeling Ykwese te lewer en sal dit nie vir hulle nodig wees om hulle standaardgewigte vir yking na die buiteland te stuur nie.

'n Groot aantal ykingsertifikate is uitgereik, hoofsaaklik vir gewigte wat vir die essai van goud gebruik word.

Voorlopige werk is gedoen om ervaring op te doen met die oprigting van 'n meettonnel waarin die meetbande van die Afdeling Driehoeksmeting gereeld geëyk kan word. Hierdie diens sal mettertyd tot die beskikking van alle opmeters gestel word.

### Windvlae wat deur Vliegtuie Teengekom Word

Metings van skielike versnellings ondervind deur vliegtuie wat op die gereelde lugroetes van Suid-Afrika teengekom word, is voortgesit. 'n Beeld van die vliegtuistoestand op hierdie roetes word op dié wyse opgebou en 'n verslag aangaande die frekwensie waarvolgens groot versnellings ondervind word, is onlangs aan die Departement van Vervoer voorgelê tydens besprekings insake vermoedheid wat in vliegtuigvlerke voorkom.

### Lugbesoedeling

'n Begin is gemaak met die meting van lugbesoedeling deur die oprigting van vyf toetsstasies op verskillende plekke in die sentrale gedeelte van Pretoria. Die doel van die werk is om die mate van lugbesoedeling in Pretoria vas te stel en om 'n idee te kry van die omvang van die lugbesoedelingsprobleem in Suid-Afrika.

### Foto-elastiese Metodes

'n Verbeterde praktiese metode om die aard van interne spannings in meganiese strukture vas te stel is ontwikkel. Hierdie metode is vinniger as dié wat tevore gebruik is en die inligting is meer voor die hand liggend vir die waarnemer. Foto-elastiese metodes is aangewend as 'n hulpmiddel by die studie van deursnitte van verbeterde spoorwegstawe van die Suid-Afrikaanse Spoorweë.

'n Studie word ook gemaak van die spannings wat in verband staan met die beskadiging van rotsbore wat in die myne gebruik word.

## PHYSICS OF MATTER

### Fundamental Standards

Four copies of the international kilogramme weight have been received. These weights have been tested and certified at the International Bureau of Weights and Measures in France and, as a result, the standardizing activities of the National Physical Laboratory are now firmly linked with the international standard.

If the recent proposals in England and America, to define the pound legally in terms of the kilogramme, are agreed to by the South African Government, the C.S.I.R. will immediately be able to supply a standardizing service to the Division of Assize which will then not have to send any of its weight standards overseas for testing.

A large number of calibration certificates have been issued, mainly for weights used in the assaying of gold.

Some preliminary work has been done towards the setting up of a measuring tunnel in which the geodetic measuring tapes used by the Trigonometrical Survey may be calibrated regularly. This service will subsequently be available for all users of surveying instruments in South Africa.

### Gusts Experienced by Aircraft

Measurements of the sudden accelerations experienced by aircraft flying over the air routes of South Africa continue to be made. A picture of the flying conditions experienced on these routes is being built up with this information, and recently a report on the frequency with which large accelerations are experienced was supplied to the Department of Transport as an aid in a discussion on fatigue in aircraft wings.

### Atmospheric Pollution

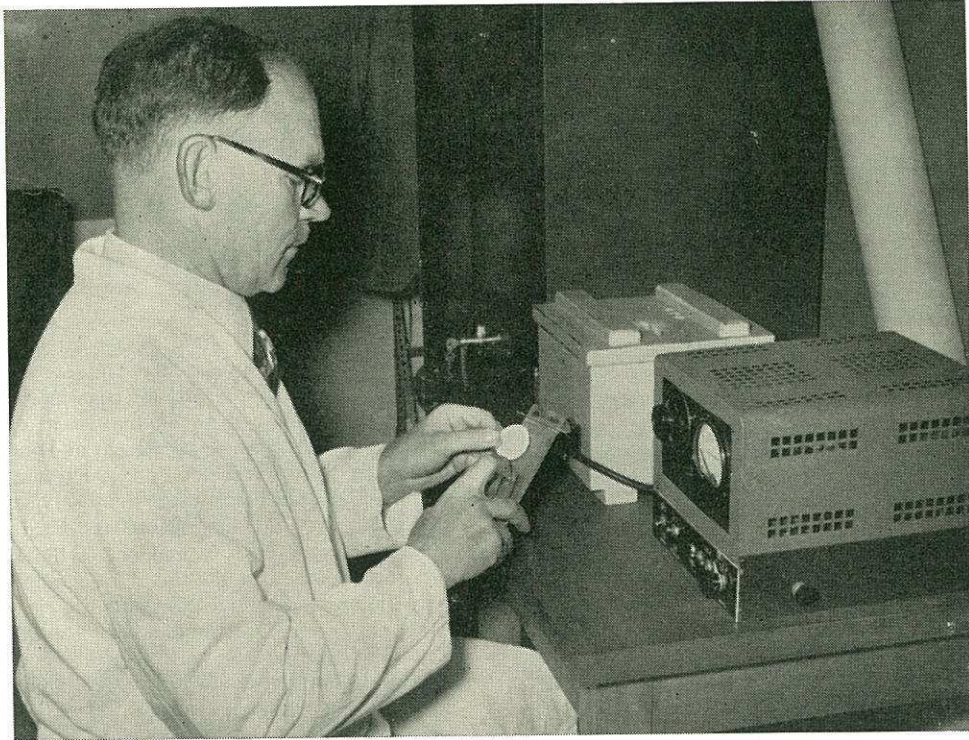
Work has started on the measurement of air pollution at five test stations situated in the central area of Pretoria. This work is designed to give a figure for the general pollution level in Pretoria, and will aid in assessing the pollution problem in South Africa.

### Photoelasticity Methods

An improved practical method of presenting the nature of the internal stresses in mechanical structures has been developed. This method takes less time than the older methods and the information is more readily appreciated by the observer. Photoelasticity was used as an aid in the study of improved railway line cross-sections for the South African Railways.

A study is being made of the stresses associated with damage sustained by rock drills used in mining.





*Meting van die neerslag op 'n stukkie filtreerpapier waardeur lug getrek is in 'n ondersoek van lugbesoedeling in een van die groter stede.*

*Measurement of the deposit on a piece of filter paper through which air has been drawn in an investigation of atmospheric pollution in one of the larger cities.*

## AKOESTIEK

### Verstaanbaarheid van Spraak

'n Luisteraar in 'n auditorium bepaal die posisie van 'n spreker deur die tydverskil van aankoms by sy twee ore van die eerste klankpuls van elke spraakklank, vanaf die spreker se mond. Vir die luisteraar klink dit asof die klank vanaf die spreker se mond kom, maar in werklikheid bereik meeste van die akoestiese energie hom as weerkaatsings vanaf die verskillende vlakke in die auditorium. Hierdie weerkaatsings word dus deur die menslike gehoorsisteem subjektief gemasker, maar terselfdertyd word dit binne 'n sekere periode, wat die integrasie-periode genoem word, saamgetel om die subjektiewe intensiteit van die klank te verhoog en spraak meer verstaanbaar te maak. Geen klank wat die luisteraar na hierdie integrasie-periode bereik dien 'n nuttige doel nie, maar veroorsaak intendeel oorvleueling en maskering van spraakklanke en gevolglik 'n verlagings van die verstaanbaarheid van spraak.

Bogenoemde karakteristieke van die menslike gehoorsisteem is nou vir die eerste maal kwantitatief bepaal. Hierdie werk is van fundamentele belang by die ontwerp

## ACOUSTICS

### Intelligibility of Speech

A listener in an auditorium judges the position of a speaker by the time difference of arrival of the first sound pulses of every speech sound from the speaker's mouth at the two ears of the listener. Because a straight line from a speaker to listener is shorter than any path by which sound may reach the listener via reflections from the walls, it appears to the listener as though all the sound is coming from the speaker's mouth although most of the acoustical energy is in fact reaching the listener as reflections from the different surfaces in the room. These reflections are, therefore, subjectively masked by the hearing mechanism, but at the same time they are integrated over a certain period, known as the "integration period," to increase the subjective intensity of sound and make speech more intelligible. No useful purpose is served by reflections reaching the listener after this integration period, but on the contrary, they cause overlapping and masking of speech sounds which result in a reduction of the intelligibility of speech.



van auditoria vir spraak en vir die ontwerp van klankreproduksiesisteme in publieke geboue.

### **Akoestiek van Geboue**

Die resultate van die bogenoemde fundamentele werk op die gebied van psigo-akoestiek is in die praktyk toegepas.

As gevolg van die swak verstaanbaarheid van die aankondigingsstelsel by die Jan Smuts-lughawe, is die laboratorium deur die Departement van Vervoer genader om hulle met advies te bedien in verband met die akoestiese ontwerp van die nuwe lughawegeboue wat tans elders in aanbou is. Spesifikasies is opgestel vir die geboue op die lughawes in Durban, Kaapstad en Port Elizabeth. Die gebou in Port Elizabeth is reeds in gebruik geneem en die verstaanbaarheid van aankondigings is bevredigend. Toetse wat met behulp van die mobiele laboratorium in die gebou van die D. F. Malan-lughawe uitgevoer is, het ook aangedui dat die verstaanbaarheid van aankondigings in die Kaapstad- en Durban-geboue na wense behoort te wees. Spesifikasies is ook opgestel vir die akoestiese behandeling van die gebou op Jan Smuts-lughawe en ook vir 'n nuwe ontwerp van die klankreproduksiesistelsel, ten einde die verstaanbaarheid van aankondigings te verhoog.

Die moeilike probleem van klankversterking in die Suid-Afrikaanse Volksraadsaal is met sukses opgelos. 'n Spesiaal ontwerpte vertraagde klankreproduksiesistelsel is geïnstalleer en ingestel om die illusie te behou dat die klank vanaf die spreker kom en nie vanaf die luisterers nie. Die verstaanbaarheid van spraak vanaf hierdie sistelsel is hoër as vanaf 'n direkte versterkingsistelsel met gelyke klanksterkte.

Die nuwe S.A.U.K.-ateljee te Rocklands, waarvoor die akoestiese ontwerp deur hierdie laboratorium gedoen is, nader nou voltooiing en sal binnekort in diens geneem word. Gedurende die afgelope jaar is die mobiele laboratorium na Kaapstad geneem en akoestiese toetse is uitgevoer om te verseker dat daar aan die streng isolasievereistes voldoen word.

Daar word tans 'n groot aantal sale vir Transvaalse Provinsiale skole beplan. Om te verseker dat goeie akoestiese toestande verkry word, is die laboratorium versoek om die betrokke argitekke met advies te bedien. 'n Verdere kontrak in verband met die meganiese opname van hofverrigtinge is met die Departement van Justisie aangegaan. 'n Groot aantal argitekke is met raad bedien in verband met die akoestiese ontwerp van raadsale, auditoriums, teaters, kerke, fabriekke, ens.

The above characteristics of the human hearing mechanism have now been determined quantitatively for the first time. These results are of fundamental importance for the design of new auditoria for speech and for the design of sound reproduction systems in public buildings.

### **Acoustics of Buildings**

The results of this fundamental work in the realms of psycho-acoustics have been applied in practice.

As a result of the poor intelligibility of announcements at the Jan Smuts airport, the laboratory was approached by the Department of Transport to advise them on the design of the new airport buildings now being erected at Durban, Cape Town and Port Elizabeth. The Port Elizabeth airport building has been taken into service, and the intelligibility of announcements has been found to be satisfactory. Tests carried out in the Dr. Malan airport building with the aid of the mobile laboratory indicated that the intelligibility in both the Cape Town and Durban buildings should be satisfactory. Specifications were also drawn up for the acoustical correction of the Jan Smuts airport building and redesign of the sound reproduction system in order to improve the intelligibility of announcements.

The difficult problem of sound amplification in the South African Houses of Parliament has been solved satisfactorily. A specially designed delayed-sound reproduction system has been installed and adjusted to maintain the illusion that the speech is coming from the speaker and not from the loudspeakers. The intelligibility of speech reproduced through this system is higher than through a direct system with equal gain.

The new S.A.B.C. studios at Rocklands, for which the acoustical design was done by this laboratory, are nearing completion and will soon be taken into use. The mobile laboratory was taken down to Cape Town during the past year and tests were carried out to ensure that the strict isolation requirements are met.

A large number of halls are at present being planned for the provincial schools of the Transvaal. The laboratory was requested to advise the architects concerned in order to ensure that satisfactory acoustical conditions will be obtained. A further contract, in connection with the mechanical recording of law court proceedings, has been undertaken for the Department of Justice. Advice was given to a large number of architects on the acoustical correction of conference rooms, auditoria, theatres, churches, factories, etc.

## **Geraas en Vibrasies**

Ontledings van lawaai en aanbevelings in verband met die demping daarvan, is ten behoeve van 'n aantal buite-lyggame gedoen. Argitekte en ingenieurs is ook in die beplanningstadium met raad bedien om lawaai in geboue en fabriek te verhoed. Die Navorsingseenheid vir Werktuigkundige Ingenieurswese is bygestaan met hulp in verband met hulle navorsing op waaierlawaa.

## **Akoestiese Metodes**

Toerusting is ontwikkel om verskillende elastiese eienskappe van rotsmonsters te bepaal. Dit sal deur die Navorsingseenheid vir Werktuigkundige Ingenieurswese gebruik word vir hulle ondersoek na die oorsake van rotsstortings in myne. Voorlopige werk is ondergronds gedoen ten einde krake in rotse met soniese metodes op te spoor.

## **Akoestiese Eienskappe van Boumateriale**

Klankabsorpsiemetings is ten behoeve van Suid-Afrikaanse vervaardigers, op 'n aantal monsters boumateriaal uitgevoer, beide in die impedansbuis en in die weerkaatsingskamer. Absorpsiemetings is ook op stoele in die weerkaatsingskamer uitgevoer. Klankdeurlatings-toetse is op verskillende strukture in die deurlatingskamers uitgevoer.

## **ELEKTROTEGNOLOGIE**

### **Standaardisasie**

Behalwe die normale intervergelykings tussen aparte selle uit die groep standaard selle en weerstande wat die nasionale standarde van spanning en weerstand vir Suid-Afrika uitmaak, was dit ook moontlik om 'n internasionale vergelyking van spanningstandaarde uit te voer. Deur die welwillendheid van die Britse Nasionale Fisiese Laboratorium is 'n groep van vier gekke standaard selle ontvang wat kort vantevore getoets was tydens 'n internasionale vergelyking aan die B.I.P.M. te Sevres. Die vergelyking van hierdie groep selle met die standaard wat in Pretoria in stand gehou word, het aangedui dat die verhouding tussen die Teddington-volt en die Pretoria-volt nog binne 'n mikrovolt dieselfde is as wat dit in 1946 was. Aangesien hierdie verskil baie kleiner is as die afwykings wat intussen tussen selle van die Pretoria-groep self waargeneem is, moet hierdie resultaat as hoogs bevredigend beskou word.

### **Hoë-stroom Newsluitings**

Die opbou van 'n reeks weerstande wat die noukeurigheid van die 1 ohm primêre standaard sal oordra tot groottes van 0.0001 ohm nader voltooiing. 'n Kenmerk

## **Noise and Vibrations**

Analyses of noise and recommendations for its suppression were made on behalf of outside organizations. Architects and engineers were also advised on the prevention of noise in the planning stage of buildings and factories. The Mechanical Engineering Research Unit was also assisted with its research on ventilation fan noise.

## **Acoustic Methods**

Equipment was developed for determining the elastic properties of rock specimens. This equipment will be used by the Mechanical Engineering Research Unit for its research into the causes of rock bursts in mines. Preliminary work was done underground with the object of locating cracks in rock formations using sonic techniques.

## **Acoustical Characteristics of Building Materials**

Sound absorption measurements were carried out on a number of building materials for South African industries, using the reverberation room and also the impedance tubes. Absorption tests were also carried out on a number of chairs in the reverberation room. Sound transmission tests on different structures were carried out in the transmission rooms.

## **ELECTROTECHNOLOGY**

### **Standardization**

Besides the normal inter-comparisons between members of the groups of standard cells and resistors which comprise the national standards of voltage and resistance for South Africa, it was possible to make an international comparison of voltage standards. By courtesy of the British National Physical Laboratory, this laboratory received a group of four calibrated standard cells which had shortly before participated in an international comparison at the B.I.P.M. (International Bureau for Weights and Measures) at Sevres. The result of the comparison of these cells with the standard maintained in Pretoria indicated the same relationship between the Teddington volt and the Pretoria volt as had been measured in 1946 to within a microvolt. As this difference is considerably smaller than variations which have occurred in the meantime between cells within the Pretoria standard itself, the result must be regarded as highly gratifying.

### **High Current Shunts**

The programme of building a series of resistors which would extend the accuracy of the 1 ohm primary standard down to the 0.0001 ohm denomi-



van hierdie weerstande is dat, terwyl die hoë strome wat nodig is om vergelykende metings te maak, deur hulle vloei, hulle onbeduidende verhoging in temperatuur ondergaan.

### **Diëlektriese Konstante en Verliesfaktor van Gesteentes**

Die diëlektriese konstante en verliesfaktor van 'n aantal rotsmonsters is by frekwensies van 10 kiloperiodes/sekond tot 100 megaperiodes/sekond gemeet. Die oogmerk van die metings was om vas te stel tot watter dieptes elektromagnetiese golwe by hierdie frekwensies, in rotse indring. Apparaat vir metings by nog hoër frekwensies word ontwikkel aangesien die inligting wat deur die gebruik van sulke golwe om die struktuur van rotse op 'n afstand agter hulle oppervlakte vas te stel, meer noukeurig word namate die frekwensies hoër word.

### **Vakuumbuiskonstruksie**

Tydens die aanbou van 'n nuwe vakuumsisteem is 'n Penning-tipe ionisasie-meter gebou en vir drukke tussen  $10^{-3}$  tot  $10^{-7}$  mm Hg geyk. Soortgelyke meters is sedertdien vir ander laboratoria vervaardig.

'n Apparaat om die fluoressensie van organiese stowwe in die vakuultraviolet te ondersoek, is in aanbou. Dit berus op die beskieting van 'n monster met elektrone van genoegsame snelheid. Die fluoresserende lig wat as gevolg hiervan ontstaan, word waargeneem deur middel van 'n ingeboude foto-elektriese buis.

Proewe is onderneem met die vervaardiging van gasontladingsbuise wat deur middel van 'n magnetiese veld gekontroleer kan word. Die buise sal in sekere beheerprobleme nuttig gebruik kan word.

Om die ontwerp van vakuumbuise en van elektronstralers te vereenvoudig word 'n analoogrekenmasjien gebou om die elektronbane van 'n gegewe elektrodesisteem outomaties aan te teken. By voltooiing sal dit ook beskikbaar wees vir die oplossing van soortgelyke probleme in ander rigtings, insluitende die kaartering van stasiese velde.

### **Magnetiese en Kristalversterkers**

Gedurende die ontwerp van magnetiese versterkers is ontdek dat formules wat in die literatuur aangegee word vir optimum-ontwerp nie van toepassing was nie. Nuwe formules is ontwikkel.

Versterkers wat van transistore gebruik maak vind steeds groter toepassing. In Suid-Afrikaanse toestande moet daar egter aandag gegee word aan die feit dat germaniumtransistore aansienlike temperatuurkoeffisiënte het. Ondersoeke in hierdie verband het uitgedaag op die ontwerp van 'n versterker wat van germanium-transistore gebruik maak en wat 'n byna konstante versterking tussen  $15^{\circ}\text{C}$  en  $40^{\circ}\text{C}$  het.

Ondersoek in verband met die verbetering van die hoogfrekwensie-karakteristieke van transistorstroombane is ook met 'n mate van sukses uitgevoer.

nation is nearing completion. The feature of these resistors is that, when carrying the high currents necessary to make a comparison, they suffer a negligible temperature rise.

### **Dielectric Constant and Loss Factor of Rocks**

The dielectric constant and loss factor of a number of samples of rock have been measured at frequencies of 10 kilocycles/sec. to 100 megacycles/sec. The object of these measurements has been to determine the practically usable depth of penetration into the rock of electromagnetic waves at these frequencies. Apparatus is being developed for measurements at still higher frequencies, since the higher the frequency which can be used, the more exact the information that could be gained by using such waves to explore the structure of the rock at a distance behind its surface.

### **Vacuum Tube Construction**

In the course of constructing a new vacuum system, a Penning type of ionization gauge was constructed and calibrated for the range  $10^{-3}$  to  $10^{-7}$  mm. Hg. Similar gauges have since been constructed for other laboratories.

An apparatus for investigating the fluorescences of organic material in the vacuum ultra-violet is in process of construction. This provides for bombarding a specimen with electrons of suitable velocity and observing the resulting fluorescence with a built-in photoelectric tube.

Experiments have been conducted on the construction of gaseous discharge tubes which can be controlled by a magnetic field. These tubes would be useful in certain problems in automatic control.

For facilitating the design of vacuum tubes and electron guns, an analogue computer is being built to plot electron trajectories for a given electrode system automatically. When completed it will also be available for the solution of similar problems in other fields, including the mapping of static fields.

### **Magnetic and Crystal Amplifiers**

In the course of designing magnetic amplifiers, it was discovered that formulae given in the literature for optimum design were not applicable. Revised formulae were developed.

Amplifiers using transistors are finding ever wider applications. Under South African conditions, however, the fact that the germanium transistor has a large temperature coefficient must receive particular attention. Arising out of studies undertaken in this laboratory an amplifier using germanium transistors has been built having an amplification which is nearly constant from  $15^{\circ}\text{C}$ . to  $40^{\circ}\text{C}$ .

Studies for improving the high frequency characteristics of transistor circuits have also been carried out with some success.



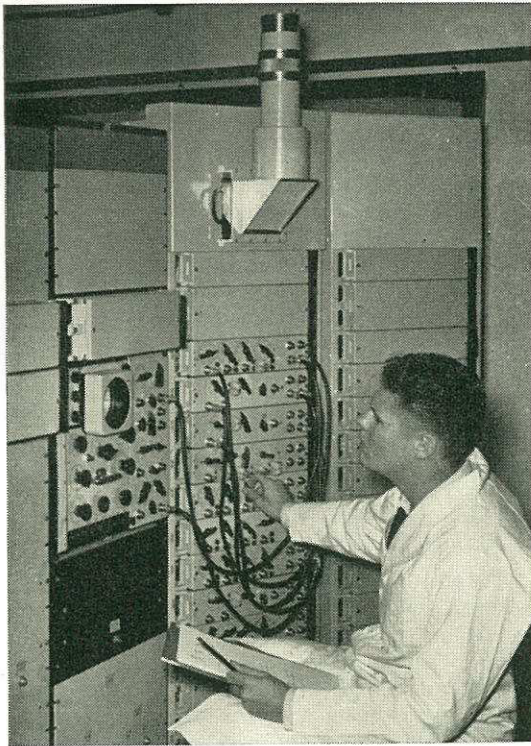
## Servomeganismes

Die frekwensieweergawe van die verskillende onderdele van 'n sisteem word dikwels gebruik in die ontwerp van 'n servomeganisme. In baie gevalle moet die weergawe gemeet word in terme van meganiese hoeveelhede en vir die doel is 'n meganiese sinusgolf-generator ontwerp en word in die W.N.N.R.-werkplaas opgebou. Wanneer dit voltooi is, sal die apparaat wat oor 'n frekwensiegebied van 0.05 tot 20 periodes/sekonde werk, van groot waarde wees vir die toets en ontwerp van servosisteme.

'n 12-Volt gereguleerde gelykspanningskragbron wat van 3 fase wisselspanning werk, en 'n konstante stroomkragbron vir spektroskopiese boë is gedurende die jaar voltooi. Goeie vordering is ook gemaak met 'n verbeterde outomatiese kontinu-wegende masjien wat spesiaal ontwerp is vir gemaklike foutbediening in 'n chemiese fabriek, asook met 'n noukeurige spoedbeheerkontrolle vir 'n swaaiarm wat gebruik word vir die yking van anemometers.

## Elektroniese Rekenmasjiene

Analogrekenmasjiene vir spesifieke doeleindes is in aanbou en sommige is reeds voltooi. Die Elektron-



*Die elektroniese analogrekenmasjiene in aanbou in die N.F.L.*

*The analogue electronic computer under construction in the N.P.L.*

## Servomechanisms

The frequency response of the various components of a system is often used in the design of a servomechanism. In many cases this response must be measured in terms of mechanical quantities, and for this purpose a mechanical sine wave generator has been designed and is being constructed in the Central Workshops. When complete, this apparatus, which operates over a frequency range of 0.05 c.p.s. to 20 c.p.s., will be useful for testing and designing servomechanisms.

During the year a regulated 12 volt D.C. supply from 3 phase A.C. mains and a constant current supply for spectroscopic arcs were completed, and good progress was made with an improved automatic continuous weighing machine engineered for easy servicing in a chemical plant, and with an accurate speed control for a whirling arm for the calibration of anemometers.

## Electronic Computers

Special purpose analogue computers have already been, or are being, built in this laboratory. Such is the Electron Trajectory Computer mentioned above. Another is the X-ray Structure Factor Computer which was completed during the course of the year. The latter machine was designed to compute rapidly the diffraction pattern which would result from an assumed crystal structure, until the computed pattern approaches the observed pattern sufficiently closely to justify more accurate and more time-consuming methods.

During the course of the year, construction of a general purpose analogue computer was begun with the main object of obtaining solutions of ordinary differential equations, linear or non-linear. Solutions are obtained by the proper interconnection of four basic units, namely: integrators, adders, function generators and multipliers. Prototype integrators and adders have already been built, and construction of the power supplies has been begun. Some exploratory work on a new type of electronic multiplier has also been done.

## Instrumentation

A microphotometer has been designed to replace an existing instrument in an observatory. It will give improved performance and operate without batteries. The recording portion has already been installed; the stabilized light source has been tested in the laboratory and has now to be built into the instrument.

An instrument has been built at the request of the Bituminous Binder Research Unit for measuring the stresses in a road surface as the wheels of a motor car pass over it. Horizontal and vertical



baanrekenmasjien is alreeds genoem. Nog een is die X-straal-struktuurfaktorrekenmasjien wat gedurende die loop van die jaar voltooi is. Laasgenoemde masjien is ontwerp met die doel om 'n vinnige berekening te kan maak van die diffraksiepatroon wat 'n voorgestelde kristalstruktuur sou gee, totdat die berekende patroon met die waargenome patroon genoegsaam ooreenstem sodat vir die laaste benadering meer tydrowende en noukeurige berekeningsmetodes geregverdig is.

In die loop van die jaar is 'n begin gemaak met die opbou van 'n analogerekenmasjien vir algemene doeleindes. Die hoofdoel is om gewone differensiaalvergelings met konstante sowel as veranderlike koëffisiënte, op te los. Sulke oplossings word verkry deur die geskikte aaneenskakeling van vier basiese eenhede nl. integrators, optellers, funksie-ontwikkelaars en vermenigvuldigers. Prototipes van die integrators en optellers is reeds gebou en daar is begin met die opbou van kragbronne. Voorlopige ondersoekte op 'n nuwe tipe vermenigvuldiger is ook uitgevoer.

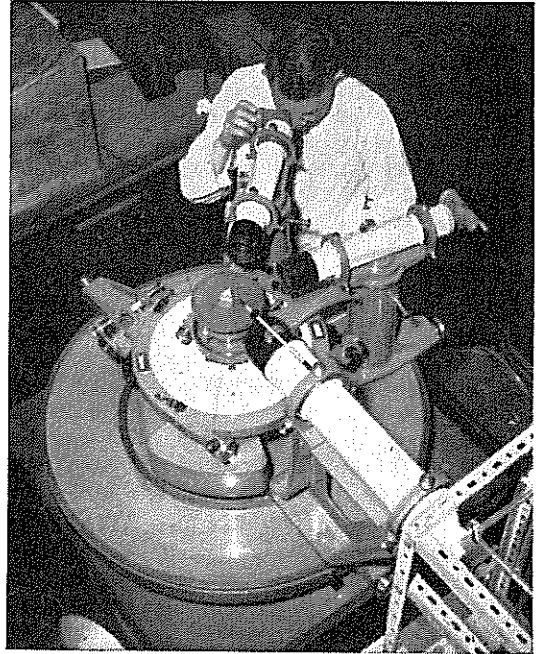
### Instrumentasie

'n Mikrofotometer wat onafhanklik is van batterye is ontwerp om die bestaande instrument in die sterrewag te vervang. Die registreergeedeelte van die instrument is reeds voltooi en geïnstalleer. Die gestabiliseerde ligbron is in die laboratorium getoets en sal eersdaags in die instrument ingebou word.

Op versoek van die Navorsingseenheid vir Bitumeneuse Bindstof is 'n instrument gebou wat die kragte kan meet wat op 'n padoppervlak uitgeoefen word wanneer die wiele van 'n motorkar daaroor gaan. Horisontale sowel as vertikale kragte word gelyktydig gemeet op 'n klein „knopie” wat los van die res van die pad is en 'n deel van die instrument vorm. Die instrument word onder die oppervlak van die pad aangebring. Met die doel om die elastiese eienskappe van bitumeneuse padbindmateriale te meet is 'n instrument ontwerp en nader tans voltooiing in die werkplaas.

Op versoek van die Maritieme Navorsingseenheid word 'n instrument ontwikkel waarmee die temperatuur en die voortplantingsnelheid van klank by verskillende dieptes in seewater, gemeet sal kan word. In die voltooiende instrument sal beide hoeveelhede gelyktydig as funksies van diepte geregistreer word.

Die instrumentasie-afdeling was verantwoordelik vir die herstelling van 'n groot aantal instrumente uit verskillende W.N.N.R.-laboratoria en ook ten behoeve van buite-organisasies. Hulp is ook verleen met verbeteringe en veranderinge wat aan die infra-rooi spektrofotometer aangebring is. 'n Takistoskoop is ontwerp en elektroniese toerusting is ontwikkel waarmee die spoed van kunsmatige haelstene bepaal kan word. Verdere dienste is gelewer in verband met die ontwikkeling en konstruksie van 'n groot aantal instrumente vir ander W.N.N.R.-laboratoriums.



*The goniometer spectrometer used by the N.P.L. for determining the refractive indices of optical glass.*

*Die goniometer-spektrometer wat deur die N.F.L. gebruik word vir die bepaling van die brekingsindeks van optiese glas.*

stresses are measured simultaneously on a small "button" isolated from the rest of the road surface and attached to the instrument, which is sunk below the surface. In order to measure the visco-elastic properties of bituminous road binders an instrument has been designed and is nearing completion in the workshops.

At the request of the Maritime Research Unit an instrument is being developed for measuring the temperature and speed of propagation of sound at various depths in the sea. In the completed instrument both quantities will be recorded simultaneously as functions of depth.

The instrumentation section has been responsible for the repair of a large number of instruments in the various laboratories of the C.S.I.R. and of several outside organizations. In addition it has assisted in the improvement of and alterations to an infra-red spectrophotometer, designed a tachistoscope, devised a means of, and developed electronic equipment for, measuring the velocity of artificial hailstones, and assisted in the development and construction of numerous other instruments for the laboratories of the C.S.I.R.

## WISKUNDE

### Basiese Navorsing in Wiskunde

Basiese navorsing in wiskunde is die fondament waarop wetenskaplike navorsing in die meer tegepaste rigtings van byvoorbeeld die fisika en ingenieurswese voortgebou kan word. Navorsing is voortgesit na verdere eienskappe van spesiale funksies en vordering is veral gemaak met die uitbreidings van die binomiale en faktoriaal-binomiale stellings. Hierdie uitbreidings is spesiale gevalle van hipergeometriese reekse in meer veranderlikes, die eienskappe waarvan ondersoek word. 'n Begin is gemaak met die teoretiese ondersoek na die eienskappe van komplekse funksies wat van belang is by die spanningsverdeling in elastiese media.

### Basiese Navorsing in Statistiek

Die uitbreidings van die hipergeometriese reekse asook die uitbreidings van die faktoriaal-binomiaal lewer nuwe diskrete kansfunksies. Die eienskappe hiervan is ondersoek en die standaardfoute van koëffisiënte vir hierdie kansfunksies is bereken. As grensvorme is 'n aantal statistiese koëffisiënte afgelei wat verdeel is volgens  $\chi^2$ -verdelings.

### Toegepaste Navorsing in Wiskunde en Statistiek

Met die snelle industriële ontwikkeling van die land word die toepassing van wiskundige en statistiese teorieë al meer van belang. Om te voorsien in die uiteenlopendheid van toepassingsvelde word 'n literatuurindekssisteem in wiskunde en statistiek opgebou.

In samewerking met die Navorsingseenheid vir Werktuigkundige Ingenieurswese is die statistiese studie van moontlike faktore wat rotsstortings in myne beïnvloed voortgesit. Onder andere is deur verwerking van die beskikbare data aanduidings gevind dat daar by werksfronte, waar slegs gebruik gemaak word van strooksgewyse trapafbouing, minder ernstige stortings voorkom as in ander afdelings van die myn.

'n Omvattende verslag oor samestelling van die bevolking en oor die sirkulasie van koerante is ten behoeve van 'n regeringskommissie voltooi.

### Hulp aan Ander Afdelings

Een van die belangrikste funksies van die Afdeling Wiskunde is om ander laboratoria van die W.N.N.R. van hulp te bedien by die oplossing van hulle wiskundige en statistiese probleme. Uit die verskeidenheid van probleme wat afgehandel is, kan die volgende genoem word:—

- 'n verslag oor die afleidings van spanningsfunksies is opgestel;
  - vertrouensintervalle vir statistiese koëffisiënte is bereken; en
  - verskillende differensiaalvergelykinge is opgelos.
- Die Afdeling Wiskunde lewer op hierdie wyse 'n

## MATHEMATICS

### Basic Research in Mathematics

Basic research in mathematics is the foundation on which scientific research in the more practical branches of physics and engineering is based. Research on further properties of special functions was continued and progress has been made in the generalization of the binomial and factorial-binomial theorems. These generalizations are special cases of the hypergeometric series in more than one variable, the properties of which are also being investigated. A theoretical investigation of the properties of complex functions which are of importance in stress-distributions in elastic media has been started.

### Basic Research in Statistics

The generalizations of the hypergeometric series and of the factorial-binomial give rise to new discrete probability functions. The properties of these probability functions have been investigated and standard errors of coefficients have been derived. A few statistical coefficients which are distributed according to the  $\chi^2$ -distribution have been considered as limiting forms.

### Applied Research in Mathematics and Statistics

Due to the rapid industrial development of the country the application of mathematical and statistical theories has become more and more important. On account of the diversity of the fields of application of mathematics and statistics a literature index system is being built up.

In collaboration with the Mechanical Engineering Research Unit a statistical study of the possible factors which may influence rockbursts in mines was continued. Among other things there were indications from the available data that at working-faces where use is made of underground longwall stoping only, there occur significantly less severe bursts than at other sections of the mine.

A comprehensive report on population distribution and on the circulation of daily papers was prepared for a government commission.

### Assistance to Other Divisions

One of the most important functions of the Mathematics Division is to assist other laboratories of the C.S.I.R. in the solution of their mathematical and statistical problems. From the variety of problems that were handled the following may be mentioned: a report was drawn up on the derivation of stress functions; confidence intervals were calculated for statistical coefficients; and various differential equations were solved. In this way the Mathematics Division makes a contribution to the



bydrae tot die navorsing van die W.N.N.R. as geheel. Talle navrae, veral in verband met statistiek, is van buite-organisasies ontvang.

#### **ALGEMEEN**

In die afgelope jaar is 160 navrae van wetenskaplike of tegniese aard behandel.

#### **BEDANKINGS**

Die Raad wil van die geleentheid gebruik maak om hul besondere waardering uit te spreek vir die hartlike samewerking en wedersydse hulpbetoning wat van die volgende nasionale institute ondervind is: National Physical Laboratory (Groot-Brittanje), National Bureau of Standards (V.S.A.), National Research Council (Kanada), Physical Laboratory of the Commonwealth Scientific and Industrial Research Organization (Australië), Atomic Energy Research Establishment (Engeland), Bernard Price Instituut vir Geofisika en die Suid-Afrikaanse Buro vir Standaarde.

Ook word met erkentlikheid verwys na die gasvryheid wat personeellede in verskillende buitelandse navorsingslaboratoriums en institute geniet het.

research of the C.S.I.R. as a whole. A number of enquiries, particularly in connection with statistics, were received from outside organizations.

#### **GENERAL**

In the past year 160 enquiries of a scientific or technical nature were handled.

#### **ACKNOWLEDGEMENTS**

The Council takes this opportunity of expressing its appreciation of the whole-hearted co-operation and assistance received from the following national institutes: the National Physical Laboratory (United Kingdom), National Bureau of Standards (U.S.A.), National Research Council (Canada), Physical Laboratory of the Commonwealth Scientific and Industrial Research Organization (Australia), Atomic Energy Research Establishment (United Kingdom), Bernard Price Institute for Geophysics, and the South African Bureau of Standards.

At the same time indebtedness is acknowledged for the hospitality enjoyed by personnel in various overseas laboratories and institutes.

# Navorsingseenheid vir Werktuigkundige Ingenieurswese

*Direkteur:* DR. A. J. A. ROUX

In die tydperk onder behandeling was die navorsingswerk hoofsaaklik toegespits op vraagstukke van die nywerheid terwyl aansienlike vordering ook gemaak is met die uitbreiding van geriewe vir navorsingswerk op die gebied van werktuigkundige ingenieurswese. Ontwikkelings gedurende die afgelope jaar het baie duidelik getoon dat die bestaande navorsingsgeriewe nog aansienlik uitgebrei sal moet word om die groot aantal aanvrae wat uit verskeie rigtings vir navorsingswerk ontvang word, te kan behartig. Hoewel alle moontlike pogings aangewend is om die nywerheid in die algemeen te help, was dit onmoontlik om al die vraagstukke wat na die laboratorium verwys is, te ondersoek.

Afgesien van die dringende navorsingsprojekte wat van regstreekse belang vir die nywerheid is, is dit ook uiters belangrik dat aandag gewy word aan langtermynprojekte wat ten doel het die ontwikkeling van nuwe gebiede en die voorsiening van basiese inligting aan die nywerheid oor onderwerpe wat binnekort van praktiese belang mag wees. Tot dusver moes baie van die vraagstukke hangende gelaat word en in die toekoms behoort ernstiger aandag miskien aan langtermynprojekte gewy te word.

## **METAALKUNDE**

Die toerusting van die metaalkunde-laboratorium is gedurende die afgelope jaar aansienlik uitgebrei. 'n Aantal hittebehandelingsoonde, ten volle toegerus met noukeurige outomatiese kontrole, is ingebou en in werking gestel, sodat hittebehandelings wat gewoonlik op staal, nie-ysterhoudende en ligte legerings aangewend word, nou toegepas kan word.

Op die gebied van metallografiese mikrografie is toerusting nou beskikbaar om gespesialiseerde tegnieke soos bv. gepolariseerde lig, fasekontrasmikroskopie en interferometrie toe te pas.

## **Voorvervorming en die Plastiese Eienskappe van Metale**

Vordering is gemaak met die studie van die invloed van voorvervorming op die plastiese eienskappe van metale. 'n Redelike aantal enkelkristalle van sink van gemiddelde en hoë suiwerheid is in 'n lugleegte van taamlik lae druk gekweek. Die enkelkristalle is gevorm uit 'n smeltel in 'n spesiale elektriese oond waarin nie alleen die temperatuurhelling nie, maar ook die afkoelingsnelheid noukeurig gereël kan word. Ondervinding het bewys dat hierdie noukeurige kontrole noodsaaklik is indien enkelkristalle van hoë gehalte verlang word. Enkelkristalle met gladde buitevlakke en egalige dikte

# Mechanical Engineering Research Unit

*Director:* DR. A. J. A. ROUX

The period under review was marked by the concentration of research effort on problems on behalf of industry. Further facilities were established for research in the field of mechanical engineering. Developments during the last year, however, have made it quite clear that the existing research facilities will have to be considerably extended to cope with the large number of requests for research received from various quarters. Although every effort was made to help the industry at large, it was not possible to investigate all the problems referred to the Laboratory.

Apart from the immediate research projects which are of direct interest to industry, it is also most important that attention be given to long-term projects which aim at developing new fields and supplying basic information to industry on subjects which will be of practical interest in the near future. Up to the present, many of these problems have had to be left in abeyance, and more serious attention should, perhaps, be given to long-term projects in future.

## **METALLURGY**

The testing facilities of the metallurgical laboratory were appreciably enlarged during the year. A number of heat-treatment furnaces, fully instrumented for accurate automatic control, were installed and are in operation, so that all the normal forms of heat-treatment commonly applied to steel, non-ferrous and light alloys can now be applied.

In the field of metallographic micrography, facilities are now available for the use of specialized techniques such as polarised-light, phase-contrast microscopy and interferometry.

## **Predeformation and the Plastic Properties of Metals.**

The study of the influence of predeformation on the plastic properties of metals has been continued. A number of medium- and high-purity zinc single crystals of high perfection were grown, under a fairly high vacuum, from the melt in a special electric furnace in which it is possible to control both the temperature gradient and the rate of cooling very accurately. It was found that accurate control of these factors is essential if high quality single crystals are to be produced. Single crystals having smooth surfaces and uniform cross-sections were produced by



kon verkry word deur gebruik te maak van spesiale vorms van pyrex glasbuise met egalige binne-afmetings.

'n Spesiale hoogs gevoelige trek-druktoetsmasjien vir die toets van enkelkristalle is ontwikkel en geïk en trek-drukproewe word tans uitgevoer om kwantitatiewe metings van die Bauschinger-effek in enkelkristalle te verkry.

### **Invloed van Spanning op Korrosie**

Die gevoeligheid van 'n ligte gegote aluminium-silikonlegering vir spanningskorrosie in 'n soutoplossing, word tans ondersoek. Dié legering word algemeen in die ingenieurswese gebruik en die mening is dat die ondersoek na die weerstand daarvan teen spanningskorrosie in soutoplossings van verskillende sterktes van praktiese nut sal wees. Die invloed van die mikrostruktuur en hittebehandeling word ook ondersoek.

### **Alkaliese Verbrossing van Ketelplaatstaal**

Onlangs is die ondersoek na die alkaliese verbrossing van ketelplaatstaal aangevoer. Alkaliese verbrossing van geklinkte keteldromme is al baie jare lank 'n probleem in die nywerheid. Hoewel daar al heelwat ondersoekingswerk in die verband gedoen is, is daar tot dusver geen aanneemlike uitleg vir die grondoorsake en meganisme van alkaliese kraakvorming gevind nie.

Die toetsprogram behels die blootstelling van geskikte staalproefstukke aan die inwerking van alkaliese oplossings van verskillende sterktes in 'n outoklaaf wat by tipiese keteltemperatuur en -drukke ingestel word. Belaste sowel as onbelaste proefstukke sal ondersoek word.

### **Swigtings in die Praktijk**

'n Aantal gevalle van swigtings wat in die praktijk voorgekom het, is ten behoeve van die betrokke nywerhede ondersoek.

Die swigting van 'n gesweisde staal impellor van 'n sentrifugaalwaaier is ondersoek en deur middel van metallografiese, radiografiese en sterkte-ondersoeke is vasgestel dat die oorsaak van swigting toegeskryf moet word aan 'n foutiewe sweismetode. 'n Metallurgiese ondersoek en die bepaling van die hardheid van die gietyster-suierringe van 'n ammonia-kompressor wat buitensporig geslyt was, het getoon dat die slytasie nie aan metaalkundige oorsake toegeskryf kon word nie. Ondersoek is ook ingestel na die oorsake van die swigting van die loodhulsel van 'n kabel, blykbaar as gevolg van plaaslike oorbelaasting wat veroorsaak is deur die heen en weer buig van die kabel. Ander ondersoeke het metallografiese en meganiese toetse ingesluit op 'n aantal aluminiumlegeringgietsukke van verskillende samestellings ten opsigte van die moeder- en hersmelte metaal.

the use of special "precision-bore" pyrex glass moulds.

A highly sensitive special tension-compression testing machine, for the mechanical testing of the single crystals, was developed and calibrated, and tension-compression tests, aiming at quantitative measurement of the Bauschinger effect in the single crystals produced, are now in progress.

### **Influence of Stress on Corrosion**

The susceptibility of a light aluminium-silicon alloy of casting grade to stress-corrosion cracking in a saline solution is at present being investigated. This alloy is widely used in engineering applications, and it is felt that an assessment of its resistance to stress-corrosion cracking in solutions of varying concentration will be of practical importance. The influence of heat-treatment and microstructure is also under investigation.

### **Caustic Embrittlement of Boiler Plate Steel**

Work has recently been started on an investigation concerned with the phenomenon of caustic embrittlement of boiler plate steel. Caustic embrittlement in riveted boiler drums has been a major problem to industry for several decades, and, though much work has been done on this problem, an acceptable explanation of the basic causes and mechanism of caustic cracking is still lacking.

The testing programme involves the exposure of suitable steel specimens to caustic solutions of varying concentrations in an autoclave operating at typical boiler temperatures and pressures. Both stressed and unstressed specimens are to be investigated.

### **Operational Failures**

A number of cases of operational failure were investigated on behalf of the industry.

The failure of a centrifugal fan impellor of welded steel construction was examined, and it was found from metallographic, radiographic and mechanical tests that the cause of the failure was due to incorrect welding practice. The grey cast iron of a number of ammonia compressor piston rings which exhibited poor wearing properties was metallographically examined and hardness-tested, revealing that the poor wearing properties were not due to metallurgical causes. Investigations were also conducted to determine the cause of failure of a lead cable sheath, apparently due to local overstressing resulting from reversed bending of the cable. Other investigations involved the mechanical and metallographic tests on a number of aluminium alloy castings consisting of different portions of virgin and remelted metal.



## STERKTELEER

### Vermoeidheid van Metale

Fundamentele navorsing oor die uitwerking van onderbreking van wisselende belasting op Yskor En-45-veerstaalproefstukke in 'n getemperde toestand het getoon dat onderbrekings van tot 24 uur geen uitwerking op die vermoedingsduur van die materiaal het nie. Die uitwerking van langer rustyde word nou ondersoek.

Ten behoeve van die Suid-Afrikaanse Spoorweë is 'n uitvoerige eksperimentele ondersoek gedoen van die spanningsverdeling in 'n kort spoorlengte onderhewig aan belastings van verskillende eksentrisiteite en belastingshoeke ten einde die vermoedheid van spore om draaie te bepaal. Soortgelyke spanningsontledings is uitgevoer op 'n lang spoorstaaf wat in 'n spoorstoel geklem is. Die resultate is gebruik om 'n geskikte metode van vermoedheidsbelasting op te stel om die belastingstoestande in die praktyk na te boots. 'n Reeks spoorstaafproefstukke word nou onder verskillende belastingstoestande getoets in 'n 100-ton Amsler-pulsator.

Ook ten behoeve van die Suid-Afrikaanse Spoorweë is daar begin met vermoedheidstoetse op termiet-gesweisde spoorstawe terwyl 'n ondersoek na die vermoedheid van gesweisde boorstawe ook beplan word.

Korrosie-vermoedheidstoetse is op aluminiumlegeringproefstukke uitgevoer om uit te vind wat die oorsaak van swigting is van aluminiumwaaierlemme wat in 'n korrosiewe atmosfeer werk. Die gevolgtrekking was dat die materiaal sterk aangeval word deur die korrosiewe atmosfeer en dat die swigting aan die gesamentlike uitwerking van korrosie en vermoedheid toegeskryf kan word.

### Rotsstortings in Diep Myne

Die ondersoek na die rotsstortingsprobleem in die diep myne van die Witwatersrand wat reeds in November 1952 'n aanvang geneem het, duur voort.

'n Wiskundige ontleding word tans gemaak van die spanningsverdeling om uitgrawings van verskillende vorms in 'n homogene, isotropiese, elastiese, oneindige medium wat onderhewig aan swaartekrag is. Voorbereidings word getref vir spanningsontleding deur middel van foto-elastiese metodes. 'n Groot belastingsraam wat verstelbare, vertikale en horisontale belastings op foto-elastiese modelle kan aanwend, is ontwerp en word gebou.

As die spanningsverdeling rondom 'n uitgraving sowel as die sterkte van die rots bekend is, sal dit moontlik wees om die gedrag van die rots rondom die uitgraving te voorspel. Druktoetse is dus op kwartsietmonsters uitgevoer met die doel om die lineêre druksterkte van kwartsiet en ook die elastiese eienskappe te bepaal. 'n Apparaat is ontwikkel om die hewigheid van die swigting van toetsmonsters kwantitatief te bepaal. Die kruip-eienskappe van kwartsiet word ook vasgestel. Ten einde ook die spanningsverandering in die soliede rots om 'n

## STRENGTH OF MATERIALS

### Fatigue of Metals

Fundamental research, carried out on the effect of interrupted and alternating load for different test periods, as applied to specimens of Iscor En-45 spring steel in the annealed condition, revealed that rest periods of up to 24 hours have no effect on the fatigue life of the above material. The investigation is being continued for greater rest periods.

On behalf of the South African Railways a detailed experimental analysis of the stress distribution in a short length of rail subjected to loading of varying eccentricity and obliquity was carried out to investigate the fatigue strength of rails in curves. Similar stress analyses were conducted on a long rail carried in a rail chair. The results obtained made possible the selection of a suitable fatigue loading programme to simulate the loading conditions that were found to occur in practice. A series of rail specimens is now being tested under different loading conditions in the 100-ton Amsler pulsating fatigue testing machine.

Fatigue tests on thermit welded rails have commenced on behalf of the South African Railways, and investigations into the fatigue strength of welded drill rods are also in preparation.

Corrosion fatigue tests were carried out on aluminium alloy specimens in an attempt to discover the reason for the failure of aluminium alloy fan blades in a corrosive atmosphere. It was concluded that the material was markedly affected by the corrosive atmosphere and that the failure could be attributed to the combined action of corrosion and fatigue.

### Rock Bursts in Deep-level Mining

The investigation into the problem of rock bursts in deep-level mines of the Witwatersrand, which was commenced in November, 1952, was continued.

Mathematical analysis of the stress distribution around excavations of different shape and size in a homogeneous, isotropic, elastic, continuous medium under gravitational forces is in progress. Stress analyses, using photoelastic methods, are being prepared. A large loading frame to suit photoelastic models and to apply variable vertical and horizontal loads has been designed and is being manufactured.

If the stress in the rock around an excavation and the strength of the rock are both known, it might be possible to predict the behaviour of the rock around the excavation. Consequently, compression tests on quartzite samples taken from various localities were carried out to determine the linear compression strength of quartzite and its elastic constants. A device has been developed to ascertain the violence of rupture of the test samples quantitatively. The creep properties of quartzite are



uitgraving te kan bepaal, namate die werksfront nader kom, is 'n vervormingsel ontwikkel wat in 'n boorgat ingemessel kan word, van 50 tot 100 voet diep in die werksfront.

Die vorm van die gekraakte rotsmassa rondom uitgrawings op groot diepte word ondergronds ondersoek deur die spore van breekvlakke na te gaan wat in een delfplek ontstaan en in omliggende delfvlakke te voorskyn kom. Om hierdie gegewens aan te vul word laboratorium-toetse uitgevoer op modelle van verskillende materiale onder druk. 'n Studie word dan gemaak van die aard van breekvlakke rondom gleuwe van verskillende groottes en vorms wat in die modelle ingesny word.

Ten einde die invloed van verskillende faktore op die voorkoms van rotsstortings te bepaal, is statistiese ontledings, gegrond op die gegewens van 614 rotsstortings wat van 1948 tot 1953 in 'n bepaalde myn van die Witwatersrand voorgekom het, in medewerking met die Wiskunde-afdeling van die Nasionale Fisiese Laboratorium uitgevoer. Die bevinding was dat die voorkoms van stortings 'n aanmerklike hoogtepunt bereik gedurende skiettye. Ook is bevind dat die mynmetode 'n betekenisvolle invloed het op die voorkoms van ernstige stortings. Verdere ontledings het gegaan oor die invloed van die hoek tussen werksfronte en van uitgrawingsnelheid op die voorkoms van rotsstortings.

Ontspanningsmetodes word tans toegepas in 'n aantal werksplekke van 'n myn in die Sentrale Witwatersrand, met die doel om die werksfront kunstmatig los te kraak. Die metode van ontspanning is om gate 10 voet diep en van 2 tot 5 voet van mekaar ongeveer loodreg in die werksfront te boor, en hulle weekliks saam met die gewone ertsgate met dinamiet te laai en te skiet. Die skiet van die ontspanningsgate breek nie erts uit nie, maar kraak net die soliede rots 'n ent voor die werksfront los, waardeur die gebied van hoë spanning verder teruggeskuif word in die soliede rots, terwyl 'n kussing van gekraakte rots tussen die werksfront en die gevaarlike hoogspanningsrots ontstaan. Ten einde die doeltreffende ontspanningsmetode te ontwikkel, word die uitwerking op die werksfront, waar gate van bekende spasiering en diepte met 'n bepaalde lading afgeskiet word, tans gemeet.

Vir hierdie ondersoek is 'n akoestiese meetmetode deur die Onderafdeling Akoestiek van die Nasionale Fisiese Laboratorium ontwikkel. Met behulp van die toerusting kan die tyd bepaal word wat nodig is vir klankgolwe om vanaf die frontvlak na meetplekke op verskillende dieptes in die ontspanningsgat te beweeg. Verwag word dat die klanksnelheid in die rots 'n kwantitatiewe aanduiding sal gee van die mate waarin die rots in die toetsgebied vergruis is. Die toetsuitrusting is nog in die ontwikkelingstadium.

also being determined. In order to measure the change in stress in the solid rock around an excavation as the face advances, a strain cell has been developed and will be cemented into a borehole drilled about 50 to 100 feet ahead of the working face.

The configuration of the fracture zone around excavations at depth is being studied by making observations in places underground where failure planes due to excavations nearby can be detected. To supplement this information, laboratory studies are being made on the formation of fracture zones around slots of different shape and size in models subjected to suitable loading conditions.

Statistical analyses, based on the data of 614 bursts which occurred in a specific mine of the Witwatersrand during the years 1948 to 1953, were carried out with the aid of the Mathematics Division of the National Physical Laboratory in order to determine the influence of different factors on the occurrence of rock bursts. It was found that the frequency distribution of bursts during the day shows a significant peak at blasting time. It was also found that the method of mining has a significant effect upon the incidence of severe bursts. Further analyses dealt with the influence of the angle between face and dyke on the incidence of bursts, the effect of different lengths of leads between faces, and the effect of rate of advance of the face.

De-stressing operations, which aim at causing the crushing of stope faces artificially, are in progress in a number of stopes of a mine on the Witwatersrand. The de-stressing procedure consists of drilling holes 10 feet deep and 2 to 5 feet apart almost normal to the face, and blasting them weekly in addition to the ore breaking holes. The blasting of the "de-stressing holes" does not necessarily result in breaking ore, but in effect crushes the solid zone ahead of the face for a certain distance, thereby shifting the zone of high stress further back into the solid and creating a cushion of crushed rock between the dangerous highly stressed solid zone and the working place. The most efficacious method of de-stressing must be developed, and to ascertain this, the effects on a face, of exploding known charges in holes of known depth and spaced at a known pitch are being studied.

For these investigations, acoustic equipment has been developed with the aid of the Acoustics Division of the National Physical Laboratory. With this equipment the time of propagation of sound waves from the surface of the face to points at various depths in a de-stressing hole can be measured. It is hoped that the velocity of sound in the rock can be used as a quantitative indicator for the degree to which the rock is crushed in the area tested. The equipment is still in an experimental stage.



## **Benutting van Plaaslike Hout**

'n Beurs is deur die South African Lumber Millers' and Shook Manufacturers' Association ingestel om die moontlikhede te ondersoek van groter gebruik van plaaslike hout vir verpakkingsdoeleindes. Daar is begin met 'n opname van plaaslike houtbronne en houtverbruik.

## **Dienste aan die Nywerheid**

Verskeie versoeke is van die nywerheid ontvang vir stasiese en vermoedheidstoetse op verskillende materiale, vir spanningsontledings op konstruksies en masjiendele, en vir ondersoeke van swigtings in die praktyk. Heelwat belangstelling is getoon in die broslaktoerusting wat onlangs aangeskaf is en aanvrae is al ontvang om dit te gebruik vir die ondersoek van verskeie praktiese probleme waarin dit nodig is om spanningsontledings te maak. Ander werk het ingesluit die bepaling van die kragte tussen 'n motorband en die pad, die ontwerp van kafferbiervate, die meet van die krag in die flensboute van 'n ontsoutingsapparaat en die ondersoek van die doeltreffendheid van gipsverbande.

## **MEGANIKA**

### **Dempingsvermoë van Materiale**

Die dempingsvermoë van 'n materiaal is sy vermoë om die meganiese trillingsenergie wat daarop oorgedra word, deur middel van onomkeerbare prosesse te absorbeer. Hoe groter die dempingsvermoë van 'n materiaal is, hoe kleiner is die gevaar van 'n uitputtingsbreuk. Die dempingsvermoë word beïnvloed deur die soort materiaal wat gebruik word, sowel as deur die grootte en vorm van die onderdele en die belastingsmetode.

Verskeie formules om hierdie faktore saam te koppel is deur navorsers opgestel en daar word nou gepoog om die teoretiese bevindinge eksperimenteel te bevestig en in 'n geskikte vorm vir praktiese gebruik uit te druk. Toetse is uitgevoer op kantelbalkproefstukke van sagte staal van verskillende lengtes met puntlaste aan die vry end. Die dempingsvermoë van die proefstukke is bepaal deur die afname in trillingswydte van die kantelbank te meet nadat dit in vrye trilling geplaas is. 'n Optiese metode is ontwikkel om die afname in trillingswydte te meet. Die resultate wat tot dusver verkry is, is bevredigend en die voorneme is om met hierdie ondersoek voort te gaan.

## **HITTEVOORTPLANTING**

### **Hittevoortplanting tussen Vaste Wand en Vloei-stowwe**

Daar is voortgegaan met fundamentele navorsing op die gebied. Proefnemings waarin gebruik gemaak is van 'n spesiale verhittingsplaat (waarvan in die vorige jaarverslag melding gemaak is), in 'n horisontale posisie en met horisontale luvloei, het getoon hoe die plaaslike hitte-uitruilingskoeffisiënt afneem namate lug oor die

## **Utilization of Local Timber**

A fellowship of the South African Lumber Millers' and Shook Manufacturers' Association has been established to investigate the possibilities of increased use of local timber for packaging. A survey of the local timber resources and consumption has been started.

## **Services to Industry**

Several requests were received from industry for fatigue and static tests on different materials, for analyses of stress in various structures and machine parts and for investigations of service failures. Considerable interest has been aroused by the recent acquisition of a "stresscoat" outfit, and requests for its application to practical problems requiring stress analyses have been received. Other work included the estimation of forces between a tyre and the road, the design of kaffir beer vats, the determination of load in flange bolts of a desalting apparatus and a study of the performance of plaster of Paris bandages.

## **MECHANICS**

### **Damping Capacity of Materials**

The damping capacity of a material is its ability to absorb, by means of irreversible processes the mechanical vibrational energy imparted to it. The greater the damping capacity of a material, the less will be the danger of fatigue failure. Apart from the nature of the material, the size and shape of the structural members, and the method of loading also affect the damping capacity.

Various investigators have developed formulae relating these factors, and research is now being conducted to verify the theoretical findings experimentally and to express them in forms suitable for practical engineering use. Tests have been conducted on mild steel cantilevers of different lengths with a concentrated load applied at their free end. The damping capacity of the specimens was obtained from measurements of the decrease in amplitude of the cantilever vibrations after being set in free vibration. An optical device was developed to measure the amplitude decay. The results obtained so far appear to be satisfactory and it is the intention to continue with the investigations.

## **HEAT TRANSFER**

### **Heat Transfer Between solid Surfaces and Fluids**

Fundamental research in this field has continued. In experiments conducted with a special heater plate (mentioned in the last Annual Report) in a horizontal position and with horizontal air flow, it has been shown how the local heat transfer coefficient decreases progressively as the air flows along its



verhittingsplaat vloei, en verder hoe die geometriese vorm van die onverhitte gedeelte, stroomop van die verhittingsplaat, die koëffisiënte beïnvloed.

#### **Hittevoortplantingseinskappe van „Gevinde Buise”**

Vir die voortsetting van die werk het dit nodig geblyk om 'n windtonnel op te rig waarin die lugsnelheid, temperatuur en voggehalte binne nou grense beheer kan word. Hoewel die meeste van die bykomende toerusting vir die windtonnel ontvang is, is die ontwerp van die windtonnelkomponente en die vervaardiging daarvan ietwat vertraag weens ander dringende werk.

#### **Meet van Hittenvloei vanaf die Menslike Liggaam**

Ten behoeve van die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese is die laboratorium nou besig om ondersoek in te stel na die moontlikheid om die hitte wat die menslike liggaam deur straling, konveksie en verdamping afgee, regstreeks in die toetskamers van die klimaatskamer te meet. 'n Begin is gemaak met die meet van die konveksiehitte deur 'n verwarmde model van 'n man in die laboratorium se 10 voet windtonnel te plaas en die hittewins in die naloop agter die model aan die stroomafkant in die vlak loodreg op die windrigting, te meet.

Dit kan genoeg word dat die direkte meet van hittenvloei vanaf die menslike liggaam nie die menskalorimeter sal vervang nie, maar dit sal aanvul.

### **LUGREËLING EN VERKOELING**

#### **Die Klimaatskamer**

Die verskillende onderdele van die klimaatskamer word tans in die Laboratorium vir Toegepaste Fisiologie van die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese aanmeekaargesit en goeie vordering is reeds gemaak. Die hoofwindtonnel is reeds opgerig met hoeklemme, waaier, toetskamers, ens. in posisie en tans word die bykomende toerusting geïnstalleer. Verwag word dat die kamer teen die einde van die jaar voltooi sal wees wanneer voorlopige toetse uitgevoer sal word om te verseker dat die verskillende onderdele behoorlik funksioneer. Hierna sal dit geïk word sodat fisioloë toetse kan uitvoer onder noukeurig-beheerde en bekende toestande.

Die eenheid het die ontwerp van die installasie, toesighouding gedurende oprigting, yking en vervaardiging van die toetskamers onder kontrak met die Kamer van Mynwese vir 'n bedrag van £12,350 onderneem.

surface. It has also been shown that the geometry of the unheated section upstream of the heater plate has a marked influence on the coefficients.

#### **Heat Transfer Characteristics of Finned Tubing**

For the continuation of this work it has proved necessary to construct a wind tunnel in which the air velocity, temperature and humidity can be controlled to within narrow limits. Most of the auxiliary equipment for this wind tunnel has been received but, due to the urgency of other work, the progress on the design of the wind tunnel components and its manufacture has been somewhat delayed.

#### **Measurement of Heat Flow from the Human Body**

On behalf of the Transvaal and Orange Free State Chamber of Mines, the Laboratory is making a study of the feasibility of the direct measurement of the heat loss by radiation, convection and evaporation from the human body, in the test chamber of the climatic chamber. A start was made with the measurement of convective heat by placing a heated model of a man in the 10-ft. diameter wind tunnel of the Laboratory and measuring the heat gain in a plane normal to the direction of airflow in the wake of the model on the downstream side.

It may be mentioned that the direct measurement of heat flow from the human body will not replace the human calorimeter but will be supplementary to it.

### **AIR CONDITIONING AND REFRIGERATION**

#### **Climatic Chamber**

The component parts of the climatic chamber are now being assembled in the Applied Physiology Laboratory of the Transvaal and Orange Free State Chamber of Mines, and good progress has been made. The main wind tunnel has already been erected with corner vanes, fan, test chamber, etc., in position, and the ancillary equipment is now being installed. It is expected that the chamber will be completed towards the end of the year, when preliminary tests will be conducted to ensure that the different components function satisfactorily. Thereafter it will be calibrated, thus enabling the physiologists to conduct the tests under carefully controlled and known conditions.

The design and supervision during erection and calibration of the climatic chamber and the manufacture of the test chambers, was undertaken under contract with the Chamber of Mines at a cost of £12,350.

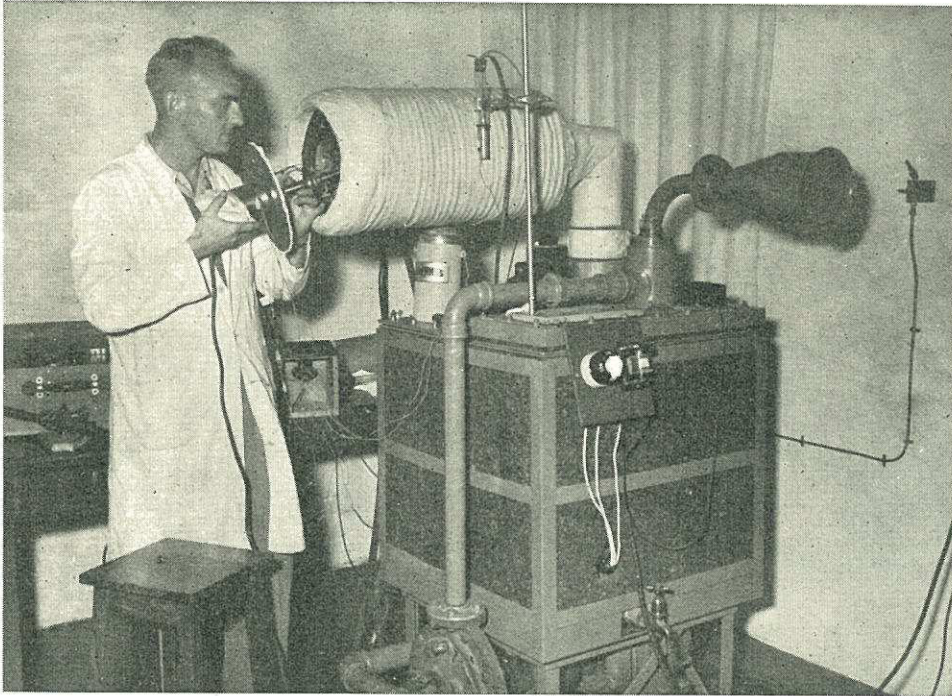


### **Noukeurige Meting van Hoë Voggehalte**

In baie nywerheidstoepassings word vereis dat die voggehalte van 'n lugstroom of van die lug in 'n kamer noukeurig beheer moet word. Om aan hierdie vereiste te voldoen, is 'n instrument ontwikkel wat nie alleen oor 'n baie wye gebied die relatiewe vogtigheid sal meet nie, maar selfs voggehalte by oorsadigde toestande. Om rede van sy groot meetgebied en noukeurigheid sal so 'n instrument in die klimaatskamer ingebou word. Verdere navorsingswerk word nou onderneem na ander moontlike metodes vir noukeurige lugvogtigheidsmeting met eenvoudige apparate.

### **Accurate Measurement of High Humidity**

In many industrial applications it is necessary that the humidity in an airstream or of the air in a room be accurately controlled. To meet this requirement an instrument was developed which will not only measure over a very wide range of relative humidity, but will also allow humidities to be measured up to supersaturated conditions. Because of its wide measuring range and accuracy, an instrument of this type will be built into the climatic chamber. However, further research is being conducted into other possibilities for the accurate measurement of humidity with a simple apparatus.



*'n Apparaat wat deur N.E.W.I. ontwerp is om instrumente wat voggehalte meet, te kalibreer.*

*An apparatus developed in the M.E.R.U. for the calibration of humidity-measuring instruments.*

### **TERMODINAMIKA** **Gasturbiennavorsing**

Werk in verband met die ontwikkeling van 'n termo-akoestiese resonator waarin poeiersteenkool as brandstof gebruik sal word, het voortgeduur. Die eerste eksperimentele model wat waterstof as brandstof gebruik, is gebou en voorlopige toetse is uitgevoer. Hoewel hierdie toetse tentatief is, het hulle getoon hoe belangrik die korrekte instelling van die elemente van die termo-akoestiese resonator is; en verdere werk word tans gedoen

### **THERMODYNAMICS** **Gas Turbine Research**

Work on the development of a thermo-acoustic resonator in which pulverized coal will be used as a fuel, has been continued. The first experimental model operating on hydrogen as fuel has been built, and some preliminary tests have been conducted. Although tentative, these tests have shown the importance of the correct tuning of the elements of the thermo-acoustic resonator, and further work



om vas te stel in watter mate die verskillende ontwerp parameters die werking van die resonator beïnvloed.

#### **Ontwikkeling van 'n Verbrandingsoond**

Op versoek van die Suid-Afrikaanse Reserwebank het die Laboratorium die ontwikkeling en ontwerp van 'n verbrandingsoond vir die vernietiging van verouderde banknote onderneem.

'n Model-verbrandingsoond, wat deur die Laboratorium ontwerp en gebou is, het bevredigende diens gelewer in 'n langdurige toets waarin ou note ter waarde van £18,000,000 vernietig is. Daar is nou begin met die ontwerp van 'n volskaaleenheid.

#### **Bosilindersmering**

'n Bosilinder-smeerolieverstuiver, wat deur 'n private ondersteuner ontwerp en gepatenteer is, is deur die laboratorium gebou en die werkverrigting daarvan op 'n motorenjin uitgetoets. In die verstuiver word die smeerolie in 'n fyn mis opgebreek en onmiddellik stroomaf van die vergasser in die inlaatspruitstuk ingevoer.

Drie reekse toetse is vir die doel uitgevoer: eerstens met petrol alleen, tweedens met 'n mengsel van bosilinder-smeerolie en petrol en derdens met die verstuiver in werking. Slegs 'n geringe verbetering in die werkverrigting was te bespeur in die geval waar die petrol-bosilinder-smeeroliemengsel in plaas van petrol alleen gebruik was.

is now being done to determine to what extent the various design parameters affect its functioning.

#### **Development of an Incinerator**

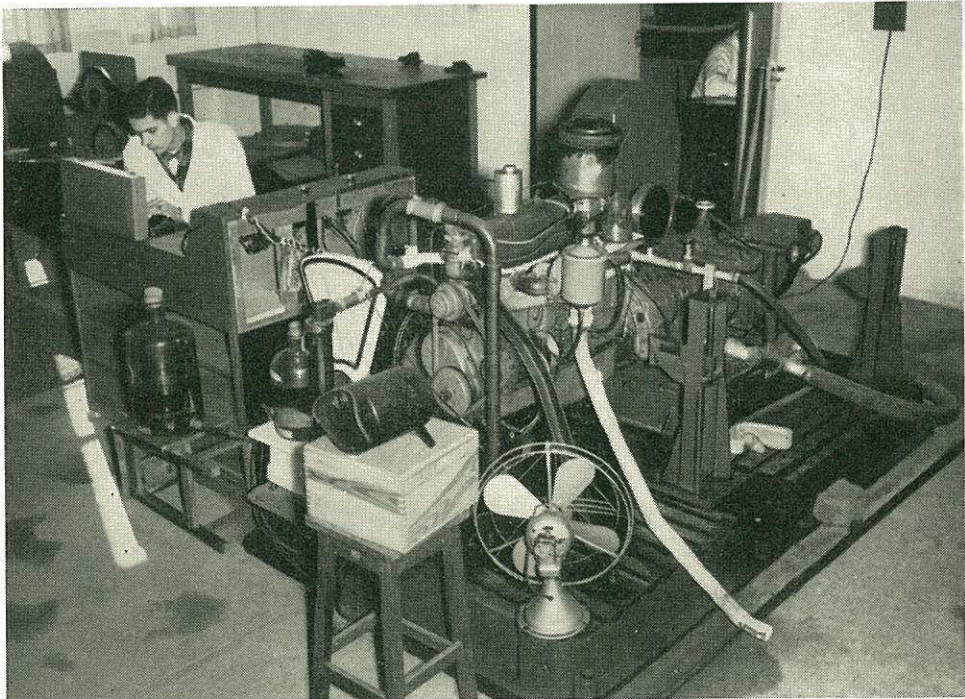
At the request of the South African Reserve Bank, the Laboratory undertook the design and development of an incinerator for the destruction of obsolete bank notes.

A model incinerator, designed and constructed by the Laboratory, functioned satisfactorily in an endurance test during which obsolete notes to the value of £18,000,000 were destroyed. A start has now been made on the design of the full-scale plant.

#### **Upper Cylinder Lubrication**

An upper cylinder lubricant atomizer designed and patented by a private sponsor was constructed by the Laboratory, and its performance tested on an automobile engine. In this atomizer the lubricant is broken up into a fine mist which is then introduced into the inlet manifold immediately downstream from the carburettor.

The investigation involved three series of tests: the first with straight petrol, the second with the upper cylinder lubricant mixed with the petrol, and the third with the atomizer in operation. Slight improvement in engine performance was found to



*'n Motorenjin op 'n toetsstand gemonteer vir 'n studie van die uitwerking van bosilinder-smeerolies op brandstofverbruik.*

*An automobile engine mounted on a test bed for a study of the effect of upper cylinder lubricants on fuel consumption.*



Met die verstuiwer in werking, terwyl die enjin lig belas en teen middelmatige spoed geloop het, was die soortlike brandstofverbruik met sowat 5 persent verbeter, hoewel die bosilindersmeerolie-verbruik niks hoër was as in die vorige toets waar dit met die petrol vermeng was nie. Verdere toetse het egter getoon dat die vernaamste oorsaak vir die verbetering die insuiging van addisionele lug vanaf die verstuiwer was, wat tot gevolg gehad het dat 'n dunner brandstof/lug mengsel die silinders bereik het. Nadat 'n korreksie aangebring is vir verbetering as gevolg van die addisionele lug, het dit geblyk dat die verbetering in soortlike brandstofverbruik deur die verstuiwingstoestel as sodanig sowat 1 tot 1½ persent is, wat klaarblyklik nie 'n groot verbetering op die smeerolie-petrolmengsel is nie.

## VLOEIMEGANIKA

### Die Meting van Lae Lugspoede

Die akkurate meting van lae lugspoede skep 'n probleem wat van belang is by studies van ventilasie in geboue en van verskynsels wat in die grenslaag naby 'n vaste wand optree.

Verskeie verbeterings is aan die 24-duim laespoed-windtonnel aangebring en met die voltooiing van die 5 vt. 6 dm.-draaiarm is daar nou 'n toetsbereik van tussen 3 vt./min. en 100 vt./sek. vir die ontwikkeling van instrumente beskikbaar.

Nuwe instrumente wat tans ontwikkel word, sluit 'n sentrifugaal-lugmanometer in wat met 'n spesiale pitotbuis van lae weerstand gebruik moet word, 'n gevoelige vloeistofmanometer met elektromagnetiese balans-indikator, 'n instrument wat die aksiale komponent van lugsnelheid meet, 'n pitometer met vloeibuis waarin olie-stuifsel gebruik word om spoed aan te dui, 'n miniatuur vlerkwindspoedmeter met elektroniese omwentelings-teller, en eindelijk 'n warmdraadwindspoedmeter wat met gelyk- of wisselstroom werk. Die laasgenoemde twee instrumente sal ook as standaardmeters in die draaiarm gebruik word om direkte lesings van relatiewe lugsnelheid te gee en sodoende die vooruitbepaling van sleursnelhede, wat by die yking van 'n instrument in die ringvormige kanaal opgestel word, uitskakel.

### Studie van Dakventilatore

In medewerking met die Suid-Afrikaanse Buro vir Standaarde is voortgegaan met die werk oor 'n voorlopige toetskode vir die doeltreffendheid van dakventilatore wat gebruik maak van natuurlike lugstroming. Die ondersoek behels 'n studie van al die betrokke aspekte van instrumentasie en tegniek, asook 'n reeks toetse op 'n paar tipiese ventilatore van verskillende ontwerp.

occur when running the engine on the petrol mixed with the upper cylinder lubricant as compared with straight petrol, the improvement in specific fuel consumption being of the order of 1 per cent. With the atomizer in operation, and the engine running at light loads and medium speeds, the specific fuel consumption was improved by about 5 per cent., although the upper cylinder lubricant consumption was no more than when mixed with the petrol. However, further tests revealed that the main reason for this improvement was due to additional air being drawn in from the atomizer, resulting in a leaner fuel/air mixture reaching the cylinders. After correcting for the improvement due to the additional air, the improvement resulting from the upper cylinder lubricant atomizer was of the order of 1 to 1½ per cent., which did not seem to be much of an improvement on the lubricant mixed with petrol.

## AERODYNAMICS

### The Measurement of Low Velocities

The accurate measurement of low air velocities constitutes a problem which has an important bearing on studies of ventilation in buildings, and on boundary layer phenomena.

Several improvements have been effected on the 24-in. low speed wind tunnel and, with the completion of the 5 ft. 6 in. whirling arm, an overall range of speeds between 3 ft./min. and 100 ft./sec. is now available for instrument development.

New instruments at present under development include a centrifugal air manometer to be used with a special low resistance pitot tube, a sensitive liquid manometer with electro-magnetic balance indicator, an instrument for measuring axial component of velocity, a pitometer with flow tube using "atomized" oil for speed indication, a miniature vane anemometer having an electronic revolution counter, and, finally, a hot-wire anemometer operating either on direct or alternating current. The last two of these are to be used as standards on the whirling arm to measure the relative air velocity directly, thus obviating the necessity for pre-determining the swirl velocities set up in the circular duct during the calibration of an instrument.

### Studies of Roof Ventilators

Work was continued on the draft test code for the assessment of natural draught roof ventilator performance, in collaboration with the South African Bureau of Standards. The work embraces an investigation into all the relevant aspects of instrumentation and technique, and includes a series of tests on some typical ventilators of different design.



Die invloed van dakhelling op die werking van ventilatore, wat tans ondersoek word, sal toon of die beskikbare werksruimte in die windtunnel voldoende is om 'n vals dak te akkommodeer. So nie, sal daar van modelgeboue gebruik gemaak word om die invloed van dakhelling op vloeitoestande by die normale ventilatorposisie vas te stel. Die ventilator kan dan onder ooreenstemmende toestande van windsnelheid en -rigting getoets word.

### Lugvervoer van Gekorrelde Stowwe

Die aanwending van druklug om gekorrelde stowwe te vervoer, bied die voordele van 'n goedkoop, beknopte en buigsame installasie. Om egter die bedryfskoste van 'n lugvervoerstelsel redelik laag te hou, moet hulle met meer sorg ontwerp word as wat tot dusver die geval was. 'n Uitgebreide navorsingsprogram is dus van stapel gestuur om basiese inligting in hierdie verband in te win.

Geskikte eksperimentele toerusting is ontwerp en omvattende toetse uitgevoer op die vervoer van sago en sand in beide horisontale en vertikale pype. Vloeiverliese en materiaal-snelhede onder verskillende toestande is bepaal. Die invloed van 'n reghoekige pypboog op vloeiverliese en die minimum lugsnelhede om bepaalde massas van gekorrelde stowwe te vervoer, is ondersoek.

### Windtunnel-ontwikkeling

In dié projek word gesigspunte bestudeer wat mag lei tot 'n verbeterde werking van windtonnels. 'n Vraagstuk wat spesiale aandag geniet het, was die demping van wisselinge in snelheid wat in die werkseksie van die 10 vt.-deursnit vrystraalwindtunnel voorkom en wat blykbaar 'n inherente verskynsel by hierdie tipe windtunnel is. Dit word veroorsaak deur die periodieke vorming van groot werwels buite die vrye straal. Met behulp van 'n kring klappies in die bek van die inlaatruim kon die groter werwels vernietig word. Verdere toetse is nodig om vas te stel of die gebruik van die klappies dit moontlik sal maak om beheer uit te oefen oor die spoedverdeling in die straal.

### 'n Studie van Lugvloei deur Lemroosters

'n Grondige kennis van gasvloei deur lemroosters is van fundamentele belang in die ontwerp van waaiers en turbines. Hoewel baie werk reeds op die gebied gedoen is, bestaan daar nog 'n aantal probleme wat verdere ondersoek vereis. Die drie belangrikste hiervan is die volgende:—

- (1) Die ontwerp van waaiers en leilomme in gevalle waar hulle te naby aan mekaar geleë is om die ontwerpse gegewens oor enkelstaande vleuels toepaslik te maak en waar rowwigheid van die oppervlakte en noukeurigheid van afwerking die probleem verder bemoeilik.

The affect of roof pitch on the performance of ventilators, at present being investigated, will indicate whether the working section of the wind tunnel is large enough to accommodate a dummy roof, or whether scale model buildings will have to be used to assess the effect of roof pitch on the flow pattern at the position normally taken up by the ventilator, which can then be tested at the corresponding speeds and flow inclinations.

### Pneumatic Conveyance of Granular Material

The use of compressed air to convey granular materials offers the advantages of an inexpensive, versatile and compact plant. However, if the running costs are to be reduced to a reasonable level, it will be necessary to design pneumatic conveyor systems more rationally than has been the case in the past. With this object in view, a comprehensive research programme has been initiated to obtain the necessary fundamental design data.

Suitable experimental equipment was designed and an extensive series of tests has been conducted on the conveyance of sand and sago in the horizontal and vertical pipes. Flow losses and grain velocities were determined under different conditions. The effect of a 90 deg. bend on flow losses, and minimum air velocities for each rate of flow were investigated.

### Wind Tunnel Development

In this project a study is being made of some of the factors that may lead to improved performance of wind tunnels. A problem that required special attention was the damping of flow pulsations in the working section of the 10-ft. diameter open-jet wind tunnel. The presence of these pulsations appears to be an inherent characteristic of all open-jet type wind tunnels and is caused by the periodical formation of large vortices outside the jet boundary. Disintegration of the larger vortices was effected by means of a ring of tabs situated in the mouth of the inlet section. Further tests are necessary to indicate whether the use of tabs permits of control being exercised on the velocity distribution in the jet.

### A Study of Flow through Cascades

A detailed knowledge of the flow of gases through cascades is of primary importance in the design of turbo-machinery. Although much work has already been done in this field, there are a number of problems which require further investigation. The three most important are:—

- (1) The design of fan blades and guide vanes in cases where they are too closely spaced for single aerofoil design data to be applicable, and where further complications are introduced by the effects of blade surface rough-



- (2) Die bepaling van die invloed van basiese vloei-verskynsels op die geraas van waaiers.
- (3) Die ontwerp van lemme vir steenkool-gevuurde gasturbines, om lemwegvreting tot 'n minimum te beperk, d.w.s. om die verband tussen erosie en lug-dinamiese ontwerpparameters te bepaal.

'n Studie van gepubliseerde werke wat hierop betrekking het, het getoon dat beskikbare gegewens oor lemroosters nie toereikend is om die huidige probleme op te los nie, sodat verdere navorsing noodsaaklik geword het. Die ontwerp van eksperimentele toerusting vir navorsing oor wegvreting by turbienlemme vorder goed en daar sal spoedig begin word met die ontwerp van apparaat wat vir ander lemroostervraagstukke benodig word.

#### 'n Studie van Waaierontwerp met Betrekking tot Geraas

Daar is voortgegaan met die ondersoek van die geraas-probleem by waaiers met die uiteindelijke doel om metodes te vind waarvolgens geraas deur geskikte waaierontwerp verminder kan word. 'n Toetseheid in die vorm van 'n 30-dm. aksiale waaier waarvan die meeste ontwerp-groottes veranderbaar is, is vir die werk ontwerp en word tans vervaardig.

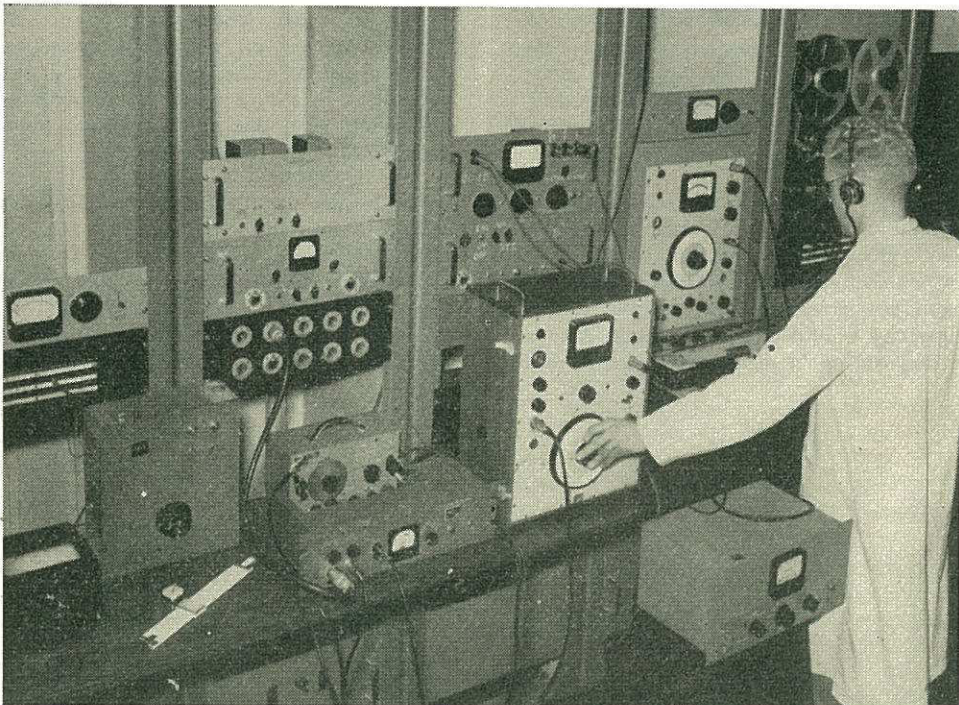
ness and manufacturing tolerances.

- (2) The evaluation of the fundamental effects of flow phenomena in a fan in relation to the mechanism of noise generation.
- (3) The design of turbine blades for a coal-fired gas turbine so as to reduce blade erosion to a minimum, *i.e.*, to establish a relationship between erosion phenomena and aerodynamic design.

A survey of relevant literature indicated that available cascade data could not be effectively applied to solve the present problems, so that further research became necessary. The design of a test-rig for studying turbine blade erosion phenomena is well under way and a start will soon be made with the design of experimental equipment for other cascade flow studies.

#### A Study of Fan Design in Relation to Noise

The investigation of the problem of fan noise, with the ultimate object of suggesting methods for reducing noise by means of suitable fan design, has been continued. A 30-in. diameter experimental axial flow fan unit, in which most design parameters



*Die rangskikking van kontroles en instrumente wat gebruik word vir navorsing oor die vermindering van lawaai by waaiers in pypleidinge.*

*The arrangement of controls and instruments used in research into the reduction of noise from ducted fans.*



'n Kleinskaalse toetsapparaat is ontwerp en opgerig met die doel om geskikte metodes te ontwikkel om geraas by waaiers in pypleidings te meet en te ontleed. Die werk is nog aan die gang en sluit ook eksperimente in om die bruikbaarheid van 'n mikrofoon, met geskikte windskeerm toegevoeg, vir geraasmetings, in 'n pypleiding te ondersoek.

#### **Die Werksvermoë van 'n Hidrouliese Lugkompressor**

'n Uitgebreide ondersoek is uitgevoer om die doeltreffendheid te bepaal van die verskillende onderdele van 'n hidrouliese lugkompressor wat deur 'n private ondersteuner ontwikkel en gepatenteer is. Die kompressor maak gebruik van 'n waterpomp om 'n mengsel van lug en water deur 'n stel spesiale mondstukke te suig en in 'n tenk te pomp waar die lug van die water geskei en as saamgeperste lug in die ruimte bo die oppervlak van die water versamel. Toetse het getoon dat meer navorsingswerk nodig sal wees, veral oor die vorm van die mondstuksisteem, voordat so 'n tipe kompressor met gewone tipes kan meeding.

#### **Ander Hidro- en Lugdinamiese Ondersoeke**

Verskeie take wat korttermynnavorsing vereis het, is onderneem. Afgesien van die roetine-yking van lugvloei-instrumente ten behoeve van ander laboratoriums is daar ook etlike ykings van meetinstrumente gedoen wat spesiale toetsmetodes vereis het soos van 'n asemhalingstoestel en van 'n vlerkwindspoedmeter binne 'n buis met hoë interne vloeierstand.

'n Ondersoek is vir 'n buitefirma uitgevoer om die werksvermoë van 'n 10-vt. deursnit windmeul te bepaal. Aangesien so 'n groot windmeul nie met akkuraatheid in die 10-vt. windtonnel getoets kan word nie, is dit op 'n ligte vragmotor gemonteer en kon die gewenste relatiewe lugbeweging verkry word deur op 'n windstille dag teen vasgestelde snelhede op 'n reguit, gelyk pad voort te beweeg.

will be variable, has been designed for this work and is at present under construction.

A small-scale test rig has been designed and erected in order to establish a suitable technique of measuring and analysing the noise of ducted fans. This work is still in progress, and includes an investigation into the possibility of using a microphone, fitted with a suitable windscreen, inside a fan duct.

#### **Performance of Hydraulic Air Compressor**

A comprehensive test was conducted to determine the component efficiencies of an hydraulic air compressor developed and patented by a private sponsor. In this compressor, a water pump is employed to draw a mixture of air and water through air entrainment injectors and then discharge it into a receiver, where the air is separated from the water and retained as compressed air in the space over the water surface. The tests indicated that more research would be required, especially on the injector system, to make this type competitive with present-day compressors.

#### **Other Aero- and Hydrodynamic Investigations**

Several tasks requiring short-term research have been undertaken. In addition to the routine calibration of a number of air flow instruments on behalf of other laboratories, several calibrations were performed on measuring instruments which required special techniques for testing, such as the calibration of a flow meter for respiration measurements and of a vane anemometer accommodated in a tube with high internal resistance to flow.

An investigation to determine the performance characteristics of a 10-ft. dia. windmill was undertaken on behalf of a private firm. Since a windmill of these dimensions could not be accurately tested in the 10-ft. dia. wind tunnel, it was mounted on a light motor truck, the required relative air flow being obtained in calm weather by driving the truck along a straight, smooth road at predetermined speeds.



# Telekommunikasie- Navorsingslaboratorium

*Direkteur:* DR. F. J. HEWITT

Met goedkeuring van die Minister het die Raad die status van die laboratorium in Augustus 1954 verhef tot die van die ander hooflaboratoriums van die Wetenskaplike en Nywerheidsnavorsingsraad.

Die Direkteur van die laboratorium het die elfde Algemene Vergadering van U.R.S.I. (Internasionale Wetenskaplike Radio-Unie) wat in Augustus 1954 in Den Haag gehou is, as amptelike afgevaardigde van Suid-Afrika bygewoon. Kort besoeke is ook gebring aan navorsingsorganisasies vir militêre en siviele radio en radar in die Verenigde Koninkryk.

## Die Frekwensievoorrekeningsdiens

Daar is voortgegaan met gereelde metings van ionosfeerenskappe by vertikale invalshoeke by Johannesburg en Kaapstad en resultate is maandeliks gepubliseer. Die ionosfeerregistreerder in Nairobi is effe verskuif en lewer nou bevredigende resultate.

Voorrekenings van hoogfrekwensievoortplantings-toestande vir Suidelike Afrika is maandeliks opgestel en gepubliseer.

Die Raad is dank verskuldig aan die Suid-Afrikaanse Departement van Pos- en Telegraafwese en die Oos-Afrikaanse Departement van Weerkunde wat die ionosfeerregistreerders in Kaapstad en Nairobi onderskeidelik bedien.

## Ionosfeerstudies

Met gebruik van 'n dubbelpulsmetode is daar voortgegaan met die ondersoek van die verandering van elektrondigtheid en botsingsfrekwensie volgens die hoogte in die laer ionosfeer. Die uitwerking van een puls op die verskillende ionosfeerlae is deur 'n tweede verkenningspuls waargeneem terwyl die tye van voorkoms van die laasgenoemde in verhouding tot die eerste gekontroleer is.

Volgens die beginsel is 'n paar waarnemings met betreklik swak senders gemaak. Hoewel die resultate die moontlikhede van die metode getoon het en sekere nuwe inligting verskaf het oor die laer ionosfeer het hulle getoon dat sterker sendekrag nodig is. Daar is dus besluit om die buitepos met 'n sterk aldoelpulssender uit te rus vir ionosfeerstudies. Aanvanklik sal dit vir die kruis-modulasiestudies gebruik word, maar later mag dit ook nuttig wees vir studies van skuins pulsuitstralings en terugstrooiing.

Die Laboratorium is dank verskuldig aan die Unie-verdedigingsmag vir die leen van 'n sender wat die basis van die nuwe uitrusting sal vorm.

# Telecommunications Research Laboratory

*Director:* DR. F. J. HEWITT

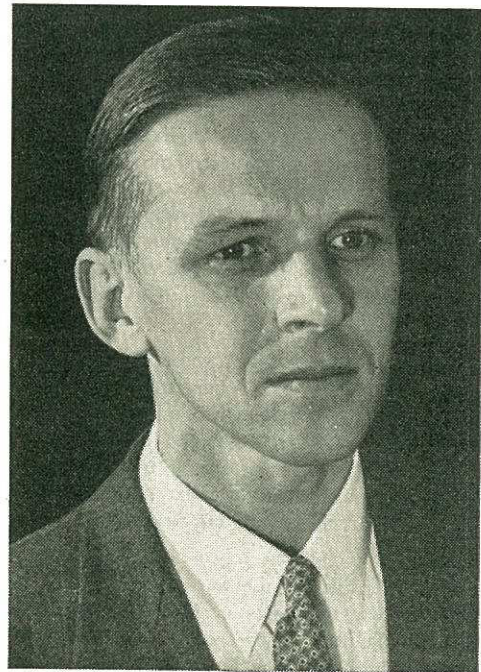
With the Minister's approval, the Council raised the status of the Laboratory in August, 1954, to that of the other major laboratories of the Council for Scientific and Industrial Research.

The XIth General Assembly of U.R.S.I. (International Scientific Radio Union), held at The Hague in August 1954, was attended by the Director of the Laboratory as the official South African delegate. A short series of visits to United Kingdom military and civil radio and radar research organizations was also carried out.

## The Frequency Prediction Service

Regular measurements of ionospheric characteristics at vertical incidence have continued at Johannesburg and Cape Town and results have been published monthly. The site of the ionosphere recorder in Nairobi has been changed slightly and satisfactory results are now being obtained.

Predictions of high frequency propagation condi-



*Dr. F. J. Hewitt.*



## Afstandmeting deur Radio

Ondersoek is ingestel na die moontlikheid van noukeurige afstandmeting deur radio vir opnamedoel-eindes. Voorlopige aanduidings is dat 'n instrument wat deur die laboratorium ontwerp is sodanige meting met hoë akkuraatheid moontlik sal maak. Die metode is aantreklik in vergelyking met die gewone metode wat gebruik maak van hoekmetings wat met 'n teodoliet gemeet is, terug verwys na 'n grondlyn wat met veel moeite met band afgemerk is.

## Radioruispeile en Navigasiehulpmiddels

Die meting van radioruispeile by 100 kh., met die doel om die uitwerking van radiolugsteurings op verskillende navigasiehulpmiddels te bepaal, het voortgeduur in gebiede ten noorde van die Unie. Die studie word gesteun deur die Lugvervoerraad van Suidelike Afrika.

Daar is nou genoeg gegewens uit Lusaka ontvang en geen verdere registrasies sal hier gemaak word nie. Onlangs is 'n registreerder in Jinja geïnstalleer waar dit deur die Oos-Afrikaanse Pos- en Telekommunikasie-Administrasie bedien word. Die resultate van die pos is besonder belangrik met die oog op die buitengewoon hoë ruispeile wat in die gebied voorkom.

Reëlings word getref vir die tussenvergelyking van die T.N.L. 100 kh.-geruisregistreerder met 'n nuwe laefrekwensieregistreerder wat deur die Radionavorsingsafdeling van die Departement van Wetenskaplike en Industriële Navorsing van die Verenigde Koninkryk ontwikkel is vir gebruik saam met hul bestaande hoëfrekwensie-geruisregistreerder wat met die hand bedien word.

Resultate vir twee somerseisoene is verkry deur die geruisregistreerder wat in 'n Skymaster van die Suid-Afrikaanse Lugmag geïnstalleer is om die voorkoms van neerslagsteurings waar te neem. Die resultate word bestudeer en 'n verslag word opgestel. Die toerusting is onttrek, deels omdat wysigings aan die vliegtuig herinstallasie nodig sou gemaak het en deels omdat die gegewens wat geregistreer moet word, in die lig van onder-vinding gewysig moet word.

Daar is baie min gedoen in verband met lugsteuring in die hoëfrekwensieband. Die multifrekwensiegeruis-registreerder wat deur die Sentrale Radiovoortplantings-laboratorium van die Verenigde State se Buro vir Standaarde ontwikkel is, is nog nie beskikbaar nie. Reëlings is egter getref met die Afdeling Burgerlike Lugvaart dat dit later by die Jan Smuts-lughawe geïnstal-leer sal word.

As gevolg van besluite wat geneem is op die elfde Algemene Vergadering van U.R.S.I. (Internasionale Wetenskaplike Radio-Unie) sal die laboratorium deel-neem-aan 'n internasionale studie van die statistiese eienskappe van lugsteurings.

tions for Southern Africa have been prepared and published monthly.

The Council is indebted to the South African Department of Posts and telegraphs and to the East African Meteorological Department, which are responsible for the operation of the ionosphere recorders at Cape Town and Nairobi, respectively.

## Ionospheric Studies

Work has continued on the investigation of the variation with height of the electron density and collision frequency in the lower ionosphere using a double pulse system: the effect of one pulse on the various ionospheric layers being observed by a second exploring pulse, the time of occurrence of the latter relative to the first being controllable.

Some observations with comparatively low power transmitters have been made using this principle. The results, while demonstrating the potentialities of the method and supplying some new information about the lower ionosphere, indicated the need for higher transmitter power. It was therefore decided to equip the field station with a high-power general-purpose pulse transmitter for ionospheric studies. Initially it will be used for these cross-modulation studies but it will also be useful at some later date for oblique incidence pulse transmissions and back-scattering studies.

The laboratory is indebted to the Union Defence Force for the loan of a transmitter which will form the basis of the new equipment.

## Distance Measurement by Radio

The possibility of precise distance measurement by radio for survey purposes has been investigated and preliminary indications are that an instrument devised by the Laboratory will enable this to be done with great accuracy. The method is attractive when compared with the conventional method which uses angular measurements made by a theodolite referred to a base-line laboriously laid out with tapes.

## Radio Noise Levels and Navigational aids

The measurement of radio noise levels at 100 Kc/s, sponsored by the Southern Africa Air Transport Council, with a view to assessing the effect of atmospheric radio noise on various radio aids to navigation, has continued in territories to the north of the Union.

Adequate records from Lusaka have now been obtained and no further recording is proposed at this site. A recorder has recently been installed at Jinja where it is operated by the East African Posts and Telecommunications Administration. The results from this site are of particular interest in view of





*Mikrogolfoerusting deur die T.N.L. ontwikkel vir afstandsmeting.  
Microwave equipment developed by the T.R.L. for distance measurement.*

Die Internasionale Konsulerende Komitee vir Radio (C.C.I.R.) het hul lede aangeraai om die gedrag van verskillende soorte weerligtelers te bestudeer om op die wyse meer uitgebreide inligting in te win oor die bronne van lugsteurings. Die Suid-Afrikaanse Poskantoor het dus versoek dat werk van die aard in Suid-Afrika gedoen word deur die Telekommunikasie-navorsingslaboratorium in medwerking met die Bernard Price-instituut. Twee soorte weerligtelers is gebou volgens spesifikasies wat van die C.C.I.R. ontvang is en die eerste toetse is verlede somer uitgevoer.

#### **Opname van Grondkonstantes**

Die resultate is ontleed en gepubliseer. Die Laboratorium is dank verskuldig aan die Afdeling Driehoeksmeting vir hulp by die opstelling van die kaart waarin die resultate van die opname opgesom is.

#### **Kristalbeheer van Veranderbare Frekwensie**

Onderhandelinge is aangegaan vir die lisensieer van die patente vir die Wadley-ontvangstoestel vir vervaardiging deur 'n radiofirma in Groot-Brittanje.

the extremely high noise levels prevailing in this area.

Arrangements are in hand for the inter-comparison of the T.R.L. 100 Kc/sec noise recorder with a new frequency recorder developed by the Radio Research Division of the United Kingdom Department of Scientific and Industrial Research, for use in conjunction with their existing manually operated high frequency noise recorder.

Results are now available for two summer seasons from the airborne noise recorder installed in a South African Airways Skymaster to observe the occurrence of precipitation static. These results are being studied and a report is in preparation. The equipment has been withdrawn, partly owing to the fact that modifications to the aircraft in which it was fitted would have necessitated re-installation, and partly to the fact that the data to be recorded should be reviewed in the light of experience.

Very little work has been done on atmospheric noise in the high frequency band. The multifrequency noise recorder developed by the Central Radio Propagation Laboratory of the United States National Bureau of Standards is still not available. Arrangements have, however, been made with the Division of Civil Aviation for its installation at Jan Smuts Airport in due course.

As a result of decisions reached at the XIth General Assembly of U.R.S.I. (International Scientific Radio Union), the Laboratory will take part in an international study of the statistical properties of atmospheric noise.

The study of the behaviour of various types of lightning counter has been recommended to its members by the International Radio Consultative Committee as a means of obtaining more widespread information on the sources of atmospheric noise. The South African Post Office has, therefore, requested that work of this nature be carried out in South Africa by the Telecommunications Research Laboratory in collaboration with the Bernard Price Institute. Two types of lightning counter have been built to specifications received from the International Radio Consultative Committee and initial tests were carried out during the last summer.

#### **Ground Constants Survey**

The analysis of the results and the publication thereof have been completed. The Laboratory is indebted to the Department of Trigonometrical Survey for assistance in the preparation of the map summarising the results of the survey.

#### **Variable Frequency Crystal Control**

Negotiations for the licencing of the Wadley receiver patents for manufacture by a radio firm in Great Britain were concluded.

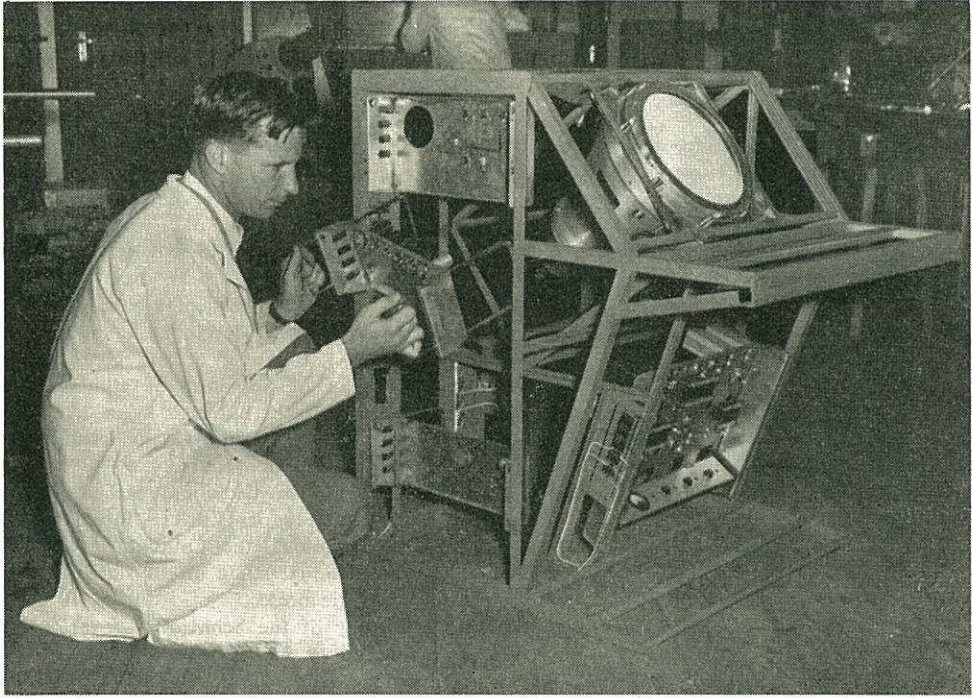


### **Afdeling vir Verdedigingsnavorsing**

Die ontwikkeling van die basiese radaruitrusting vir die Departement van Verdediging, met sekere spesiale kenmerke om dit geskik te maak vir Suid-Afrikaanse toestande, is byna voltooi. Binnekort sal daar begin word met werk oor sekere hulpuitrusting.

### **Defence Research Section**

The development of the basic radar equipment with certain special features to suit South African conditions for the Department of Defence is nearing completion. Work on certain auxiliary equipment will commence shortly.



*Die vertooneenheid van 'n radarstel in aanbou in die T.N.L.*

*The display console of a radar set under construction in the T.R.L.*

# Nasionale Bounavorsingsinstituut

*Direkteur: MNR. N. STUTTERHEIM*

Mnr. J. E. Jennings, sedert 1947 direkteur van die Instituut, het aan die end van 1954 bedank om professor in Siviele Ingenieurswese aan die Universiteit van die Witwatersrand te word. Sy bedanking is 'n groot verlies vir die Instituut, want die sukses van die werk was in groot mate te danke aan sy leiding en inspirasie gedurende die kritieke jare van die Instituut se totstandkoming en uitbreiding tot sy huidige grootte. Die aanstelling van mnr. Stutterheim as sy opvolger is gedurende Februarie 1955 deur die Raad bekragtig.

Die Navorsingskomitee oor die Koste van Naturelle-behuising, onder voorsitterskap van mnr. T. H. Louw, het hul werk gedurende die jaar afgehandel. Die finale verslag is in boekvorm gepubliseer en is 'n uitstaande prestasie op die gebied van baie goedkoop behuising.

Gedurende die jaar het die Instituut beurse, kontrakte en skenkings ter waarde van £24,000 gehanteer. 'n Toenemende hoeveelheid werk moet nou egter na konsulterende deskundiges verwys word.

## AFDELING ARGITEKTUUR

Gedurende die jaar het die afdeling toenemende finansiële steun van buite vir hul werk ontvang. Uit één hoofprojek—naturellebehuising—het drie vertakings van navorsing ontwikkel, naamlik werk oor behuising van blankes, behuising van Bantoes, skoolgeboue en hospitaalgeboue. Vir dié projekte is ruime finansiële steun van die Nasionale Behuisings- en Beplanningskommissie en die Transvaalse en Kaapse Provinsiale Administrasie ontvang. Vir die werk i.v.m. hospitale het die Departement van Gesondheid en die vier Provinsiale Administrasies besondere voorsiening gemaak.

Van die Munisipaliteit van Springs is 'n skenking van £500 ontvang as blyk van waardering vir werk in verband met die beplanning van hul nuwe Bantoeoord, Kwa-Thema.

## Publikasie van 'n Brosjyre oor Behuising

'n Behuisingsbrosjyre gebaseer op die beste ontwerpe wat ingedien is in die wedstryd gereël deur die S.A. Instituut van Argitekte oor goedkoop huise geskik vir eiendomskeemas vir Bantoes, is gepubliseer, en werks-tekeninge en lysste van materiale is opgestel. Die brosjures en werktekeninge is verkrygbaar van die Departement van Naturellesake.

# National Building Research Institute

*Director: MR. N. STUTTERHEIM*

Mr. J. E. Jennings, Director of the Institute since 1947, resigned at the end of 1954 to take the chair of Civil Engineering at the University of the Witwatersrand. This resignation is a great loss to the Institute; the success of its work, was, in a great measure, attributable to his leadership and inspiration during the critical years during which the Institute was established and built up to its present size. The appointment of Mr. N. Stutterheim as his successor was confirmed by the Council during February, 1955.

The Research Committee on the Costs of Native Housing, under the chairmanship, of Mr. T. H. Louw, concluded its work during the year. The final report has been published in book form and represents an outstanding achievement in the field of very low-cost housing.



*Mnr./Mr. N. Stutterheim.*



### W.N.N.R.-beurs oor Naturelebehuising

'n W.N.N.R.-beurshouer is besig om die groepering en estetiese vraagstukke van Bantoebehuising te bestudeer. Volskaalse toetse is gedoen oor kleure vir huise in Meadowlands, Johannesburg, en 'n kort verslag oor die landskapaspekte in Bantoeedorpe word opgestel as voorbereiding vir praktiese toepassing.

### Sosio-Ekonomiese Studies

Dié werk is gedeeltelik gesteun deur 'n toekenning van die Raad vir Sosiale Navorsing.

Voorlopige verslae oor die sosio-ekonomiese studies oor nie-blanke stadsbewoners is opgestel en finale verslae word voorberei.

Wat blanke behuising betref, is die Buro vir Sensus en Statistiek gevra om hul opnames van gesinsbegrotings uit te brei om inligting oor behuising en huurgelde in te sluit. Hulle het ingestem en die opnames sal binnekort gemaak word.



*Ongeskoolde naturelebouers besig om tussen hoeke wat deur halfgeskoolde ambagsmanne opgerig is, „in te vul.” Dit is 'n metode wat deur die N.B.N.I. ontwikkel is vir meer doeltreffende gebruik van arbeid.*

*Unskilled Native building operators “infilling” between corners erected by semi-skilled artisans, a method devised by the N.B.R.I. for the more efficient use of building labour.*

The Institute has handled fellowships, contracts and grants to the value of £24,000 during the year. An increasing amount of work is, however, being referred to consultants and other bodies.

### ARCHITECTURAL DIVISION

The year was marked by increased financial support of the work of the Division from outside sources. From one major project — Native Housing — three other projects have developed, viz. housing research covering both European and Bantu, schools research, and hospital research. Generous financial support for these projects has been forthcoming from the National Housing and Planning Commission, the Transvaal and Cape Provincial Administrations and, in the case of hospitals, from the Department of Health and from each of the four Provincial Administrations.

A grant of £500 was received from Springs Municipality in appreciation of the work done in planning their new Bantu township of Kwa-Thema.

### Publication of a Housing Brochure

A housing brochure based on the best designs submitted in a competition organized by the S.A. Institute of Architects for low-cost houses for Bantu ownership schemes, has been published, and for these working drawings and lists of materials have been produced. The brochures and drawings are obtainable from the Department of Native Affairs.

### C.S.I.R. Bursary on Native Housing

A C.S.I.R. Bursar is studying the grouping and aesthetic problems of Bantu housing. Full-scale tests on colours for houses in Meadowlands, Johannesburg, have been made and a short report on landscaping in Bantu townships is being prepared as a preliminary to practical application.

### Socio-Economic Studies

This work was partly sponsored by a grant from the Council for Social Research.

Preliminary reports on the socio-economic studies of Non-European urban dwellers have been prepared and final reports are in hand.

In respect of European housing, the Bureau of Census and Statistics was requested to extend its surveys on family budgets to include information on housing and rents. This has been agreed to and the surveys will be undertaken shortly.





*'n Tipiese woning vir nie-blankes in die dorp Kwa-Thema met verbeterings deur die huurders aangebring, o.a. 'n stoep, grasperke en tuin.*

*A typical non-European home in Kwa-Thema township showing improvements by the tenants in the form of a stoep, lawns and gardens.*

### **Skoolmeubels**

'n Volledige navorsingsprogram oor skoolmeubels is afgehandel en die finale verslag gepubliseer.

### **Skoolgeboue**

Drie Bantoeskole is in Meadowlands, Johannesburg, gebou volgens ontwerpe van die Afdeling. Proefnemings oor natuurlike beligting en kleur in die skole was baie geslaag.

Navorsingswerk oor skole vir blankes het tot 'n projek ontwikkel wat gesteun word deur die Transvaalse en Kaapse Provinsiale administrasies. 'n Bedrag van £1,500 per jaar vir drie jaar is beskikbaar gestel deur elkeen vir navorsingswerk deur die Nasionale Bounavorsingsinstituut. Gedurende die jaar is minimumstandaarde vir klaskamerakkommodasie vir laer- en hoërskole ontwikkel en prototipe-kamers word by verskillende sentrums gebou.

Transvaal se Provinsiale Argitek het 'n argitek aan die Afdeling geleen om vir ses maande ondersoek in te stel na skoolsale en om terselfdertyd die navorsingsmetodes wat in die Instituut gebruik word te leer ken.

### **Hospitaalgeboue**

Die Departement van Gesondheid en die vier Provinsiale Administrasies skenk gesamentlik £5,000 per jaar

### **School Furniture**

A full research programme on school furniture was concluded and the final report published.

### **School Buildings**

Three Bantu schools have been built in Meadowlands, Johannesburg, all to designs prepared by the Division. Experiments in daylighting and colour in these schools have proved very successful.

Research on European schools has developed into a project sponsored by the Transvaal and Cape Provincial Administrations, a sum of £1,500 per annum being made available by each for three years in order to assist the researches of the National Building Research Institute. During the year, minimum standards of classroom accommodation were evolved for primary and high schools and prototype rooms are being constructed at various centres.

The Transvaal Provincial Architect seconded an architect to the Division for a period of six months to investigate school halls and at the same time to become acquainted with the methods of research used at the Institute.

### **Hospital Buildings**

The Department of Health and the four Provin-



vir drie jaar ter steuning van die navorsingswerk oor hospitaalgeboue. Daarna sal die saak heroorweeg word. Daar is reeds begin met 'n studie van die vereistes van hospitale en die funksies van siekesale.

#### **Kostestudies**

Die koste van administrasie en van dienste in dorpe vir stedelike Bantoes word breedvoerig ondersoek om kostemaatstawwe vas te stel en om middels te vind vir kostevermindering.

#### **AFDELING FUNKSIONELE DOELTREFFENDHEID**

##### **Plafonhoogte**

'n Verslag oor die talle funksionele aspekte wat in ag geneem moet word by die keuse van minimum plafonhoogtes vir Suid-Afrikaanse toestande, is aan belangstellende liggame uitgereik vir kommentaar en sal in gewysigde vorm gepubliseer word. Die vraagstuk het aansienlike ekonomiese implikasies.

##### **Termiese Eienskappe van Boumateriale**

Die termiese geleidingsvermoë van baie boumateriale

cial Administrations are collectively sponsoring research into hospital buildings to the extent of £5,000 per annum for three years, after which the position will be reviewed. A start has been made on investigations into the requirements of hospitals and the functions of wards.

#### **Cost Studies**

The costs of administration of urban Bantu townships and of services for these townships are being studied in detail, in order to establish cost norms and to find means of reducing these costs.

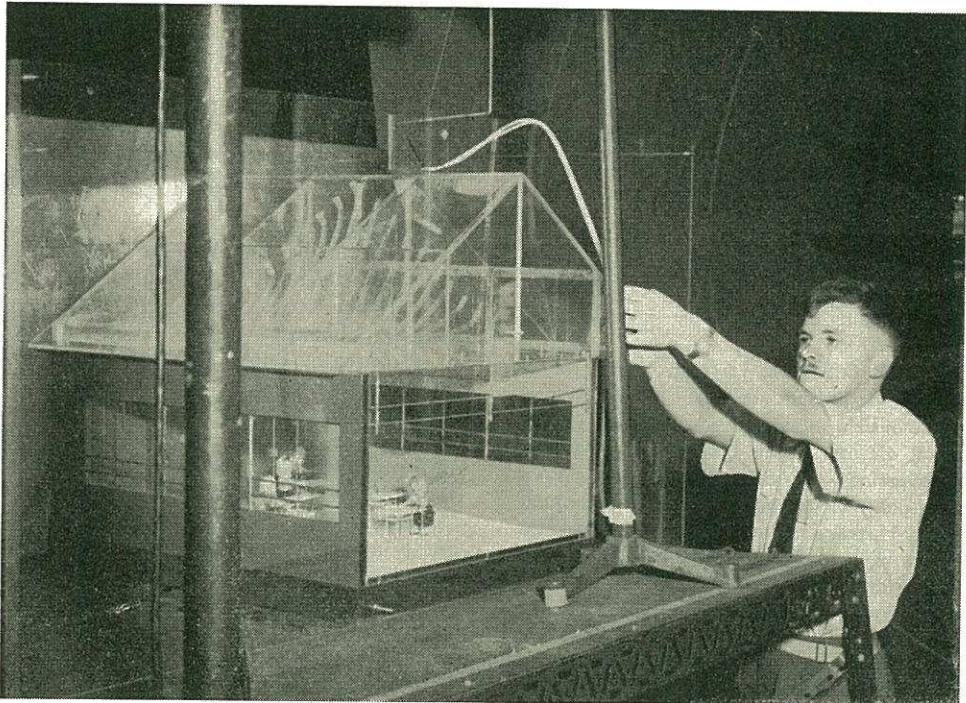
#### **FUNCTIONAL EFFICIENCY DIVISION**

##### **Ceiling Heights**

A report dealing with the many functional aspects to be considered in the selection of minimum ceiling heights for South African conditions was issued to interested bodies for comment and will be published in modified form. This problem has considerable economic implications.

##### **Thermal Properties of Building Materials**

The thermal conductivity of many building ma-



*Ventilasietoetse word op 'n skaalmodel van 'n klaskamer in die windtonnel uitgevoer.*

*Ventilation tests being carried out on a scale model of a classroom in the wind tunnel.*



word in groot mate deur voggehalte beïnvloed. Inligting oor die faktor is belangrik vir bepaling van hitte-oordrag en van verhittings- en verkoelingsbelastinge i.v.m. lugreëling. Eksperimentele metodes word uitge-toets om die verwantskap tussen termiese geleidings-vermoë en voggehalte van die meer algemene bou-materiale te bepaal.

### **Hitte-oordrag in Geboue**

Hoewel die Afdeling baie werk gedoen het oor gereelde hittevloei deur homogene mure, is daar nog geen bevredigende metode gevind vir die bepaling hiervan vir dakke en dak-plafonkombinasies nie. Met behulp van die toetskamer vir hitte-oordrag tesame met model-ondersoek, word daar nou 'n studie gemaak van die hitte-oordragprosesse oor lug en solderruimtes van verskillende dakkonstruksies in verskillende weers-toestande.

Die uitwerking van plafonne en plafonisolering op binnemuurse gemak word bestudeer deur middel van gelyktydige metings in sewe soortgelyke toetshuise wat slegs verskillende soorte plafonne en plafonisoleringe het.

### **Klammigheid in Geboue**

'n Breedvoerige verslag oor alle ondersoekes wat tot dusver gedoen is oor deursyfering van reën deur mure, word vir publikasie opgestel.

'n Uitgebreide opname en studie is gemaak van vogweringsvraagstukke en -metodes in die Unie. Daar is gevind dat verkeerde ontwerp-aanduidings dikwels die oorsaak is van vogdeurdringing. 'n Volledige verslag oor die bevindinge word opgestel.

### **Termiese Toestande en Lugreëling in Geboue**

Die termiese en ventilasietoestande wat gedurende die warm weer in drie eenderse toetshuise met verskillende ventilasiereëlings ondervind is, is vergelyk met die toestande wat gedurende dieselfde tyd voorgekom het in 'n soortgelyke huis met standaard-ventilasiereëlings. Op die wyse is getoon dat aansienlike binnemuurse verkoeling verkry kan word deur 'n eenvoudige maar nuwe lug-reëlingstelsel.

Verdere volskaalse toetse is in Bantoeuise in Atteridgeville uitgevoer om beter ventilasietodes vir die winter te ontwikkel sonder dat trekke vererger word. 'n Vraagstuk wat nou aandag geniet, is hoe om die minimum ventilasie te verkry wat nodig is om die gevaar van koolstofmonoksiedvergiftiging te wyte aan oop vure in Bantoeuise, af te weer.

Verbeterde ventilasie en vensterrangskikkings vir skole word ook nou bestudeer. Die doel is om genoeg vars lug-uitruiling in die winter te verskaf terwyl die beste gebruik gemaak moet word van lugstromings in die somer om voldoende binnemuurse luginbeweging op liggaamshoogte te verkry. Vir die werk word nou 'n metode ontwikkel waarvolgens skaalmodelle van kamers en

materials is greatly affected by moisture content. Information on this factor is important in heat transmission determinations and in estimating heating and cooling loads for air-conditioning. Experimental methods are being tried out to determine the relationship between thermal conductivity and moisture content for the more common building materials.

### **Heat Transmission in Buildings**

Although much work has been done by the Division on periodic heat flow through homogeneous walls, the problem of determining this for roofs and roof-ceiling combinations has not been satisfactorily solved. With the aid of the heat transmission test room supplemented by model investigations, a study is being made of the processes of heat transfer across air and attic spaces of various roof constructions under a variety of weather conditions.

The effects of ceilings and ceiling insulation on indoor comfort conditions are being studied by means of simultaneous measurements in seven test houses differing only in the type of ceiling or ceiling insulation used.

### **Dampness in Buildings**

A comprehensive report on all investigations carried out so far on rain penetration through walls is being prepared for publication.

A detailed survey and study of dampproofing problems and practices in the Union has been carried out. It was found that faulty detailing commonly leads to damp penetration. A full report of the findings is in preparation.

### **Thermal Conditions and Ventilation in Buildings**

The thermal and ventilation conditions during hot weather, in three similar test houses employing different ventilation schemes, were compared with the conditions found at the same time in a similar house employing standard ventilation arrangements. In this way it was demonstrated that a significant degree of indoor cooling can be obtained by a simple but novel system of ventilation.

Further full-scale tests were carried out in Bantu houses at Atteridgeville to develop methods for improving ventilation during winter, without increasing draughts. The problem of achieving the minimum ventilation needed to obviate dangers due to carbon monoxide poisoning from open fires in Bantu houses is now under consideration.

Studies are also in progress on improved ventilation and window arrangements for schools. The aim is to provide sufficient fresh air exchange in winter, while making the most of breezes in summer to promote adequate air movement indoors, at body level. For this work, a technique using scale models



geboue in 'n windtonnel getoets word, om basiese gegewens te verkry vir die aanpassing van die ontwerp by plaaslike topografie en klimaat.

#### **Verligting in Geboue**

Metings van buitemuurse verligting en verspreiding van lughelderheid wat naby Pretoria geneem is, word ontleed in verhouding tot voorkoms van helder, bewolkte en betrokke lug. Dit behoort meer realistiese gegewens te verskaf vir die ontwerp van binnemuurse dagverligting om die tradisionele metodes wat tans in gebruik is, te vervang.

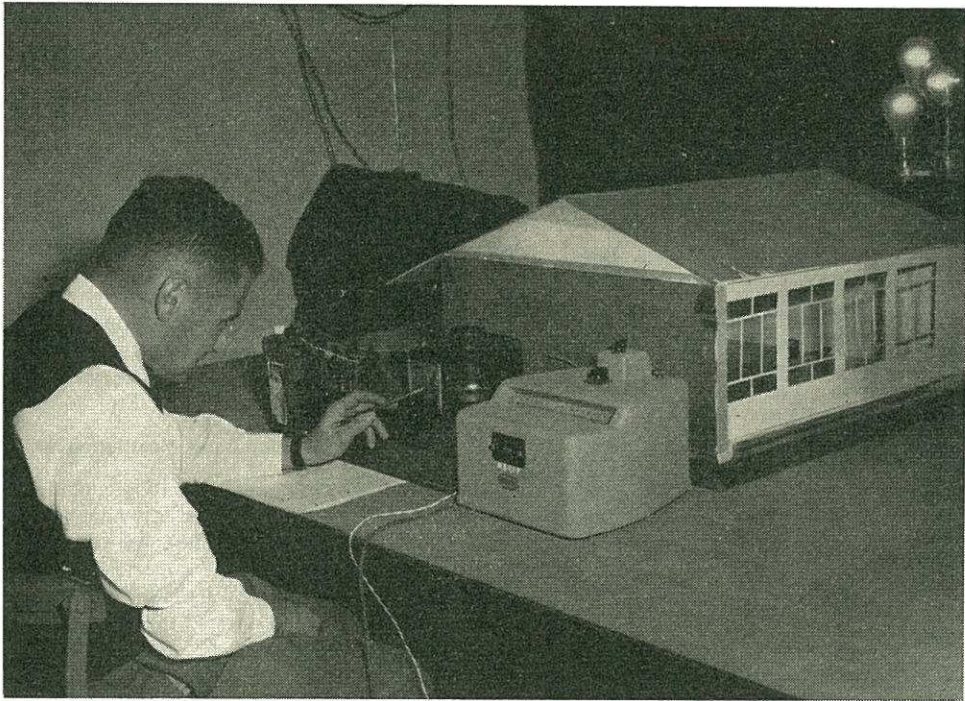
Om voldoende natuurlike beligting in verskillende lugtoestande te verkry, is verdere toetse uitgevoer met modelle volgens skaal van klaskamers en ander geboue, met inagneming van oriëntering, venstergrootte en rangskikking, plafonhoogte en keuse van kleure vir binnemuurse oppervlaktes en meubels.

of rooms and buildings in a wind tunnel is being developed in order to obtain basic data which can be applied in design to suit local topography and climate.

#### **Lighting in Buildings**

Outdoor illumination and sky brightness distribution measurements made at Pretoria are being analysed in relation to the occurrence of clear, cloudy and overcast skies. This should provide more realistic design data for interior daylighting to replace the rule-of-thumb methods at present in use.

Further tests have been carried out with scale models of schoolrooms and other buildings, to obtain adequate daylighting under different sky conditions, taking into account colour selections for interior surfaces and furnishings.



*Verligting van 'n skaalmodel van 'n klaskamer onder beheerde toestande word gemeet om die hoeveelheid en verspreiding van daglig te bepaal.*

*Illumination measurements being taken on a scale model of a classroom under controlled conditions to determine the amount and distribution of daylight.*

#### **AFDELING GRONDMEGANIKA**

Stygende grond bly die hoofprojek van die Afdeling Grondmeganika en baie pogings is aangewend om ons kennis oor die fondamentbewegings in geboue te vergroot. Verreweg die meeste navrae wat ontvang is, was in verband met fondamente op sulke grond. Daar moet nog baie navorsingswerk oor die vraagstuk gedoen word.

#### **SOIL MECHANICS DIVISION**

The subject of heaving soils remains the major project of the Soil Mechanics Division and much work has been done in accumulating knowledge of the movement of buildings. By far the greater proportion of enquiries received concern foundations on these soils, and much research work on the problem still remains to be done.



## **Drukselle**

Studies het getoon dat die induktansietipe-sel om gronddruk te meet, blykbaar bevredigend werk in die laboratorium en 'n groot aantal van die selle is nou vervaardig vir langtermynveldstudies van gronddruk-verspreiding in fondamente.

Ykingstoetse op 'n kondensatortipe-sel vir bepaling van poriewaterdruk het sekere tekortkomings getoon wat nou in 'n nuwe ontwerp uitgeskakel word. Die selle sal gebruik word vir die meet van poriewaterdruk in grond en in slykdamme.

## **Fondamente op Uitsettende Grond**

Veldwaarnemings van fondamentbewegings en ondersoek van gebarste geboue het getoon dat styging vir baie jare voortduur en op sommige plekke is styging van soveel as 8 duim waargeneem. Styging kom oor 'n wye gebied voor en gedurende die jaar is gevalle waargeneem in Kokstad, Umtata, Queenstown, Oos-Londen, King William's Town, Peddie, Grahamstad, Sand Flats, Cedarville, Matatiele, Schweizer-Reneke en Vryburg, asook in Pretoria, Vereeniging en die grootste deel van die Vrystaatse goudvelde. Gevalle van styging is ook in Lusaka (Noord-Rhodesië) waargeneem, wat toon dat dit waarskynlik dwarsdeur Suidelike Afrika voorkom.

Daar is ver gevorder met die studie van die geologiese ontwikkeling van uitsettende kleiprofiel en van die meganisme van uitsetting en die druk daardeur veroorsaak. Sommige van die resultate sal bekend gemaak word by die Streekskonferensie van Suidelike Afrika oor Grondmeganika wat in Oktober in Pretoria gehou sal word.

## **Skuiwweerstand in Gedeeltelik versadigde Grond**

'n Mate van werk is gedoen oor die meting van skuiwspannings van herwerkte grondmonsters in die spesiale drie-assige masjiene, om die uitwerking van voggehalte te bepaal. Die apparaat het moeilikhede opgelewer en wysigings word aangebring om noukeurige meting van poriedruk gedurende skuiwing te verseker.

Dié studie is van groot belang in Suid-Afrika, waar, in teenstelling met toestande in Europa en die grootste deel van Noord-Amerika, fondamentgronde gewoonlik in 'n gedeeltelik versadigde toestand is. Fondamentontwerp gebaseer op oorsese maatstawwe is nie altyd toepasbaar nie en ontwerpgegevens moet verkry word vir plaaslike toestande.

## **INGENIEURSAFDELING**

### **Bewapende Baksteenmure**

Metodes vir die voorkoming van barste in geboue op stygende fondamente is verder ondersoek. Vertikale voorspanning is uitgetoets op bewapende prototipe baksteenmure. Die Afdeling het nog 'n „driepunthuis” ontwerp

## **Pressure Cells**

Studies have shown that the performance of the inductance type of earth pressure cell appears to be satisfactory under laboratory conditions and a large number of these cells have now been manufactured for long-term field use to study earth pressure distribution in foundations.

Calibration tests on a capacitance type of pure water pressure cell, revealed certain shortcomings which are now being overcome in a new design. These cells are intended for measuring pure water pressures in soil and in slimes dams.

## **Foundations on Expansive Soils**

Field observations of foundation movements and examinations of cracked buildings have revealed that heaving continues for many years, vertical movement of the order of 8 in. having been recorded in some cases. The incidence of heaving is widespread, cases having been reported during the year in Kokstad, Umtata, Queenstown, East London, Kingwilliamstown, Peddie, Grahamstown, Sand Flats, Cedarville, Matatiele, Schweizer-Reneke and Vryburg, as well as in Pretoria, Vereeniging and most of the O.F.S. Goldfields area. Cases of heaving were also observed at Lusaka in Northern Rhodesia, which indicates that the problem probably exists throughout Southern Africa.

The work on the geological development of expansive clay profiles, and on the mechanism of swelling and swelling pressures, has reached an advanced stage and some of the results will be published at the Southern African Regional Conference on Soil Mechanics to be held in Pretoria in October.

## **Shear in Partially Saturated Soils**

Some work has been done on measuring the shear strength of remoulded soils in the special triaxial machines, to determine the effect of moisture content. Difficulties were encountered with the apparatus and modifications are being made to ensure accurate measurement of pore pressure during shear.

This study is of great importance in South Africa, where, contrary to conditions in Europe and most of North America, foundation soils are generally in a partially saturated state. Foundation design based on criteria developed overseas is not always applicable and design data for local conditions must be obtained.

## **ENGINEERING DIVISION**

### **Reinforced Brick Walls**

The investigations on methods of preventing the cracking of buildings on heaving foundations have continued. Vertical prestressing has been tried out on prototype reinforced brick walls. Another “three-



wat deur 'n kontrakteur vir private bewoning gebou is. Daar is voortgegaan met buitewaarnemings op geboue in gebiede waar stygende grond voorkom, met spesiale aandag aan die doeltreffendheid van verskeie voorsorg-maatreëls.

#### **Koste van Sanitêre Dienste**

Daar is begin met 'n studie met die oog op die vermindering van die installerings- en instandhoudingskoste van sanitêre stelsels vir goedkoop behuisingskemas. Dit behels die ondersoek van verskillende sanitêre stelsels om aan te pas by die wye reeks toestande wat in die Unie voorkom.

#### **Weerstand van Dakmateriale teen Hael**

'n Nuwe ondersoek om die weerstand van dakmateriale teen hael te bepaal, geniet nou aandag. 'n Aantal oorsese dakmateriale sowel as nuwe of verbeterde plaaslike materiale is op kontrakgrondslag in die program ingesluit. Die voorneme is om 'n vereenvoudigde laboratoriumtoets te ontwikkel vir roetinemeting van weerstand teen hael.

#### **Kontrakondersoeke**

Met die steun van verskillende plaaslike owerhede en private ondernemings is werk onderneem in verband met belastingsdefleksie-eienskappe van strukturelemente, spannings en vervormings in voorgespanne betonopgaardamme, en oorsake in gevalle waar die bewapening gefaal het.

Vir verskeie plaaslike owerhede is struktuurtoetse op Bantohuise uitgevoer om vas te stel of hulle voldoen aan standaarde van werkverrigting wat onlangs neergelê is.

#### **MATERIALE-AFDELING**

GEDurende die jaar was daar voortdurend 'n groot aanvraag na inligting oor boumateriale en na ondersoek van verwante probleme. Hoewel dit die hoeveelheid fundamentele navorsingswerk beperk het, vergoed dit in soverre dit die verspreiding van kennis en die praktiese toepassing van baie navorsingsbevindinge moontlik gemaak het.

#### **Betontechnologie**

In ondersoeke na die deurdringbaarheid van beton is die uitwerking van aggregraatgradering, porieë en rypwordingstoestande met behulp van hoogdrukpermeameters bepaal. Die resultate word toegepas in die ontwerp van betonbouwerke en in pogings om die vraagstuk van korrosie van die bewapening in bewapende beton in kusomgewings op te los.

Die verkryging van ultrasoniese toetsuitrusting sal snelle en gerieflike bepalinge van die gehalte van beton moontlik maak, beide binne en buite die laboratorium. Die tegniek word op uitgebreide skaal toegepas in oorsese

point" house has been designed by the Division and erected by a contractor for private occupation. Field observations on buildings in areas where heaving soils occur, have continued with particular reference to the efficacy of various preventive measures.

#### **Costs of Sanitation Services**

A study aimed at the reduction of the cost of installing and maintaining sanitation systems for low-cost housing schemes has been started. This includes examination of different sanitation systems to suit the wide range of conditions met in the Union.

#### **Hail Resistance of Roofing Materials**

A new series of investigations to determine the hail resistance of roofing materials has been commenced. A number of roofing materials from overseas, as well as new or improved local materials, are included in the programme on a contract basis. It is proposed to develop a simplified laboratory test for routine measurement of hail resistance.

#### **Contract Investigations**

Work, sponsored by various local authorities and private firms, was undertaken in connection with load-deflection characteristics of structural members, stresses and strains in prestressed reservoirs, and causes of failure of reinforcement in concrete tanks.

Structural tests on Bantu houses to determine whether they complied with recently established performance standards were carried out for various local authorities.

#### **MATERIALS DIVISION**

The demand for information concerning building materials and for investigation of problems relating thereto has been maintained at a high level during the period under review. While this has curtailed the amount of fundamental research, it has been gratifying in that it has permitted the dissemination of knowledge and the application in practice of many research findings.

#### **Concrete Technology**

Investigations on the permeability of concrete have included an evaluation of the effects of aggregate grading, air entrainment and curing conditions using high pressure permeameters. The results are being applied in the design of concrete structures and in attempts to solve the problem of the corrosion of reinforcement in marine environments.

The acquisition of ultrasonic testing equipment will permit rapid and convenient determination of the quality of concrete, both in the laboratory and in the field. This technique is being extensively ap-



betonnavorsingswerk, en 'n lid van die personeel het onlangs agtien maande oorsee deurgebring om hierdie en ander ontwikkelinge in betontechnologie te bestudeer. Die invoering van ontwerpbeginsele by die maak van betonmengsels sal lei tot verbeterde beton en besparings in Portland-sement.

Die uitgebreide ondersoek gedurende die afgelope jare van betonverwerking in aggressiewe omgewings, het die bou van betonriole moontlik gemaak wat, na verwagting, baie langer as die gewone soort sal hou, met belangrike besparings in kapitaal en onderhoudskoste. Die werk het ook uitgebreide toepassing gevind in die verskaffing van korrosiebestande betonsoorte aan die nywerheid. Met die steun van die S.A. Spoorweë en Hawens en die S.A. Instituut van Siviele Ingenieurs, word die korrosie van betonbewapening naby die see, ondersoek.

Verdere navorsingswerk oor die gedrag van beton gemaak met aggregate uit die Beaufort, Dwyka, Ecce en Stormbergse geologiese reekse, het getoon dat die abnormale volumeveranderinge wat deur die materiaal veroorsaak word, 'n diepgaande uitwerking het op die gehalte en werkverrigting van betonsoorte, pleisters en mortel. Die voorkoms van verslegting as gevolg hiervan is baie wyer versprei as wat oorspronklik gemeen is en die meganisme van die dimensionele verandering word nou ondersoek. Met geldelike steun van die Betonvereniging van Suid-Afrika kon bykomende personeel aangestel word.

#### **Kalk en Sement**

Die Suid-Afrikaanse Buro vir Standaarde het 'n nuwe standaardspesifikasie vir boukalk opgestel, hoofsaaklik op grond van die navorsingswerk wat vir die afgelope sewe jaar deur die Afdeling uitgevoer is. Omdat die nywerheid reeds die Instituut se navorsingsbevindinge in 'n mate toepas, word daar nou kalk vervaardig wat aan die spesifikasie voldoen.

'n Begin is gemaak met die vervaardiging van Portland-hoogoondsement deur gebruik van plaaslike hoogoondslakke. Dié ontwikkeling is moontlik gemaak deur navorsingswerk wat sedert 1948 deur die Instituut gedoen word. Gedurende die jaar is steun ontvang vir aansienlike ontwikkeling en toegepaste navorsingswerk op die gebied van die produksie en eienskappe van messelsemente met hoogoondslakke as hoofbestanddeel.

#### **Algemeen**

Die werk in verband met verbeterde verfsoorte vir gegalvaniseerde staal is afgehandel en die finale verslag opgestel. Ander belangrike projekte was in verband met die gebruik van steenkool-as en klinker vir boublokke, die vervaardiging van sand-kalkstene, die gebruik van hoogsulfaatsement, die toets van klei vir baksteenmaakery en die ondersoek van pleister- en betongebreke.

plied in concrete research overseas, and a member of staff has recently spent eighteen months overseas studying this and other developments in concrete technology. The introduction of concrete mix design principles is resulting in improved concrete and savings in Portland cement.

The extensive research during the past few years into the corrosion of concrete in aggressive environments has permitted the construction of concrete sewers which, it is expected, will last several times as long as the normal type, resulting in considerable savings in capital and maintenance costs. This work has also found extensive application in providing corrosion-resistant concretes in industry. Work sponsored by the S.A. Railways and Harbours and the S.A. Institution of Civil Engineers, on the deterioration of concrete near the sea, is in progress.

Further research into the behaviour of concrete made from aggregates of the Beaufort, Dwyka, Ecce, and Stormberg geological series has revealed that the abnormal volume changes caused by these materials have profound effects on the quality and performance of concretes, plasters and mortars. The incidence of deterioration due to this cause is considerably more widespread than was originally visualized. Work on the mechanism of the dimensional change responsible is in progress. Financial support from the Concrete Association of South Africa has permitted the appointment of additional staff.

#### **Limes and Cements**

Based primarily on the research work carried out by the Division during the past seven years, the South African Bureau of Standards has drafted a new standard specification for lime for use in building. Limes complying with this specification are now being produced, largely as a result of the application by the Industry of the Institute's research findings.

Production of Portland and blastfurnace cements using local blastfurnace slags has commenced. This development has been made possible by the research carried out by the Institute since 1948. Considerable development and applied research in connection with the production of masonry cements with blastfurnace slags as a major ingredient, has been sponsored during the year.

#### **Miscellaneous**

The work on improved paints for galvanized steel has been completed and the final report prepared. Other major projects have been concerned with the use of coal ash and clinker for building blocks, the manufacture of sand-lime bricks, the use of super-sulphated cement, the testing of clays for brick manufacture and the investigation of plaster and concrete failures.



# Nasionale Instituut vir Personeelnavorsing

*Direkteur: Dr. S. BIESHEUVEL*

Gedurende die jaar is 'n aantal feitestudies van algemene belang vir die nywerheidsontwikkeling van Suid-Afrika aangevoer en beplan.

Die belangrikste hiervan is die opname van arbeidskrigte wat in die stadium beperk is tot blanke mans tussen die ouderdomme van 18 en 20, d.w.s. tot die deel van ons bevolking waaruit die meerderheid van ons toekomstige tegniese, administratiewe, besturende en professionele werkers sal kom. Die doel hiervan is om inligting te verkry oor die peil en tipe van skoolopleiding en beroepsopleiding wat deur die deel van die bevolking bereik word, die soorte beroepe wat hulle volg, die mate waarin hulle talente behoorlik ontplooi en die doeltreffendheid van hul opleiding vir die werk wat hulle wil doen. Gegewens sal ingesamel word om te sien of verskille tussen taalgroepe, stedelik-plattelandse groepe en sosio-ekonomiese groepe hierdie toestande beïnvloed. Omvattende inligting sal dus beskikbaar wees vir beide ekonomiese en strategiese beplanning.

'n Ander opname wat nou in die beplanningstadium is, is 'n studie van die sosio-ekonomiese agtergrond en van die oorsprong, waardes, aspirasies en houding teenoor werk van die deel van die blanke bevolking wat die fabriekswerkers oplewer. Sulke inligting is noodsaaklik om 'n begrip te kry van die oorsake wat afwesigheid, arbeidsomset en peil van werkverrigting van die fabriekswerkers bepaal. Een opname is beplan in medewerking met 'n groot nywerheidskorporasie in Transvaal, terwyl 'n ander hom meer bepaald sal toelê op mynwerkers.

Aansporingslone word tans baie toegepas om die produksievermoë van werkers te verhoog en 'n derde opname sal vasstel in hoeverre die beoefening hiervan in Suid-Afrika posgevat het. Suid-Afrikaanse kulturele toestande en die statutêre en tradisionele verhoudings wat tussen die verskillende dele van ons veelrassige gemeenskap bestaan, mag wel veroorsaak dat die uitwerking van aansporingslone hier anders sal wees as elders. Die maontlike verskillende uitwerking word tans bestudeer in 'n fabriek waar die werksdoeltreffendheid van naturelle werkers in 'n gemeganiseerde vervaardigingsproses nagegaan word beide voor en na die invoering van 'n aansporingsloonskema.

Vorige verslae het melding gemaak van die opstelling van metodes vir die meet van bekwaamheid en houding teenoor werk en hul toepassing op ongeskoolde en half-

# National Institute for Personnel Research

*Director: DR. S. BIESHEUVEL*

This year has seen the inception and planning of a number of fact-finding studies of general significance for the industrial development of South Africa.

Most important of these is the manpower survey, which is limited at this stage to European males between the ages of 18 and 20: that is, to that portion of our population from which the majority of our future technical, administrative, managerial and professional workers will be drawn. Its aim is to indicate the level and type of scholastic education and vocational training that is being reached by this section of the population, the types of occupations they are entering, the extent to which their abilities are being properly deployed and the adequacy of their training for the jobs they aspire to do. Data on these trends will be obtained in groups which differ according to language, urban or rural, and socio-economic background. Comprehensive information will thus be provided, for both economic and strategic planning.

Another survey that has reached the planning stage is a study of the socio-economic background and origins, the values, aspirations and work attitudes of that part of the European population from which industrial operatives are drawn. Factual information of this kind is essential to gain an understanding of the causes of absenteeism, labour-turnover and level of work output among these industrial workers. One survey has been planned in association with a large industrial corporation in the Transvaal, whilst another will concern itself more specifically with workers employed in the mining industry.

Wage incentive plans have become a much-used device to raise the productivity of labour and a third survey concerns the extent to which this practice has been adopted in South Africa. South African cultural conditions and the statutory and traditional relations that obtain between the components of our multi-racial society may well cause the effects of wage incentives to be different here from what they are elsewhere. One study of possible differential effects is already under way in a factory where the work efficiency of Native labourers employed on mechanized production process is being studied both before and after the introduction of a wage incentive plan.

Previous reports have mentioned the construction





*'n Groepbesprekingstoets vir die keuring van 'n administratiewe beampte vir een van die W.N.N.R. se laboratoriums.*

*A group discussion test for the selection of an administrative officer for one of the C.S.I.R. laboratories.*

geskoolde naturellewerkers. Dit is nou uitgebrei tot persone wat gekwalifiseer is om klerklike en professionele beroepe te volg. Omdat die besit van persoonlikheidskenmerke soos betroubaarheid, persoonlike eerlikheid en die vermoë om leiding te neem 'n belangrike rol speel in sulke beroepe, is die studie op die sosiologiese grondslag begin. Dit sal bepaal hoe die ontwikkeling van karaktereenskappe en die manier waarop hulle in die werksomstandighede tot uiting kom, afhang van die veelvuldige sosiale invloede wat eie is aan die leefwyses van naturelle in die Unie. Dit sal 'n grondslag bied vir die beoordeling van wenslike eienskappe, en vir die ontwikkeling en uitlewing daarvan deur opleiding en deur die daarstelling van gesonde menslike verhoudings.

'n Studie van behuisingsvereistes in verhouding tot die vorming van buurgroepe, wat in medewerking met die Nasionale Bounavorsingsinstituut onderneem word, skakel direk aan by die opname. Die groepe wat tot dusver bestudeer is, sluit in klerke in die Departement van Naturellesake, onderwysers, verpleegsters en maatskaplike werkers.

Meer fundamenteel as die eintlike bekwaamhede en werksvermoë wat naturelle besit, is die mate waarin die eienskappe deur die fisiese, kulturele en omgewings-toestande van hul opvoeding beïnvloed is. Vir die

of techniques for the measurement of abilities and work attitudes and their application to unskilled and semi-skilled Native labour. This has now been extended to those qualified to enter clerical and professional occupations, and because the possession of such personality qualities as dependability, personal integrity and leadership capacity play an important rôle in these occupations, this study was started at the sociological level. It will determine how the growth of character qualities and the manner in which they express themselves in the work situation depend on the many social influences peculiar to the lives of Natives in the Union. This will provide some basis not only for the assessment of desirable qualities, but also for the furtherance of their growth and expression by training and by the establishment of sound human relations.

A study of housing requirements, in relation to the formation of neighbourhood groups, which is being carried out in collaboration with the National Building Research Institute, has a direct link with this enquiry. The groups that have been studied so far include clerks in the Native Affairs Department, teachers, nurses and social workers.

More fundamental than the actual abilities and work capacity that Natives bring to their jobs is



navorsing van hierdie groter onderwerp sal die gesamentlike pogings van sosiale wetenskaplikes in baie streke nodig wees. Gedurende die jaar is daar begin met 'n ondersoek na die uitwerking van die moeder se dieet gedurende swangerskap en solank sy die kind voed, en van die kind se dieet nadat hy gespeen is, op die verstandelike en liggaamlike ontwikkeling van Bantoe kinders. Ander belangrike sosiologiese omstandighede soos gesondheidsfaktore, behuisingstoestande en kindergrootmaakgewoontes sal terselfdertyd beheer word. Die ondersoek wat onderneem word in samewerking met die Nasionale Voedingnavorsingsinstituut, die Departement van Voeding en die Mediese Skool van die Universiteit van Pretoria, sal betrekking hê op baie aspekte van die beroepsmoontlikhede van naturelle bevolkings in Afrika suid van die Sahara. Dit sal ook van algemene sosiale en wetenskaplike belang wees.

Daar was dus 'n aansienlike toename in die aantal basiese, maar praktiese studies rakende breë sosiale faktore wat die doeltreffendheid van werkers bepaal, eerder as personeelvraagstukke eie aan spesifieke ondernemings. Dit is moontlik gemaak deur die oprigting van 'n Afdeling vir Nywerheids sosiologie en spesiale navorsingstoekennings van die Regering. 'n Klein sosiologiese eenheid wat in die N.B.N.I. sekere aspekte van behuising ondersoek het, is na die N.I.P.N. oorgeplaas, waar daar 'n wyer navorsingsgebied bestaan. Terwyl senior betrekkings vir beroepsielkundiges vakant moes bly, was dit moontlik om 'n aantal bekwame sosioloë aan te stel, sommige met sielkundige opleiding, om die nuwe projekte te onderneem. Met die bykomende fondse sal hulp personeel aangestel word sodat die studies op 'n behoorlike skaal beplan kan word.

Die uitbreiding van werk in die rigting het dus geen beperkings gelê op basiese, teoretiese, sielkundige navorsingswerk of op kontrakwerk vir die nywerheid en staatsdepartemente nie, afgesien van die beperkings ten gevolge van 'n tekort aan sielkundiges (waarvan voorheen melding gemaak is) en die voortdurende verlies van opgeleide personeel aan die nywerheid. Die inkomste van kontrakwerk bly op 'n hoë peil en daar was 'n welkome toename in werk vir kleiner firmas. Die Staatsdienskommissie het die Instituut genader vir hulp met die verdere ontwikkeling van die stelsels van taakwaardering en merietebeoordeling wat reeds in die Staatsdiens gebruik word. Dit is 'n veelbelowende ontwikkeling.

### **Personeelkeuring**

Nuwe aanlegtoetsmetodes is ontwikkel vir opsigtors en amptenare in die goudmynnywerheid, vir masjienbedieners en tegniese leerlinge in verskillende nywerheids-

the extent to which these attributes have been influenced by the physical, environmental and cultural conditions of their upbringing. This major research subject will require the concerted efforts of social scientists in many territories. An investigation was started during the year on the effects of maternal diet during pregnancy and nursing, and of the diet after weaning, on the mental and physical development of Bantu children. Other significant sociological circumstances, such as health factors, housing conditions and habits of child rearing will be concurrently controlled. This investigation, a joint project of this Institute, the National Nutrition Research Institute, the Department of Nutrition and the University of Pretoria Medical School, will have a bearing on many aspects of the occupational potentialities of Native population in Africa south of the Sahara. It will also be of general social and scientific value.

There has thus been a considerable increase in the number of basic yet practical studies that deal with broad social factors determining the effectiveness of men at work, rather than with personnel problems specific to particular undertakings. This has been made possible by the establishment of an Industrial Sociology Department and the provision of special research grants by the State. A small sociological unit, concerned with certain aspects of housing in the National Building Research Institute, was transferred to the N.I.P.R. where it will have more scope. Whereas senior posts for occupational psychologists have had to remain vacant, it has been found possible to appoint a number of accomplished sociologists, some with psychological training, to undertake the new projects. With the additional funds, supporting staff will be appointed, in order that these studies may be planned on a proper scale.

The expansion of work in this direction has therefore not caused any restriction of basic theoretical psychological research or of contract work for Industry and State departments, apart from the limitations imposed by previously reported shortages of psychologists and by the continued loss of trained staff to industry. Income from contracts remains at a high level, and there has been a welcome increase in jobs undertaken for smaller firms. An approach from the Public Service Commission to assist with the further development of the job evaluation and merit rating schemes that are in use in the State departments is also a promising development.

### **Personnel Selection**

New aptitude testing procedures have been developed for gangers and officials in the Gold Mining

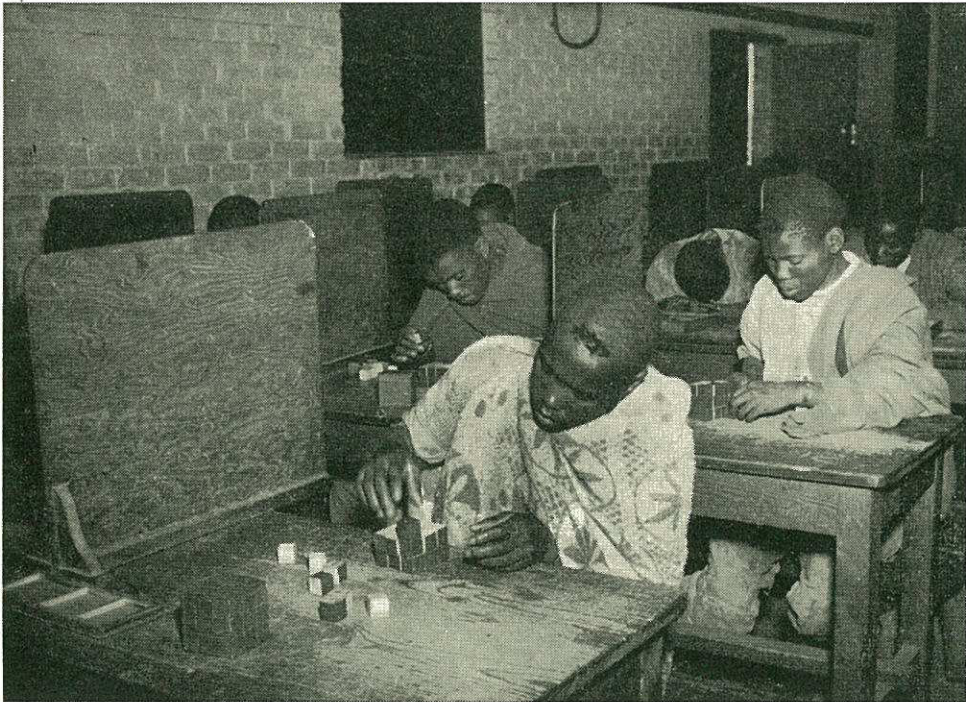


korporasies en vir klerklike en administratiewe personeel. Die gebruik van klassifikasietoetse vir natuurellearbeid is verder uitgebrei na 'n aantal sekondêre nywerhede. Gunstige verslae is ook ontvang oor die voorspellingsvermoë van die toetse by die keuring van militêre natuurellepersoneel aan die Goudkus.

Op grond van die opvolgstudies van toetsreekse wat vir vakleerlinge, verskeie kategorieë van militêre personeel, werkers in die klerebedryf en hysbakbestuurders in die myne gebruik word, is tot die gevolgtrekking geraak dat die beste resultate teen die agtergrond van maatstawwe vir beide opleidingsvermoë en werksdoeltreffendheid verkry word van betreklik kort toetsreekse vir algemene doeleindes. Die kort toetse wat die beste voorspellings moontlik maak, is die vir intelligensie, opvoedingspeil, vermoë om met woorde en syfers te kan werk, vermoë om ruimtelike verhoudings te hanteer en belangstelling in en agtergrondkennis van die bepaalde beroepsklas waarvoor die keuring gedoen word. Uitvoerige toetse van meganiese aanleg en aparate is baie selde van waarde. Ander toetse vir bepaalde doeleindes is slegs nuttig in die geval van beroepsvaardigheid waarin daar duidelike basiese individuele verskille is wat nie deur verlengde opleiding uitgeskakel word nie. Die koördineringsvermoë by die bestuur van 'n vliegtuig is 'n voorbeeld van 'n sodanige bedreweheid.

Industry, for operatives and technical trainees in various industrial corporations and for clerical and administrative personnel. There has been a further extension of the use of classification tests for Native labour to a number of secondary industries. Favourable reports have also been received concerning the predictive capacity of these tests for the selection of native military personnel on the Gold Coast.

On the basis of follow-up studies of test batteries used for apprentices, various categories of military personnel, operatives in the Garment Industry and winch drivers on the mines, it has been concluded that best results against both training potential and job efficiency criteria are obtained from relatively short test batteries of general purpose tests. Short tests which allow of best predictions are those of intelligence, educational achievement, verbal and numerical ability, ability to manipulate spatial relations and of interest and background knowledge specific to the occupational category for which one is selecting. Elaborate apparatus tests, particularly of mechanical aptitude, rarely have any value. Other specific purpose tests are only useful in the case of occupational skills in which there are marked individual differences of a basic kind, which are not abolished by prolonged training. The co-ordination



'n Aanlegtoets vir natuurelerekruite vir die goudmynbedryf.

An aptitude test for Native recruits for the Gold Mining Industry.





*Die Rorsach-inkkladoets vir die beoordeling van persoonlikheidsamestelling.*

*The Rorsach ink blot test for the assessment of personality make-up.*

Bekwaamheid in die meeste beroepe waarin handvaardigheid vereis word, is grotendeels die resultaat van opleiding en ondervinding en word dus nie maklik waargeneem deur aanlegtoetses voor opleiding nie. Geskiktheid vir sulke beroepe word die beste vasgestel volgens die minimum graad van opleiding en algemene verstandelike bekwaamheid wat vereis word om die ambag te kan aanleer, tesame met 'n bepaling van belangstelling en geskikte persoonlikheidsstruktuur. Roetineaanlegtoetsmetodes kan dus aansienlik vereenvoudig word.

Die gevolgtrekking is van praktiese belang vir die Personeelkeuringsafdeling wat gedurende die jaar opgerig is, om 'n aanvraag deur die nywerheid vir 'n roetinepersoneelkeuringdiens tegemoet te kom. Die diens is hoofsaaklik beskikbaar vir klerlike, administratiewe, tegniese en geskoolde werksaamhede. Afgesien van die toetsing van vakleerlinge vir ambagte, het die nywerhede nie na verwagting gereageer nie. Daar is egter 'n aansienlike aanvraag na beroepsvoorligting en die afdeling sal dit verskaf aan persone wat in hul laaste jaar op skool is en aan universiteitstudente wat onseker is oor hulle studierigting of wat nie bevredigend vorder met hul studies nie.

ability involved in piloting an aircraft is an example of such a skill.

Most of the skills one encounters in occupations of a manipulative nature are largely the product of training and experience and are, therefore, not readily diagnosed by means of aptitude tests applied before training takes place. Suitability for such occupations is best determined in terms of the minimum level of education and general mental abilities required to be able to learn the trade, together with an assessment of interest and appropriate personality make-up. Considerable simplification of routine aptitude testing procedures is therefore possible.

This conclusion is of some practical importance for the Personnel Selection Department that was set up during the year. This department came into being in response to requests from Industry for a routine personnel selection service. The service is mainly available for clerical, administrative, technical and skilled duties. Apart from the testing of apprentices for the skilled trades the response from Industry has not been as large as expected. There is, however, a considerable demand for vocational guidance, and the Department will provide this to those about to complete their last year at school and to University students who are uncertain about the choice of study course or who are not making satisfactory progress in their studies.

#### **Artisan Apprentices**

From large numbers of follow-up studies of apprentices tested for the military services, State departments, engineering workshops and Industry generally, and from the progress of pupils in full-time trade training at technical colleges, it has been possible to devise a selection procedure of considerable practical value. In the course of these studies it has become clear that the training of apprentices and the testing of their proficiency is capable of considerable improvement. A number of operational studies has therefore been undertaken on training methods and proficiency assessments. It will be possible to make much better use of selection and classification tests in these categories when certain deficiencies in training and assessment have been removed.

#### **Defence Research**

The volume of testing undertaken on behalf of the Department of Defence for the military gymnasias and various branches of the Permanent Force, is still considerable. The number of cases dealt with during the year was 1794. Because of this heavy routine testing load, only limited progress was made on basic research projects.



### Ambagsvakleerlinge

Uit groot aantalle opvolgstudies van vakleerlinge wat vir die militêre dienste, staatsdepartemente, ingenieurs-werkplase en die nywerheid in die algemeen getoets is en uit die vordering van leerlinge wat voltyds ambagsopleiding aan tegniese kolleges ontvang, was dit moontlik om 'n keuringsmetode van aansienlik praktiese waarde op te stel. Gedurende die studies het dit duidelik geword dat die opleiding van vakleerlinge en die toets van hul bekwaamheid aansienlik verbeter kan word. 'n Aantal bedryfstudies is dus uitgevoer oor opleidingsmetodes en beoordeling van bekwaamheid. As sekere tekortkominge in opleiding en beoordeling eers uitgeskakel is, sal beter gebruik gemaak kan word van keurings- en klassifiserings-toetse in hierdie kategorieë.

### Verdedigingsnavorsing

Daar word nog steeds 'n aansienlike hoeveelheid toetswerk ten bate van die Departement van Verdediging vir die militêre gimnasiums en verskillende takke van die staande mag gedoen. Gedurende die jaar is 1,794 gevalle getoets. Vanweë die groot hoeveelheid roetine-toetswerk is daar baie min gevorder met basiese navorsingsprojekte.

Die nuutgevormde algemene siftings- en klassifiserings-toetsreëls vir personeel van die staande mag is in sy finale vorm gedruk. Standaard vir leëringdeling is beskikbaar en die reëls is op personeel van die lugmag toegepas om die nuttigheid daarvan vir die verskillende vakindings in die lugmag te bepaal. Leierskaptotse is verder ontwikkel in die militêre gimnasiums waar kandidate vir opleiding as offisier-kadette gewarf word. Toetse wat ontwerp is vir die keuring van lugverkeersleiers, grondgeleide naderings-operateurs en vegterbeheerders is opgevolg in die lig van opleidingsresultate. Die bevinding was dat die toetse 'n baie hoë graad van voorspellingsvermoë het. Hierdie toetse word ook gebruik vir die keuring van burgerlike lugverkeersleiers. 'n Studie van vliegongelukke gedurende militêre opleiding het getoon dat die voorspellingstoetse vir ongeluksvatbaarheid, wat gedurende die oorlog nuttig was, nie van toepassing is gedurende vredetydse opleiding nie. Verdere ondersoek word ingestel.

### Werkstudie

Ten spyte van sommige vasstaande kenmerke van die loonstelsel van naturellemynwerkers was dit moontlik om 'n tegniek te ontwikkel vir die waardering van verskillende soorte werk wat deur ondergrondse naturellewerkers in die goudmyne gedoen word.

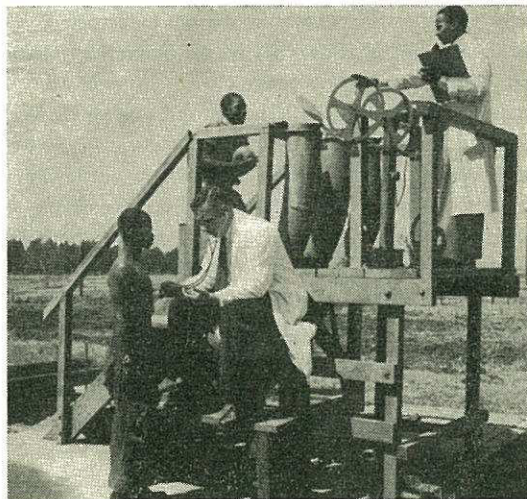
Tot dusver is werk oor taakwaardering in die Instituut beperk tot personeel wat daaglik besoldiging ontvang. Daar is nou begin met die uitbreiding van die tegniek tot gesalarieerde werkers. Die Staatsdienskommissie word gehelp met die instelling van 'n stelsel vir taakwaardering

The newly-constructed General Screening and Classification Battery for Permanent Force personnel has been printed in its final form. Standards for Army classification are available and the battery has been applied to a sample of Air Force personnel to determine its usefulness for the various musters in this service. Leadership testing was further developed in the military gymnasia from which candidates for training as officer cadets are recruited. Tests designed for the selection of Air traffic controllers, ground controlled approach operators and fighter controllers, have been followed up against training results and have been found to possess a very high degree of predictive capacity. These tests are also being used for the selection of civil air traffic control personnel. A study of flying accidents in military training has shown that the predictors of accident proneness that were found to be useful during the war, do not apply to peace-time training. A further investigation is in progress.

### Work Study

It has been found possible to develop a technique for the evaluation of jobs performed by Native underground labourers on the gold mines, despite some rigid features in the wage system of this group.

So far job evaluation work in the Institute has been confined to daily paid personnel, A start is now being made to extend the technique to salaried persons. Assistance is being given to the Public Service Commission in the establishment of a job evaluation system for senior public servants in administrative



*The ball and step test for the measurement of work capacity.*

*Die gewig en trap-toets vir die meting van werksvermoë.*



vir senior staatsamptenare in administratiewe of professionele betrekkinge. Vanweë die groot verskeidenheid van pligte wat hierby betrokke is en die verskillende maksimumsalarisse, veral vir professionele poste, sal sommige interessante tegniese probleme in die projek opgelos moet word.

Die beginsels betrokke by werksmeting wat onderneem moet word om aansporingslone te kan instel, word nou wetenskaplik ondersoek. Terwyl aansporingslone gewoonlik 'n sekere verhoging in produksievermoë teweegbring, is dit geensins duidelik of die verhoging te danke is aan verbeterde metodes, groter doeltreffendheid in bestuur of aan 'n groter inspanning van die werkers nie. Aansporingslone het ook 'n groot invloed op die goeie gees in die werksomgewing. Meer kennis oor die wyse waarop aansporingslone hul doel bereik, is dus wenslik.

### **Absentisme en arbeidsomset**

Die metode om deur middel van beheerkaarte aan besture 'n grondslag te verskaf vir behandeling van afwesigheid, is verder vereenvoudig vir praktiese gebruik deur die ontwikkeling van 'n monstertegniek. 'n Kort metode geskik vir gebruik deur arbeidsburo's, is ontwikkel vir die berekening van arbeidsomset. Dit sal 'n standaard verskaf vir vergelykinge tussen verskillende firmas en, vir dieselfde firma, tussen opeenvolgende tydperke. Dit sal ook aandui watter gedeelte van die werk van 'n Buro die gevolg is van industriële uitbreiding of van die beweging van arbeid van die een werk na die ander.

In 'n meer uitvoerige studie van die verskillende oorsake van arbeidsomset wat in 'n groot industriële korporasie uitgevoer is, is daar gevind dat biografiese inligting en ander agtergrondgegevens wat ten tyde van die indiensneming verkry is, van geen nut was vir die voorspelling van absentisme en onbestendigheid in die werk nie. Verdere pogings om oorsake by individue te vind en om maatreëls vir verbetering te tref, sal dus afhang van die resultaat van die sosiologiese studie van industriële werkers wat nou beplan word. Daar is gevind dat die voorspelling van arbeidsomset deur aktuariële metodes ook bemoelik word deur tydneigings. Hierdie neigings is nie voorspelbaar nie en hul voorkoms plaas dus 'n ernstige beperking op die gebruik van dié tegniek deur besture by die beraming van arbeidsvervangings wat op verskillende tye in die toekoms sal nodig wees.

### **Opname van Arbeidskragte**

Om 'n verteenwoordigende monster van die bevolking te kry vir die opname van blanke arbeidskragte, word gebruik gemaak van verpligte registrasie vir opleiding in

and professional posts. Because of the great variety of duties involved and the different salary ceilings, particularly for professional appointments, some interesting technical problems will have to be solved in this project.

The principles involved in work measurement carried out for the purpose of establishing wage incentives, are being subjected to scientific examination. Whilst wage incentives generally produce some increase in output, it is by no means clear whether this increase is due to improved methods, to greater managerial efficiency or to increased effort on the part of the workers. Wage incentives also have an important bearing on morale in the work situation and more knowledge concerning their precise effects and the manner in which they operate is therefore desirable.

### **Absenteeism and Labour Turnover**

The method of recording absenteeism by means of control charts which give management some basis for remedial action, has been further simplified for practical use by the development of sampling techniques. For the computation of labour turnover rates, a short cut method has been devised which is appropriate for use at labour bureaux. It will provide indices whereby comparisons can be made between various firms and, for the same firm, between successive periods. It will also indicate what proportion of the work handled by a bureau is due to industrial expansion or to the movement of labour from one job to another.

In a more detailed study of the individual causes of labour turnover, carried out in a large industrial corporation, it was found that biographical information and other background data obtained at the time of engagement, are of no value as predictors of absenteeism and occupational instability. Further attempts to determine causes in individuals and to devise remedial measures, will therefore depend on the outcome of the sociological study of industrial operatives that is now being planned. The prediction of labour turnover by actuarial means has also been found to be complicated by time trends. These in themselves are not predictable and their occurrence will, therefore, place a serious limitation on the use of this technique as a means of telling management what replacements they will have to budget for at various dates in the future.

### **Manpower Survey**

In order to obtain a representative population sample for the European manpower survey, use is being made of compulsory registration for training



die Aktiewe Burgermag. Aan alle kandidate wie se name gedurende 1955 geloot is vir opleiding in 1956, is 'n vraelys gestuur waarop hulle sekere inligting moes verskaf oor skool- en beroepsopleiding, beroep of die beroep wat hulle voornemens is om te volg. Elfduisend vraelyste is uitgestuur. Vraelyste is ook gestuur aan meer as 4,000 persone wat vrygestel is van diens of wie se deelname aan die loting uitgestel is. Uit die manskappe wat aanstaande jaar vir Aktiewe Burgermagopleiding opgeroep sal word, sal 'n lukrake keuse van 'n groep gedoen word om aan 'n reeks aanlegtoetse onderwerp te word.

### Studies van die Mentaliteit van die Bantoe

Die grootste deel van die werk oor die mentaliteit van die Bantoe word nog oorheers deur praktiese oorwegings soos die aanpassing van die indelings-toetse vir natuurleermynwerkers op fabriekswerkers en die meting van houding teenoor werk. Dit laat weinig tyd vir die studie van meer fundamentele vraagstukke soos tempo van verstandelike ontwikkeling, vermoë om spesifieke vaardighede aan te leer, aard van dinkprosesse, werksritme en uithouvermoë by verskillende naturellegroepe. Die studie van Bantoe-staatsamptenare sal in 'n mate lig werp op die oorsprong van karaktereenskappe en hul afhanklikheid van bepaalde sosiale en kulturele verhoudings. Die ondersoek oor die verhouding tussen voeding en verstandelike ontwikkeling is ook van fundamentele aard. 'n Langtermynstudie wat onlangs in die Verenigde State voltooi is, het getoon dat die toediening van vitamien-tablette aan swanger vroue van die arbeidersklas wie se dieet onvoldoende was, 'n aansienlike uitwerking gehad het op die intelligensie van hul kinders soos gemeet by die ouderdomme van drie en vier jaar. Die studie wat nou by die kraaminrigting in Lady Selborne, Pretoria, uitgevoer word, sal as 'n kontrole van die Amerikaanse bevindinge dien, hoewel die benadering ietwat anders sal wees en baie meer faktore beheer sal word as in die Amerikaanse ondersoek, bv. intelligensie van die ouers, huishoudelike omstandighede, verhouding tussen ouer en kind, gesondheid en liggaamlike toestand van moeder en kind, en die werklike voedingswaarde van die kos wat die moeder eet.

Die uitwerking van wanvoeding op mentaliteit is die onderwerp van 'n studie waarin die elektroensefalogram (E.E.G.) van kinders wat aan kwashiorkor ly, gemeet word. Die siekte wat algemeen in Afrika voorkom, is te wyte aan gebrek aan proteïen in die dieet. 'n Verslag uit Noord-Afrika meld dat daar uitgebreide veranderinge in die E.E.G. is gedurende die akute stadium van die siekte en ook vir 'n sekere tyd gedurende die herstelperiode. In 'n ander studie is 'n groot hoeveelheid abnormale E.E.G.'s gevind in andersins gesonde volwassenes. Studies van volwassenes in die Unie het nie die laasgenoemde resultaat bevestig nie, moontlik omdat tropiese siektes en kwashiorkor veel minder hier voorkom.

in the Active Citizen Force. All candidates whose names were drawn by ballot during 1955, for call-up in 1956, were sent a questionnaire requesting certain information on educational and vocational training, occupation or occupational intentions. Eleven thousand questionnaires were sent out. Questionnaires were also sent out over 4,000 cases who were exempted from service or whose participation in the ballot has been deferred. A random sample of those called up for A.C.F. training will be given a battery of aptitude tests during next year.

### Studies of the Mentality of the Bantu

Much of the work on the mentality of the Bantu is still dominated by practical considerations, such as the adaptation of the classification tests of Native mine labourers to industrial operatives and the measurement of occupational attitudes. This leaves little time for the study of more fundamental problems such as rate of mental growth, ability to acquire particular skills, nature of thinking processes, work rhythm and capacity for sustained effort in various African groups. Some light will be thrown on the origin of character qualities and their dependence on particular social and cultural relationships by the Bantu Civil Servants study. The investigation into the relationship between nutrition and mental growth is also of a fundamental nature. A long-term study, recently completed in the United States, has shown that the administration of vitamin tablets to pregnant working-class women whose diet is deficient has an appreciable effect on the intelligence of their children, as measured at the ages of three and four years. The study now being carried out at the maternity hospital in Lady Selbourne Township, Pretoria, will serve as a check on the American findings, though the approach will be rather different and many more factors are being controlled than in the American investigation, such as parental intelligence, domestic environment, parent-child relationships, health and physical condition of mother and child and the actual nutritional value of the food consumed by the mother.

The effect of malnutrition on mentality is the subject of investigation in which the electroencephalogram (E.E.G.) in children suffering from kwashiorkor is being measured. This disease is prevalent in Africa and is due to lack of protein in the diet. A North African study reports widespread changes in the E.E.G. during the acute stage and for some time during recovery. Another study reported a large proportion of abnormal E.E.G.'s in otherwise healthy adults. Adult studies in the Union have failed to confirm the latter result, possibly because the incidence of tropical diseases and



Gevalle is by die Baragwanath-hospitaal vir nie-blankes ondersoek, en 'n gelyksoortige E.E.G.-studie uitgevoer by die Eenheid vir Ondervoeding van Kinders in Kampala, Uganda. Die E.E.G. gee aanduidings van die organiese toestand en funksie van die brein wat van belang is vir die studie van gedrag. As dit blyk dat die brein deur ondervoeding beïnvloed word, dan is 'n belangrike skakel gevind tussen die laasgenoemde en mentaliteit.

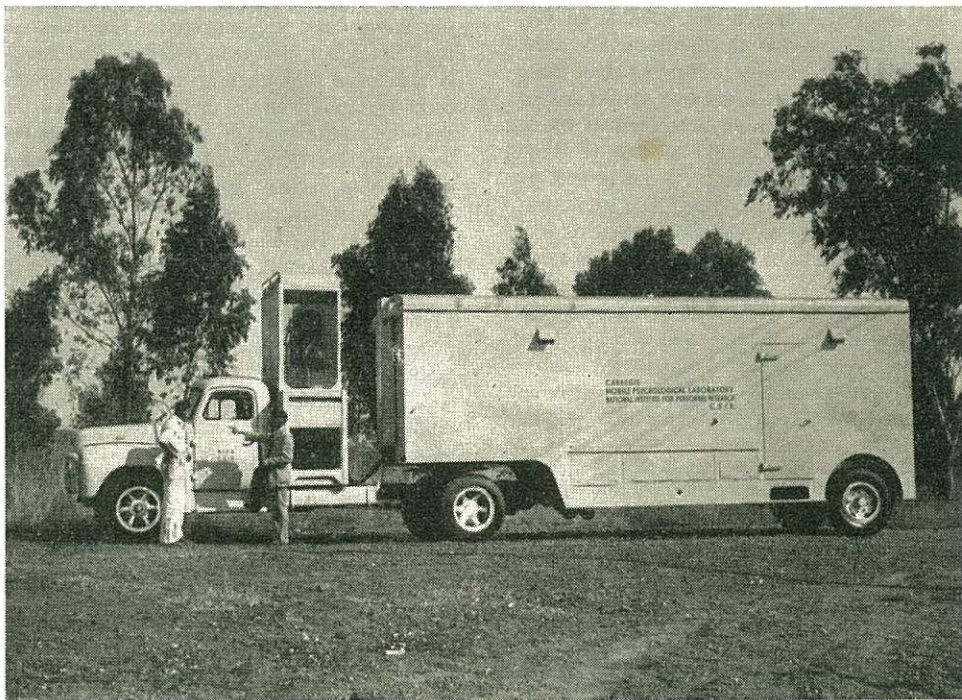
### **Mobile Toetslaboratorium**

Om buitestudies van dié aard te vergemaklik, is 'n mobiele toetslaboratorium opgerig met fondse wat deur die Carnegie-korporasie toegesê is. Die laboratorium het sitplek vir tien mense wat op banke werk wat langs die kante aangebring is. In die agterste deel is daar 'n rusbank en ander toebehore vir elektroënsefalografie. Groeptoeëse kan deur middel van die rolprenttegniek vir toetsbeheer toegepas word. Die laboratorium kan soveel water en petrol saamneem dat dit ver van die gebaande weë kan afry. Op die wyse sal laboratoriumstudies van primitiewe gemeenskappe moontlik wees.

kwashiorkor is less severe here. Cases were examined at Baragwanath Non-European hospital, with a parallel E.E.G. study at the Infantile Malnutrition Unit at Kampala, Uganda. The E.E.G. provides indications of the organic state and function of the brain that are of significance for the study of behaviour. If it turns out to be affected by malnutrition, an important link between the latter and mentality will have been established.

### **Mobile Testing Laboratory**

To facilitate field studies of this nature, a mobile testing laboratory has been constructed, with funds provided by the Carnegie Corporation. The laboratory can seat ten subjects who work on benches erected along the sides. In the rear portion there is a couch and other fittings for electro-encephalography. Group tests can be conducted by means of the film technique of test administration. The laboratory can carry sufficient water and petrol to enable it to travel far off the beaten track. Laboratory studies of primitive communities will thus be made possible.



*Die mobiele toetslaboratorium wat deur die Carnegie-korporasie geskenk is om die N.I.P.N. se navorsing oor die mentaliteit van die Bantoe te vergemaklik.*

*The mobile testing laboratory donated by the Carnegie Corporation to facilitate the N.I.P.R.'s researches into the mentality of the Bantu.*





*Die Wechsler Bellevue-toets vir die intelligensie van volwassenes.*

*The Wechsler Bellevue test for adult intelligence.*

#### **Studie oor die Aard en Meting van Persoonlikheid**

Verdere navorsingswerk is uitgevoer oor die aard van die metings wat van die voortdurende opteltoets (Pauli-toets) verkry is. Verlede jaar is vasgestel dat die toets waardevol is vir die keuring van ambagsvakleerlinge. Daar is nou gevind dat dit ook kan onderskei tussen voormanne en amptenare in die mynbedryf. Ander geldigheidstoetses is aan die gang.

Om die produksievermoë-kromme van naturelle soos deur die toets gemeet, te bestudeer, moes die toets gewysig word vir gebruik by analfabete. Een gewysigde toets is opgestel wat die gebruik van potlood en papier uitskakel en wat tog geskik is vir groepe. Dit gee 'n kurwe baie soos die wat deur die Pauli-toets verkry word en navorsingswerk word nou gedoen om vas te stel of dieselfde veranderlike temperament-eienskappe hierby betrokke is. Dit was moeilik om maatstawwe vir gestels- en ander persoonlikheidsfaktore in naturelle te verkry en die toets, wat objektief is en maklik toegepas kan word, mag nuttig wees vir die doel.

Besonder noukeurige eksperimentele werk is uitgevoer in verband met die verwantskap van sekere aspekte van waarneming (skynbare beweging, visuele flikkering, die verskynsel dat 'n mens skielik 'n volledige voorwerp waar-

#### **Studies on the Nature and Measurement of Personality**

Further research has been conducted into the nature of the measurements obtained from the continuous addition (Pauli) test. Last year it was established that the test was of value in the selection of artisan apprentices. It has now been found to differentiate also between gangers and officials in the mining industry. Other validation studies are in progress.

In order to study the curve of work output in Natives, as measured by this test, it was necessary to devise a version that was applicable to illiterate persons. One has been constructed which dispenses with the use of pencil and paper and which is nevertheless applicable to groups. It yields a curve very similar to that obtained from the Pauli Test and research is in progress to determine whether it involves the same temperament variables. It has been difficult to obtain measures of constitutional and other personality factors in Natives, and this test, being objective and easily applied, may prove a useful device for this purpose.

Meticulous experimental work has been conducted into the relationship of certain aspects of



neem terwyl slegs 'n paar dele aan hom getoon word) en die stimuleerbaarheid of tempofaktor in temperament. Die werk is moontlik gemaak deur die medewerking van 'n senior beurshouer van die W.N.N.R.

Daar is begin met 'n ander studie oor die meting van emosionaliteit deur middel van objektiewe toetse. Met verloop van tyd sal dit moontlik op groepe toegepas kan word.

### **Motorfietsongelukke**

Die studie is in medewerking met die Nasionale Padveiligheidsorganisasie onderneem. Die gegewens oor padongelukke vir die jare 1952 en 1953, verskaf deur die Departement van Sensus en Statistiek, is ontleed ten opsigte van alle motorfietsongelukke waarin persone gedood of ernstig beseer is. Omstandighede soos padtoestande, weer, tyd van die dag, week of jaar, ouderdom van bestuurders, soort motorfiets, rigting van beweging, meganiese faktore, is in verband gebring met voorkoms van ongelukke. Om die gegewens te kon vertolk, was dit nodig om die relatiewe blootstelling van motorfietsryers aan ongelukke in vergelyking met ander voertuie te weet. Vir dié doel moes die gemiddelde aantal myle wat jaarliks deur elke soort voertuig afgelê was, verkry word. Aangesien die inligting nie beskikbaar was nie, is vraelyste uitgestuur aan motorfietsryers en motorbestuurders in Johannesburg en uit die antwoorde is benaderde syfers bereken. 'n Vraelys is ook uitgestuur aan motorfietsryers om hul menings te kry oor die verskillende gevare waarin hulle verkeer het en oor die nut van sulke veiligheids-toestelle soos valhelms en valysters.

### **Psigometriese metodes**

Omdat die hoof van die afdeling nie vervang kon word nie, kon geen belangrike projekte gedurende die jaar onderneem word nie, maar daar is tog nuttige werk gedoen. Daar is begin met die opstel van bevolkingstandaarde volgens die toetse wat deur die personeelkeuringsafdeling vir beroepsvoorligting gebruik word.

Sommige van die N.I.P.N. se toetse is reeds vir veertien jaar in gebruik en daar is begin met die opstel van nuwe gewysigde toetse. Toetse word stadigaan bekend en as hulle aan personeelafdelings, kolleges of adviseurs uitgereik word, vind daar tog uitlekkings plaas ten spyte van strengte voorsorgmaatreëls.

'n Toets vir die onderwyspeil by die keuring van naturelleponeel is ook opgestel. Daar is gevind dat dit 'n belangrike faktor is in die behaling van beroepsukses, maar aangesien die inligting wat werksoekers oor hul

perception (apparent movement, visual flicker, the "closure" phenomenon, whereby one suddenly perceives a complete object, from the presentation of a few parts only) and the stimulability or tempo factor in temperament. This work has been made possible by the collaboration of a senior C.S.I.R. bursar.

Another study has been started into the measurement of emotionality by means of objective tests that may in due course prove applicable to groups.

### **Motor Cycle Accidents**

This study was undertaken in collaboration with the National Road Safety Association. Data provided by the Department of Census and Statistics concerning road accidents for the years 1952 and 1953 were analysed for all motor cycle accidents which involved fatal or serious injuries. Such circumstances as road conditions, weather, time of day, week or year, age of drivers and type of vehicle were related to accident frequencies. In order to be able to interpret these data, it was necessary to know the relative exposure to accidents of motor cycles compared with other vehicles and, for this purpose, the average annual mileage run by each type of vehicle was required. As this information was not available, questionnaires were issued to motor-cyclists and car drivers in Johannesburg, from which approximate figures have been calculated. A questionnaire was also circulated to motor-cyclists to get their views on the various hazards with which they were confronted and on the acceptability of such safety devices as crash helmets and crash bars.

### **Psychometric Methods**

Because no replacement has been found for the head of this department, no projects of major importance could be undertaken during the year, but some useful work was nevertheless done. A start was made with the establishment of population standards on the tests that are being used for vocational guidance by the personnel selection department.

Some of the N.I.P.R. tests have been in use for as many as fourteen years, and the preparation of new versions has been commenced. Tests gradually become known and, when they are issued to personnel departments, colleges or consultants, security leakages are likely to occur despite strict precautions.

An educational achievement test has also been constructed for the selection of Native personnel. Educational achievement was found to be an important determinant of occupational success, but as little reliance could be placed on the information given

onderwyskwalifikasies verskaf dikwels onbetroubaar is, moes 'n toets vir die doel opgestel word.

#### **Wiskundige Statistiek**

Twee nuwe toetse is ingevoer om vas te stel of die verskille tussen sekere maatstawwe betekenisvol is. Dit het betrekking op die bekende toetse, die Kolmogorov (distribusie vry)—Statistiek en die Jonckheere-toets. 'n Empiriese studie is ook gemaak van die betekenisvolheid van faktore en die betroubaarheid van faktorloadings wanneer klein monstertjies gebruik word. Daar is definitief vasgestel dat vir  $n=30$ , faktorontleding nie raadsaam is nie. Tabelle is opgestel vir die betroubaarheidsgrense van produk-momentkoëffisiënte, wat besonder nuttig sal wees in die praktyk. Tabelle is ook opgestel om die betekenis van  $2 \times 2$ -tabelle vir  $n=50$  te toets. Hulle sal in *Biometrika* gepubliseer word. Monsterprobleme vir die Wechsler-standaardisasie en vir die arbeidskragopname is ondersoek en metodes is aangeneem wat, hoewel nie ideaal nie, die praktiese moeilikhede wat in die projekte ondervind is, die hoof kan bied.

by werksekers on their educational qualifications, a test had to be constructed for this purpose.

#### **Mathematical Statistics**

Two new tests to determine the significance of differences between certain measures, where conventional tests are either not applicable or very lengthy, were introduced, namely the Kolmogorov (distribution free) statistic and Jonckheere's Test. An empirical study was also made of the significance of factors and reliability of loadings obtained from small samples. It was definitely established that for  $n = 30$ , factor analysis is not advisable. Tables were constructed to test the significance of  $2 \times 2$  tables for  $n = 50$ . These will be published in *Biometrika*. Sampling problems for the Wechsler standardization and for the manpower survey have been examined and procedures have been adopted which, though not ideal, meet the practical difficulties that have been encountered in these projects.



# Nasionale Voedingnavorsingsinstituut

*Direkteur:* DR. A. W. LATEGAN

Die grondslag vir voedingnavorsing is in 1952 gelê met die stigting van 'n afdeling vir voedingnavorsing binne die nuwe Departement van Voeding. In Junie 1953 is besluit om hierdie navorsingsafdeling te omskep tot 'n voedingnavorsingseenheid in die Nasionale Chemiese Navorsingslaboratorium van die Wetenskaplike en Nywerheidsnavorsingsraad en dat die Eenheid al die navorsingwerk van die Departement van Voeding sal onderneem. Die grootste onmiddellike probleem was huisvesting, maar met die goedgunstige hulp van die Landbounavorsingsinstituut aan die Universiteit van Pretoria en van die Afdeling Veeartsenydiens, Onderstepoort, kon 'n begin gemaak word met biologiese waardebeplanning van voedsel, veral i.v.m. broodverryking. In hierdie verband word die hulp met dank erken wat ons van prof. J. H. Kellermann en dr. J. G. Louw ontvang het. Chemiese en tegnologiese ondersoekte is in die Nasionale Chemiese Navorsingslaboratorium onderneem. Intussen is 'n gedeelte van Impalagebou, Pretoria, tot laboratoria omskep en in Februarie 1954 deur die Eenheid betrek. Vinnige uitbreiding het gevolg en die Eenheid is op 1 Oktober 1954



*Dr. A. W. Lategan.*

# National Nutrition Research Institute

*Director:* DR. A. W. LATEGAN

The foundation for nutrition research was laid in 1952 with the establishment of a section for nutrition research within the new Department of Nutrition. In June 1953 it was decided that this section should be converted into a Nutrition Research Unit in the National Chemical Research Laboratory of the Council for Scientific and Industrial Research and that this unit would undertake the research work of the Department of Nutrition. The greatest immediate problem was accommodation but, with the kind co-operation of the Agricultural Research Institute, University of Pretoria, and the Division of Veterinary Services, Onderstepoort, a start could be made with the biological evaluation of foods, with special attention to bread enrichment. In this respect the help received from Prof. J. H. Kellermann and Dr. J. G. Louw is acknowledged with thanks. Chemical and technological investigations were undertaken in the National Chemical Research Laboratory. In the meantime part of Impala House, Pretoria, was being converted into laboratories, and in February, 1954, the Unit moved in. This was followed by rapid expansion and on 1st October 1954 the Unit was converted into a fully fledged National Institute of the Council for Scientific and Industrial Research.

The Institute now consists of the following sections:—

- Administration
- Food Chemistry
- Physiology
- Food Technology
- Physiological Chemistry
- Histopathology
- Clinical Investigation

## FUNCTION

The function of the National Nutrition Research Institute, in broad outline, is to conduct research with a view to the improvement of the nutrition and health of all population groups in the Union.

In more specific terms the aims of the Institute are the following:—

- (i) Investigation of nutrition problems referred to the Institute by the Department of Nutrition and investigations on behalf of the National Nutrition Council, Government Departments, etc.,



tot 'n volwaardige Nasionale Instituut van die Weten-  
skaplike en Nywerheidsnavorsingsraad omskep.

Die Instituut bestaan nou uit die volgende afdelings:—

- Administrasie
- Voedselskeikunde
- Fisiologie
- Voedseltegnologie
- Fisiologiese Chemie
- Histopatologie
- Kliniese Onderzoek

## FUNKSIE

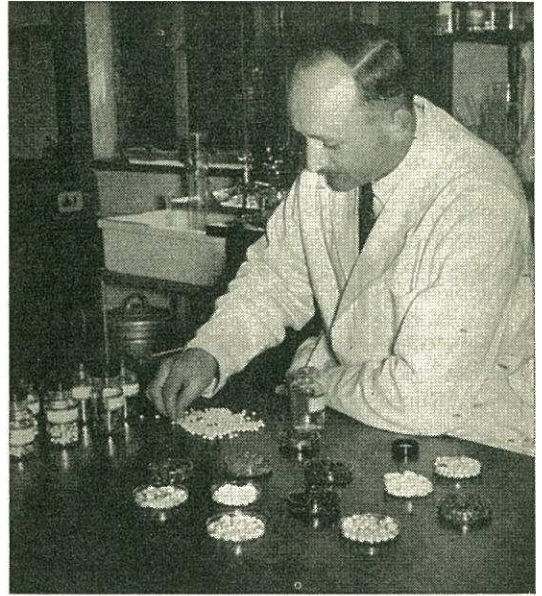
Die doel van die Nasionale Voedingnavorsingsinsti-  
tuut is, in breë trekke, om navorsing te doen met die oog  
op die verbetering van die voeding- en die gesondheids-  
toestand van al die bevolkingsgroepe in die Unie.

In meer spesifieke terme is die doelwitte van die  
Instituut die volgende:—

- (i) ondersoek van voedingsprobleme wat deur die  
Departement van Voeding na die Instituut verwys  
word en ondersoekte namens die Nasionale  
Voedingsraad, Staatsdepartemente, ens.,
- (ii) navorsingswerk van 'n fundamentele of toegepaste  
aard in sake rakende die voeding van die bevolking  
van die Unie,
- (iii) samewerking met persone, liggame, institute en  
ander organisasies in probleme betreffende  
voedingnavorsing, en die koördinerings van alle  
voedingnavorsing in die land,
- (iv) insameling, korrelering en verspreiding van inlig-  
ting oor alle aspekte van voeding,
- (v) diens aan die nywerheid met waardebe-  
paling en ondersoek van voedsel- en voedingsprobleme en  
lewering van kliniese dienste.

Die verskillende aspekte van voeding is baie na aan  
mekaar verwant en sodoende skakel die verskillende  
afdelings van die Instituut onderling baie intiem. Die  
volgende algemene prosedure word gevolg in die onder-  
soek van voedsel:—

- Landboukundige opname (in samewerking met die  
Departement van Landbou),
- Chemiese analise,
- Biologiese waardebe-  
paling,
- Tegnologiese voorbereiding tot 'n aanneembare vorm  
vir menslike gebruik,
- Chemiese analise en biologiese waardebe-  
paling van die  
voorbereide produk, en
- Kliniese toetse op die mens (fisiologies-chemiese,  
histopatologiese en hematologiese ondersoek).



*The nutritional values of various kinds of beans are  
studied with a view to promoting greater use of this  
valuable food in South Africa.*

*Die voedingswaarde van verskillende soorte bone  
word bestudeer om die groter gebruik van hierdie  
waardevolle voedsel in Suid-Afrika aan te moedig.*

- (ii) research of a fundamental or applied nature  
into matters concerning the nutrition of the  
population of the Union;
- (iii) co-operation with persons, bodies, institutes  
and other organizations on problems con-  
cerning nutrition research and coordination  
of nutrition research in the country;
- (iv) collection, correlation and distribution of in-  
formation on all aspects of nutrition;
- (v) service to Industry with evaluation and in-  
vestigation of food and nutrition problems  
and rendering of clinical service.

The different aspects of nutrition are very closely  
related, consequently there is close co-operation be-  
tween the different sections of the Institute. The fol-  
lowing general procedure is followed in the investi-  
gation of food:—

- Agricultural survey (in cooperation with the De-  
partment of Agriculture)
- Chemical analysis
- Biological evaluation
- Technological processing to a form suitable for  
human consumption
- Chemical analysis and biological evaluation of  
the processed product, and
- Clinical tests on human subjects (chemo-physio-  
logical, histopathological and haematological  
investigation).



## SUID-AFRIKAANSE VOEDSEL

### Voedseltabelle

Een van die eerste take van die Instituut is die opstel van nuwe voedseltabelle vir Suid-Afrikaanse gebruik, en dit bring mee ondersoek na die invloed van Suid-Afrikaanse kookmetodes op voedingswaarde, die invloed van verwerking en die invloed van vervoer en opberging onder Suid-Afrikaanse toestande. Alle bestaande inligting word saamgevat en aangevul waar nodig. Chemiese ontledings word uitgevoer en die biologiese waarde van sleutelvoedselsoorte soos grane, boontjies, vleis, vis en melkprodukte word bepaal. Die voedingswaarde van sekere inheemse voedselsoorte (plantaardig sowel as dierlik) wat deur die Bantoe gebruik word, word ook ondersoek.

### Bone

Die voedingswaarde van sekere boonsoorte vergelyk goed met dié van vleis of ander dierlike proteïene, en bone kan redelik goed en relatief goedkoop in Suid-Afrika gekweek word. Ondersoek word dus ingestel na die bydrae wat bone kan lewer in die voeding van die bevolking. Die Instituut is besig om 'n volledige opname te maak van alle boonvariëteite wat in die land verbou word, die proteïengehalte word biologies en chemies bepaal, en die belowendste variëteite klinies gevalueer. Die resultate van hierdie ondersoek sal hopelik die verbouing en die verbruik van die mees belowende variëteite aanmoedig. Sekere boonvariëteite is betreklik onbekend daar hulle hoofsaaklik deur die Bantoe gekweek en verbruik word. Heelwat tegnologiese navorsing is reeds gedoen op die dop, maal en sif van bone, en 'n aanneembare boonpap met goeie houbaarheid is reeds voorberei.

### Afgeroomde Melkpoeier

Suid-Afrikaanse produksiemetodes van afgeroomde melkpoeier word sistematies ondersoek. Besondere aandag word gewy aan die invloed van fabrieksgebruik op kwaliteit en voedingswaarde. Metodes vir die vasstelling van denaturasie wat in die proses mag plaasvind word vir gebruik deur vervaardigers opgestel.

Werk word ook gedoen op die hersamestelling en aansuring van afgeroomde melkpoeier en die aanvulling met Vitamien A. Namens 'n koöperasie word 'n navorsingsprojek oor die verwerking van wei uitgevoer.

### Voedselgis (Torula utilis)

'n Uitgebreide chemiese, biologiese en kliniese ondersoek oor Suid-Afrikaans vervaardigde Torula-gis is aan die gang. Die plaaslike produk word vergelyk met brouergis en buitelandse voedselgis. Die aanvullings-

## SOUTH AFRICAN FOODS

### Food tables

One of the first tasks of the Institute is the drafting of new food tables for use in South Africa, including an investigation of the effect of South African cooking methods on nutritional value, and the effect of transport and storage under South African conditions. All information available is being collated and supplemented where necessary. Chemical analyses are being carried out and the biological value of key foods such as cereals, beans, meat, fish and dairy products are being determined. The nutritional value of certain local foods (plant as well as animal) used by the Bantu, is being investigated.

### Beans

The nutritional value of certain bean varieties compares favourably with that of meat and other animal protein and beans can be cultivated readily and relatively cheaply in South Africa. Investigation is thus being conducted into the contribution which beans can make to the nutrition of the population. The Institute is making a comprehensive survey of all bean varieties cultivated in this country. Protein values are assessed biologically and chemically, and the best varieties are evaluated clinically. It is hoped that the results of this investigation will encourage the cultivation and use of the most promising varieties. Some bean varieties are relatively unknown since they are chiefly cultivated and used by the Bantu. A fair amount of technological research has been conducted on the shelling, milling and sifting of beans and an acceptable bean porridge with good keeping qualities has already been prepared.

### Skimmed Milk Powder

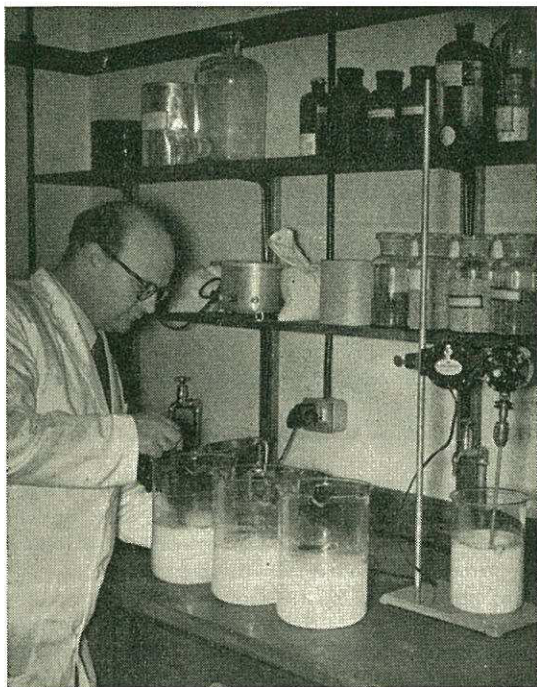
South African methods of producing skimmed milk powder are being investigated systematically. Particular attention is paid to the effect of methods used in factories on quality and nutritional value. Methods of assessing the extent of deterioration during the process are being standardized for use by the producer.

Work is being carried out on the reconstitution and souring of skimmed milk powder and fortification with vitamin A. A research project on the processing of whey is being carried out on behalf of a cooperative society.

### Food Yeast (Torula utilis)

Extensive chemical, biological and clinical investigations are being carried out on South African Torula yeast. The local product is being compared with brewer's yeast and overseas food yeast. Its value as





*Studies oor die verryking van magou, tradisionele gefermenteerde mieliemeeldrank van die Bantoe in Suid-Afrika.*

*Studies in the enrichment of magou, traditional fermented maize gruel of the Bantu in South Africa.*

waarde van die gis vir grane, bone e.a. word ondersoek asook die moontlikheid van die aanvulling van die gis self, bv. met metionien. Die werk word gedeeltelik gefinansieer deur 'n skenking van die Food Yeast Development Company of South Africa Ltd.

#### **Spesiale Ondersoeke**

Die voedingswaarde, vir die mens, van minderbekende produkte soos soetlupiëne, lusern, Russiese comfrey en soetrissies word bestudeer.

In verband met studies op die bloeddruk en ander siektetoestande word die natrium, magnesium- en kaliumgehaltes en die spoorelemente in gewone voedsel bepaal.

#### **VOEDSELVERRYKING**

Een van die belangrikste take van die Instituut is die ondersoek van voedsel vir hulle aanvullings- of verrykingswaarde in basiese voedselsoorte soos koring en mielies. Die proteïengehalte, beide kwantitatief sowel as kwalitatief, vorm 'n swak skakel in ons landsvoeding. Besondere aandag word dus gewy aan die verbetering van

a supplement for cereals, beans, etc. is being investigated, as is the possibility of the fortification of the yeast itself, e.g. with methionine. The work is partly financed by a donation from the Food Yeast Development Company of South Africa Ltd.

#### **Special Studies**

The nutritional value of lesser known products such as sweet lupins, lucerne, Russian comfrey and sweet chillies is being investigated.

In connection with studies on hypertension and other pathological conditions, common foods were analyzed for their sodium, magnesium, potassium and trace element contents.

#### **FOOD ENRICHMENT**

One of the most important projects of the Institute is the investigation of foodstuffs to determine supplementary or enriching value in basic foods such as wheat and maize. Deficiency in protein, qualitatively as well as quantitatively, is recognised as the weak link in the country's nutrition pattern. Particular attention is therefore being paid to supplementing the amino acid content of cereals. The protein value of wheat is reduced when meal is sifted, but it has been proved that this loss can largely be corrected by the addition of a small amount of fishmeal. Peanut meal is not such a good supplement for wheat flour in bread as fish meal and milk powder.

#### **Supplementary Value of Fishmeal in Bread**

Extensive biological tests were conducted in which the supplementary value of fishmeal in brown bread (90% extraction flour) was compared with that of skimmed milk powder and peanut meal. The main conclusion was that fishmeal is an outstanding enriching substance for bread, provided it is processed correctly. On a basis of 2% addition, fishmeal provides about the same protein supplementation as the present national enriching mixture 6% of which is added to flour for bread making.

In view of the high supplementary value of fish proteins to cereals and the abundant supplies of fish along our coastline, research into the manufacture of fishmeal for human consumption continues. The technology is being studied by the Fishing Industry Research Institute at Cape Town, while the determination of general nutritional value and the biological evaluation of the protein is being carried out by the Institute.

Several processed fishmeal samples have been evaluated. Certain bleaching agents and cooking treatments have, as a result of this investigation, been found unsuitable and their use discontinued.



die aminosuurkompleks van grane deur aanvulling. Die proteïengehalte van koringmeel neem af wanneer dit gesif word, maar dit is bewys dat verlies grotendeels deur die byvoeging van 'n geringe hoeveelheid vismeel herstel word. Grondbonemeel bied nie so 'n goeie proteïen-aanvulling vir brood as vismeel of melkpoeier nie.

#### **Aanvullingswaarde van Vismeel in Brood**

Uitgebreide biologiese proewe is uitgevoer waarin die aanvullingswaarde van vismeel vergelyk is met die van afgeroomde melkpoeier en grondboontjiemeele in die verryking van bruinbrood (90% ekstraksiemeel). Die belangrikste bevinding is dat vismeel, mits reg verwerk, 'n uitstekende verrykingsproduk vir brood is. Op 'n basis van 2 persent byvoeging bied vismeel ongeveer dieselfde proteïen-aanvulling as die huidige nasionale verrykingsmensele vir brood waarvan 6 persent by die broodmeel gevoeg word.

Aangesien die proteïen van vis 'n hoë aanvullingswaarde vir grane het en daar groot voorrade vis in die Suid-Afrikaanse kuswaters is, word die ondersoek i.v.m. die vervaardiging van vismeel vir menslike gebruik onverpoosd voortgesit. Tegnologiese ondersoek word deur die Visnywerheidsnavorsingsinstituut te Kaapstad onderneem, terwyl die bepaling van die algemene voedingswaarde en die biologiese waarde van die proteïene deur die Instituut uitgevoer word.

Verskeie monsters verwerkte vismeel is reeds ondersoek. Sekere bleikmiddels en temperatuurbehandelings is op grond van hierdie ondersoek ongeskik bevind en die gebruik daarvan gestaak. Die vooruitsigte om binne afsienbare tyd vismeel vir menslike gebruik beskikbaar te stel is goed, veral vismeel vir die verryking van bruinbrood, waar die kleur nie opvallend is nie.

#### **Mieliemeel**

Weens die verkleuring, lewer die verryking van mielie-meel met vismeel groter moeilikhede op, want die Bantoes, wat die grootste verbruikers van mielie-meel is, verkies 'n witter produk. Vismeele wat van olie-ryk vissoorte vervaardig word, is uit 'n voedingsoogpunt baie geskik, maar nie tegnologies aanneembaar vir mielie-meel-verryking nie. Olie-arm vissoorte soos stokvis lewer wit vismeel wat vir hierdie doel geskik is, mits die meel in groot genoeg hoeveelhede en veel goedkoper gelewer kan word.

Uitgebreide verrykingsproewe is uitgevoer met melkpoeiers, sojabone, voedselgis en sintetiese lisien. Hierdie natuurlike stowwe vul mielie-meel goed aan. Lisien alleen, of saam met triptofaan, bied prakties geen aanvulling nie, selfs nie wanneer dit saam met 'n volwaardige vitamien- of mineraalmengsel toegedien word nie. Die byvoeging van

The immediate prospects of fishmeal being made available for human consumption are promising, especially for the enrichment of brown bread, in which the colour is not noticeable.

#### **Maizemeal**

Since it causes discolouration, the use of fishmeal for the enrichment of maizemeal, which is consumed mainly by the Bantu who prefer a white product, presents greater difficulties. Fishmeal from oily species of fish, is exceptionally suitable nutritionally, but cannot as yet be manufactured by existing processes into a product acceptable for the enrichment of maizemeal. Non-oily fish such as hake, however, can be processed to a white fishmeal which may overcome this difficulty, provided the fish is obtainable in adequate quantities and at much lower prices.

Extensive enrichment tests were carried out with milk powders, soya beans, food yeast and synthetic lysine. The natural products provide an excellent supplement to maizemeal. Lysine, alone or with tryptophane, provides no significant supplementation when added with a balanced vitamin or mineral mixture. The addition of other amino acids and



*Rat cage used for metabolism studies. 'n Rotkou wat vir metabolismestudies gebruik word.*



ander aminosure en natuurlike produkte word ondersoek met die doel om 'n beter nutriëntpatroon te skep.

#### **Verrykte magou (gefermenteerde mieliepapdrink)**

Magou is 'n stapelkos van die Bantoe, maar die voedingswaarde daarvan is relatief laag. 'n Geskikte en aanneembare verrykte magou waarby o.a. weipoeier en voedselgis gevoeg is, is voorberei. Dit behoort 'n aantreklike en voedsame produk te wees vir skole en nywerhede. Verdere aanneembaarheidstoetse word uitgevoer. Navorsing word ook gedoen in verband met die voorbereiding van ontwaterde magou aangesien dit hantering en vervoer aansienlik sal vergemaklik.

#### **Geënkapsuleerde vitamien A-poeier**

Vitamien A, wat stabiel moet bly in Suid-Afrikaanse klimaatstoestande, is in poeivorm nodig vir die verryking van voedsel soos afgeroomde melkpoeier, brood, pap, beskuitjies ens. Heelwat werk is gedoen ten opsigte van 'n geënkapsuleerde produk en 'n verslag is aan die Departement van Voeding voorgelê.

### **SPEZIALE VOEDSEL**

#### **Babavoedseels**

Ondersoek is aan die gang oor die formulering van 'n goedkoop maar voedsame babavoedsel. Bone as die basis, word aangevul met stowwe soos wei, wei-produkte of voedselgis, en tegnologieë verwerk tot 'n aanneembare produk. Na chemiese en biologiese evaluering van die mengsels word hulle klinies op herstelde of gesonde kinders en uiteindelik op kwashiorkorgevalle uitgetoets. Hierdie produkte moet ook mikrobiologies beheer word, derhalwe beoog die Instituut binnekort die oprigting van 'n mikrobiologiese onderafdeling.

#### **Kunsmatige melkdranke**

Die vervaardiging van kunsmelk uit boontjies soos sojabone, grondbone, haricot- en kafferbone word ondersoek. Die voedingswaardes van hierdie produkte word ondersoek, nie alleen met die oog op babavoeding nie, maar ook om te dien as 'n goedkoop substituu-„melkdrank,” vir die minder-gegoede deel van die gemeenskap.

#### **Kragmengsels**

Die Instituut probeer ook om 'n goedkoop mengsel met hoë voedingswaarde, veral ten opsigte van proteïen, B-vitamiene en minerale, saam te stel vir gebruik in hospitale en ander inrigtings, en in noodtoestande. Verskillende produkte word voorberei soos bv. verrykte beskuitjies, ekstra verrykte brood en ander samestellings.

other natural products is being studied with the object of evolving a better nutrient pattern.

#### **Enriched Magou (fermented maize meal gruel)**

Magou is a staple food of the Bantu, but its nutritional value is relatively low. An acceptable enriched magou, to which is added, amongst other ingredients, whey powder and food yeast, has been prepared. For general school and industrial use, this should be an appealing and nutritious product. Further acceptability tests are being carried out. Research is also being conducted on the preparation of dehydrated magou, since this will greatly facilitate handling and transport.

#### **Encapsulated Vitamin A powder**

Vitamin A in powder form which must remain stable under South African climatic conditions is necessary for the enrichment of foods such as skimmed milk powder, bread, porridge, biscuits, etc. A considerable amount of work has been done on the encapsulated product and a report has been submitted to the Department of Nutrition.

### **SPECIAL FOODS**

#### **Infant Foods**

Investigations are being conducted on the formulation of a cheap, yet nutritious infant food. Beans as a base are supplemented with substances such as whey, whey products or food yeast, and then processed to an acceptable form. After chemical and biological evaluation the mixtures are tested clinically, first on recovered or healthy children and eventually on kwashiorkor cases. Since these products must also be controlled microbiologically, the Institute is planning the establishment in the near future of a microbiological sub-division.

#### **Synthetic milk drinks**

The manufacture of synthetic milk from legumes, such as soya beans, peanuts, haricot and kaffir beans, is being studied. The nutritional values of these products are being investigated, not only with a view to providing an infant food, but also to serve as a cheap substitute milk drink for the less privileged sections of the community.

#### **Fortified food mixtures**

The Institute is also endeavouring to develop an inexpensive food mixture with a high nutritional value, especially with regard to protein, B vitamins and minerals, for use in hospitals and other institutions, and for use in emergencies. Different products such as, for example, enriched biscuits, extra-enriched bread and other combinations are being developed.



## STUDIE OOR VROEGGEBOORTE

In samewerking met die Mediese Skool van die Universiteit Pretoria, die Holy Cross Kraaminrigting te Lady Selborne, die Departement van Voeding en die Nasionale Instituut vir Personeelnavorsing is 'n omvattende studie onderneem om die verband vas te stel tussen voeding en die swangerskapproses, veral in verband met vroeggeboorte, en tussen die voedingtoestand van die moeder en kinderontwikkeling, beide fisies en sielkundig. 'n Volledige nutrisionele, verloskundige, pediatriese, sosiologiese en sielkundige studie word beplan. Aanvanklik sal ongeveer 2,000 Bantoevroue ondersoek word, maar met die oog op meer verloskundige inligting aangaande die Bantoe, sal verdere ondersoeke gedoen word op nog sowat 2,000 swanger vroue. Interessante gegewens is reeds ingewin met betrekking tot fisiologies-chemiese en verloskundige verskynsels. Bloedalbumien was byvoorbeeld deurgaans laag, gamma-globulien oor die algemeen hoog en bronchopneumonie die algemeenste oorsaak van sterfte van vroeggeborenes.

## VOEDSELVERARMING

### Die verwydering van Kiem uit Mielies

Die aanwending van die nywerheidsproses vir die verwydering van kiem uit mielies met die doel om die olie en die proteïen afsonderlik te herwin het groot afmetings begin aanneem in Suid-Afrika. Aangesien mielies die stapelvoedsel van die Unie se meer as agt miljoen Bantoes is, het die besef posgevat van wat die gevolge hiervan sal wees op die voedings- en gesondheidspeil van hierdie groep. Die Instituut het die Departement van Voeding derhalwe met laboratoriumondersoek, tegniese verslae en samesprekings daadwerklik ondersteun om hierdie praktyk te stuit, en die vervaardiging van kiemlose meliemeel (bakkerstrooimeel) vir menslike gebruik, is nou verbied.

### Chemiese Stowwe in Voedsel

Die Instituut is besonder geïnteresseerd in die nadelige invloed van ongewenste verbindings soos sekere kleurstowwe en ander chemikalieë wat by voedsel gevoeg word, nie alleen wat betref die moontlike toksiese of karsinogene effek van sulke stowwe nie, maar ook t.o.v. die invloed wat dergelike produkte mag hê op die metabolisme en die voedingswaarde van die voedsel. 'n Opname word gemaak van die betrokke wetgewings, regulasies en gebruike in die buiteland, en sistematiese biologiese ondersoek word beplan met beide klein en groot proefdiere.

## BROODNAVORSING

'n Proefbakkerij, toegerus met moderne apparaat, is

## STUDY OF PREMATURE BIRTH

A comprehensive study of the relationship between nutrition and pregnancy, with special reference to premature birth and the relationship between nutrition of the mother and the physical and psychological development of the child, is being undertaken jointly with the Medical Faculty of the University of Pretoria, the Holy Cross Maternity Hospital at Lady Selbourne, the Department of Nutrition, and the National Institute for Personnel Research. A complete nutritional, obstetric, paediatric, sociological and psychological study is planned. Initially about two thousand Native women will be examined, but with a view to obtaining more obstetrical information on the Bantu, further investigations will be carried out on another two thousand pregnant women. Interesting data have already been obtained regarding chemo-physiological and obstetric phenomena: blood albumin, for instance, was generally low, gamma-globulin generally high and the most common cause of death of premature babies was broncho-pneumonia.

## FOOD IMPOVERISHMENT

### Removal of the germ from maize

The application of industrial process involving the removal of the germ from maize, in order to recover the oil and protein separately, has begun to assume considerable proportions in South Africa. As maize is the staple food of the Union's Bantu population, numbering more than 8 million, it was realized that this would have serious consequences on the standard of nutrition and health of this group. Consequently the Institute undertook laboratory research, issued technical reports, and took part in conferences in support of the Nutrition Department's campaign to stop this practice. The manufacture of germ-free maize meal (baker's cones) for human consumption has now been prohibited.

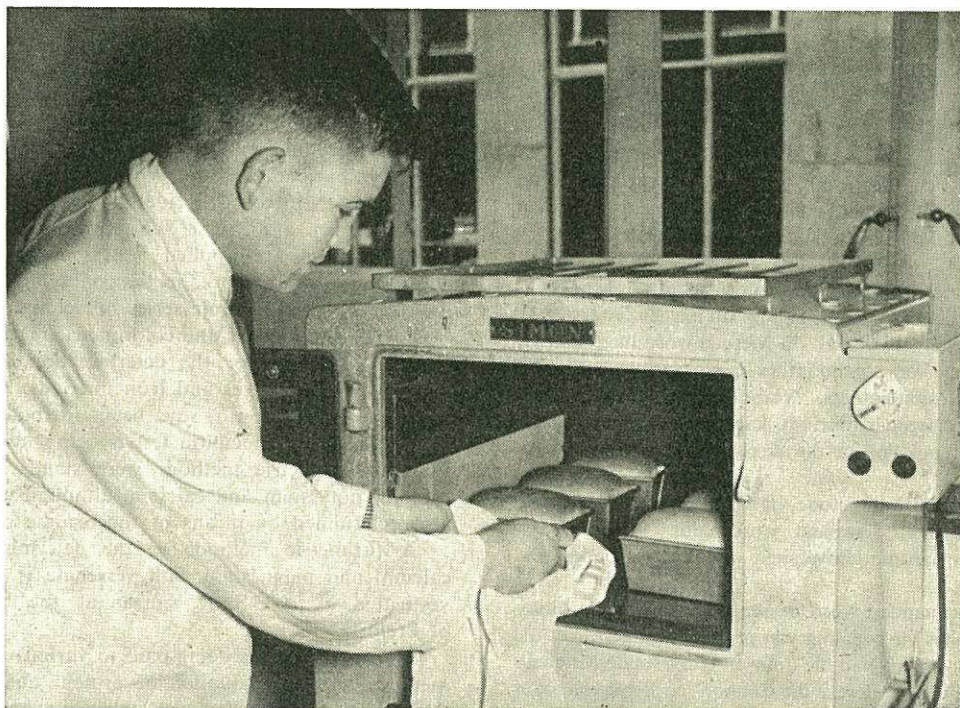
### Chemical manipulation of foods

The Institute is particularly interested in the harmful effect of undesirable compounds such as certain dyes and other chemical substances which are added to foods, not only from the aspect of the toxic and carcinogenic effects, but also from the point of view of the effect which such substances may have on metabolism and the nutritional value of foods. A survey of the relevant legislation, regulations and practices overseas is being made and a systematic biological investigation is being planned with both small and large test animals.

## BREAD RESEARCH

A bakery section equipped with modern apparatus





*Proefbrode wat gedurende navorsing na die verryking van koringmeel gebak is.*

*Experimental loaves baked in the course of research into the enrichment of wheat flour.*

een van die eerste onderafdelings wat onder die Afdeling Voedseltegnologie gestig is. Die effek van die huidige en ander moontlike verrykingsbestanddele op die bakwaarde van koringmeel word nagegaan.

Proewe is uitgevoer met lengbestrydingsmiddels in brood. Negatiewe resultate is verkry met 'n laktose-ortofosforsuurverbinding wat vir hierdie doel aanbeveel is. Die ondersoek word voortgesit met natriumdiasetaat, wat vergelyk word met kaliumasetaat.

'n Begin is gemaak om die invloed van fitiensuur en oksisure op kalsium-metabolisme te ondersoek. Die inneng van bakkersvet in die broodverrykingsmengsel is ook ondersoek. Die verband tussen die fisiese eienskappe van vette en hulle invloed op die bakeienskappe van koringmeel word bestudeer. Die Instituut bly in noue voeling met die Raad van Beheer oor die Koringnywerheid.

#### **VERGELYKING EN STANDAARDISERING VAN METODES**

'n Onmiddellike en uiters belangrike funksie van die Instituut is om metodes wat gebruik kan word in voedsel- of voedings-ondersoek te bestudeer en te standaardiseer.

Hersiene metodes is opgestel vir die bepaling van totale stikstof, ru-vesel, grondbone en asetaat in voedsel en voedselmengsels, spektrofotometriese bepaling van

was one of the first sub-sections to be established under the Food Technology Section. The effect of the present and other possible enriching materials on the baking quality of flour is being investigated.

Tests were conducted with rope inhibitors in bread. Negative results were obtained with a lactose-orthophosphoric acid compound recommended for this purpose. The investigation is being continued with sodium diacetate which is being compared with calcium acetate.

A start has been made with an investigation into the effect of phytic acid and oxy-acids on calcium metabolism. The mixing of baker's fat into bread enriching mixture has also been investigated. The relationship between the physical properties of fats and their effect on the baking qualities of flour are being studied. The Institute maintains close liaison with the Wheat Industry Control Board.

#### **COMPARISON AND STANDARDIZATION OF METHODS**

An immediate and very important function of the Institute is the study and standardization of the methods which can be used in food and nutritional studies.

Revised methods have been formulated for the determination of total nitrogen, crude fibre, ground-



hemoglobien in bloed, vitamien A en karotien, askorbien-suur, amilase, totale proteïen, albumien, alpha, beta- en gammaglobulien, alkaliese fosfatase; fluorimetrieëse be-paling van tiamien, riboflavin, N-metielnikotiensuura-mied; spektrofotometrieëse bepaling van N-metiel-2-piridoon-5-karboksielamied, 17 K.S. estrogeen en ander stowwe in urien, ens. Mikrometodes word sover moontlik aangewend in fisiologies-chemiese werk, sodat slegs klein monsters nodig is vir 'n hele reeks bepalings.

Spektrofotometrieëse en kolorimetrieëse metodes is gestandaardiseer vir die bepaling van niasien, vitamien C, fosfor en yster in voedsel. 'n Metode word nagegaan vir die bepaling van sojaboontjies in voedselmengsels volgens die presipitientoets. Vlamfotometrieëse metodes is gestandaardiseer vir natrium, kalium en kalsium, alhoewel kalsium ook volgens die oksalaatmetode bepaal word.

'n Titrimetrieëse metode vir bepaling van kalsium en magnesium met versenaat word deur 'n W.N.N.R.-beurshouer aan die Universiteit van Pretoria ondersoek.

Heelwat aandag word bestee aan verskillende biolo-giese metodes vir bepaling van proteïenkwaliteit, met die oog op vervanging van die duur en tydrowende Mitchell-metode. Onder andere is die Cannon- en Bendermetodes ondersoek en laasgenoemde word gestandaardiseer vir laboratoriumgebruik, aangesien bemoedigende resultate alreeds daarmee verkry is.

#### ONDERSOEK NAMENS DIE DEPARTEMENT VAN VOEDING

Gedurende die jaar het die Instituut daadwerklike hulp verleen aan die Departement van Voeding met verskeie ondersoekes waaronder:

- (i) kontrole van broodverrykingsmengsel; verskeie reekse ondersoekmonsters van oor die hele land is ontleed,
- (ii) inneng van bakkersvet in die brood-voormengsel,
- (iii) enkapsulering van vitamien A vir die verryking van afgeroomde melkpoeier en ander produkte,
- (iv) mieliemeelverryking met sintetiese lisien en natuurlike produkte: biologiese en chemiese bepalings, analitiese metodes,
- (v) vitamien C-gehalte van papajas gedurende rypwording en die invloed van bak en kook op vitamien C-gehalte,
- (vi) vitamien C-gehalte van afval-koejawelpoeier,
- (vii) die invloed van die verwydering van kiem uit mielies,
- (viii) proteïenbepaling van verskillende grondbone soos „Virginia Bunch” en „Natal Common” wat vir broodverryking gebruik word,
- (ix) ondersoek van verskeie monsters brood, broodverrykingsmengsel, verrykte mieliemele en mielie-

nut and acetate in food and food mixtures; for spectrophotometric determination of haemoglobin in blood, Vitamin A and carotene, ascorbic acid, amylase, total protein, albumin, alpha, beta and gamma globulin, alkaline phosphatase; for fluorimetric determination of thiamine, riboflavin, n-methyl nicotinamide; for spectro-photometric determination of N-methyl-2-pyridone-5-carboxylamide, 17 K.S. estrogen and other substances in urine etc. Micro-methods are applied as far as possible in chemophysiological work, so that only small samples are necessary for a whole series of determinations.

Spectrophotometric and colorimetric methods have been standardized for the determination of niacin, vitamin C, phosphorus and Iron in foods. A method for the determination of soya beans in food mixtures by means of the precipitin test is being investigated. Flame photometric methods were standardized for sodium, potassium and calcium, although calcium is also determined by means of the oxalate method.

A titrimetric method for the determination of calcium and magnesium with versenate is being investigated by a C.S.I.R. bursar at the University of Pretoria.

Much attention is being paid to various biological methods for the evaluation of protein quality, with the object of replacing the expensive and tedious Mitchell method. Among others, the Cannon and Bender methods were investigated and, because of the encouraging results obtained, the latter is being standardized for laboratory use.

#### INVESTIGATIONS ON BEHALF OF THE DEPARTMENT OF NUTRITION

During the year the Institute assisted the Department of Nutrition with various investigations e.g.

- (i) control of bread enriching mixture: many series of inspection samples from all parts of the country were analyzed,
- (ii) incorporation of baker's fat into the bread premix,
- (iii) encapsulation of vitamin A for the enrichment of skimmed milk powder and other products,
- (iv) enrichment of maize meal with synthetic lysine and natural products: biological and chemical evaluation, analytical methods,
- (v) vitamin C content of pawpaws during ripening, and the influence of baking and cooking on vitamin C content,
- (vi) vitamin C content of waste guava powder,
- (vii) effect of the removal of the germ from maize,
- (viii) protein evaluation of different varieties of peanuts such as “Virginia Bunch” and “Natal Common” which are used for the enrichment of bread,



meelverrykingsmengsel waaroor klagtes ontvang is, en

- (x) teel en voorbereiding van demonstrasiediere vir voedingvoorligting.

## **INDUSTRIËLE EN KLINIESE DIENS**

Alhoewel die Instituut nog jonk is, maak die Nywerheid reeds van sy tegniese dienste gebruik. Metodes vir die analise van voedsel word aangevra; die Instituut is die Nywerheid behulpsaam met die verwerking en afset van wei, met die verwerking van soetrisies en met ondersoek van voedselgê. Op kliniese gebied is inligting en hulp reeds gevra en soos hierdie afdeling verder ontwikkel, kan kliniese dienste aan mediese praktisyns en hospitale gelewer word.

## **BESOEKERS EN BESOEKE**

Gedurende Februarie is die Instituut besoek deur Dr. A. F. A. Dean, Direkteur van die M.R.C. Nutrition Research Unit, Kampala, en deur dr. E. MacDonald van die National Bureau of Standards, Washington D.C. Gedurende Maart het Prof. Ancel Keys van die Laboratory of Physiological Hygiene, University of Minnesota, die Instituut besoek en die personeel toegesprek. 'n Groot aantal plaaslike besoekers is ontvang.

Besoeke is binnelands afgelê by 'n groot aantal fabriek, firmas, universiteite, hospitale, navorsingsinrigtings, en teen die einde van Junie het die Direkteur van die buiteland vertrek as verteenwoordiger van die Unie op 'n Statebondvoedselkonferensie (Verdediging) in Londen. Hy het ook besoek gebring aan verskeie navorsingsinrigtings op die vasteland van Europa en die Verenigde Koninkryk, aan die Voedsel- en Landbouorganisasie van die Verenigde Volke in Rome en die Wêreld Gesondheidsorganisasie in Genève.

## **HUISVESTING**

Die Instituut is tans gehuisves in Impalagebou, Pretoria. Die behuising is nie ten volle doeltreffend nie, maar sal nietemin vir nog 'n jaar of wat bevestigend wees wat kantore en laboratoria betref. Die Departement van Voeding het £150,000 bewillig vir die oprigting van 'n navorsingsgebou op die nuwe terrein van die W.N.N.R. en 'n argitek is reeds benoem.

## **KOMITEEWERK**

Verskeie personeellede van die Instituut dien in die Nasionale Voedingsraad en sy onderkomitees, en in komitees van die Departement van Voeding en die S.A. Buro vir Standaarde.

- (ix) investigations of complaints in connection with different samples of bread, bread enrichment mixtures, enriched maize meals, and maize meal enrichment mixtures, and
- (x) breeding and preparation of demonstration animals for nutrition education.

## **INDUSTRIAL AND CLINICAL SERVICE**

Although the Institute was established only recently, Industry is already making use of its technical services. Methods for the analysis of foods are being requested; the Institute is assisting Industry with the processing and marketing of whey, with the processing of sweet chillies and with the investigation of food yeast. In the clinical field, information and assistance have been requested and, as this section develops, further clinical services will be available to medical practitioners and hospitals.

## **VISITORS AND VISITS**

During February the Institute was visited by Dr. A. F. A. Dean, Director of the Medical Research Council Nutrition Research Unit, Kampala, and by Dr. E. MacDonald of the National Bureau of Standards, Washington D.C. During March Prof. Ancel Keys, of the Laboratory of Physiological Hygiene, University of Minnesota, visited the Institute and addressed the staff. A large number of local visitors were received.

Visits were paid to a large number of factories, firms, universities, hospitals and research institutions in the Union and, at the end of June, the Director went overseas as the representative of the Union at the Commonwealth Food Conference (Defence) in London. He also visited several research institutions on the Continent and in the United Kingdom, the United Nations Food and Agriculture Organization in Rome and the World Health Organization in Geneva.

## **ACCOMMODATION**

The Institute is at present accommodated in Impala House, Pretoria. Though not entirely satisfactory, this will provide sufficient laboratory and office space for about another year. The Department of Nutrition has made available £150,000 for the erection of a research building at the new site of the C.S.I.R. and an architect has been appointed.

## **COMMITTEE WORK**

Members of the staff of the Institute serve on the National Nutrition Council and its sub-committees, as well as on committees of the Department of Nutrition and the South African Bureau of Standards.



# Nasionale Padnavorsings- instituut

*Direkteur:* DR. P. J. RIGDEN

Gedurende die afgelope jaar het samesprekings en onderhandelinge oor die voorstel om 'n Nasionale Padnavorsingsinstituut in die lewe te roep, finaliteit bereik en die vorming van die Instituut is in September bekend gemaak. Aangesien goedkeuring vir die oprigting van die nuwe Instituut verleen is op voorwaarde dat die koste nie uit die W.N.N.R. se jaarlikse begroting gedek sal word nie, moes geldelike steun van buite verkry word. Danksy die volle steun van die Departement van Vervoer en die Nasionale Vervoerkommissie, wat uit die staanspoor ten nouste betrokke was in hierdie ontwikkelinge, is die nodige waarborg vir die koste van die onderneming gegee. Vroeër vanjaar is ruimhartige steun reeds deur twee van die provinsiale administrasies beloof en verwag word dat al vier administrasies 'n deel van die jaarlikse koste sal bydra deur 'n regstreekse reëling met die Nasionale Vervoerkommissie. Die kommissie het in elk geval onderneem om tot £60,000 per jaar vir die werk by te dra. 'n Advieskomitee vir Padnavorsing is saamgestel en het hul eerste vergadering op 15 September gehou onder voorsitterskap van mnr. L. C. Reynolds, hoof van die Afdeling Siviele Ingenieurswese van die Departement van Vervoer.

Die aanvanklike navorsingswerk van die Instituut sal hoofsaaklik toegespits word op vraagstukke op die gebied van materiale. Aangesien basiese werk oor grondmeganika en padfondamente baie in gemeen het met die basiese werk wat in die Grondafdeling van die Nasionale Bounavorsingsinstituut gedoen word, is die voorneme om, waar moontlik, saam te werk met die N.B.N.I. om sodoende verdubbeling van duur toerusting en deskundige personeel te vermy. Navorsingsprojekte op hierdie gebied sluit in studies oor die verspreiding en beweging van vogtigheid in grond, verdere werk oor die ontbinding van rotse en die eienskappe van verweerde rots sover dit ingenieursprojekte aangaan, en studies oor die skuifsterkte van gronde met 'n lae voginhoud. Projekte van meer praktiese aard wat onderneem sal word, sluit in studies oor gruispaaie om middels te vind vir die vermindering van instandhoudingskoste en die verbetering van ry-eienskappe van sulke paaie. Stelselmatige opnames van die bou- en instandhoudingskoste van verskillende soorte paaie word ook beplan.

Die Navorsingseenheid vir Bitumineuse Bindstof wat nou byna vyf jaar bestaan, sal deel word van die Instituut, hoewel dit voorlopig sy identiteit as 'n eenheid sal behou. Vir die res van die huidige gewaarborgde tydperk sal die

# National Institute for Road Research

*Director:* DR. P. J. RIGDEN

During the year under review, discussions and negotiations in connection with the proposal to create a National Institute for Road Research were brought to finality and the formation of this Institute was publicly announced in September. Since approval for the setting up of the new Institute was conditional upon the cost thereof not falling upon the C.S.I.R. Annual Vote, it was necessary to secure financial support from outside. Thanks, however, to the fullest support from the Department of Transport and the National Transport Commission who have, from the beginning, been closely concerned in these developments, the necessary guarantee for the cost of this venture has been given. Earlier in the year, generous support had already been promised by two of the provincial administrations, and it is now expected that all four administrations will contribute a proportion of the annual costs by a direct arrangement with the National Transport Commission. The Commission has, in any case, undertaken to contribute up to £60,000/year for this work. An Advisory Committee for Road Research has been appointed, and held its first meeting on 15th September, under the chairmanship of Mr. L. C. Reynolds, Chief of the Division of Civil Engineering of the Department of Transport.

The Institute's initial research effort will be directed almost wholly to problems on the materials side. Basic work in the field of soil mechanics and road foundations has much in common with the basic work in progress in the Soils Division of the National Building Research Institute, and it is proposed that, wherever possible, research shall be done co-operatively with N.B.R.I. so as to avoid duplication of expensive equipment and specialized staff. Research projects falling under this heading include studies on the distribution and movement of moisture in soil, further work on rock decomposition and on the engineering properties of decomposed rocks, and studies on the shear strength of soils at low moisture contents. More practical projects to be tackled include studies on gravel roads with the object of finding means of reducing maintenance costs and of improving riding quality. Systematic surveys of the costs of constructing and maintaining roads of various types are also being planned.

The Bituminous Binder Research Unit, which has



besondere metode van finansiering deur verskeie organisasies, insluitende die verskillende vervaardigers en verbruikers van bitumineuse materiale, voortduur. Daarna sal die posisie hersien moet word.

#### Navorsingseenheid vir Bitumineuse Bindstof

Die eenheid het voortgegaan met 'n breë werksprogram wat beide die fundamentele vraagstukke van bindstofduursaamheid en die praktiese vraagstukke van die gebruik van bindstowwe vir padbolae, behels. Vordering is egter ietwat verhinder deur personeelveranderinge. In die vorige *Jaarverslag* is verwys na die toename in die Eenheid se jaarlikse inkomste en gedurende die jaar het 'n verdere vervaardigersgroep, die bitumen-emulsie-vervaardigers, ingestem om tot die werk by te dra en hulle word nou op die Loodskomitee verteenwoordig.

now been active for nearly five years, will become part of the Institute, though for the time being retaining its identity as a Unit. Its special method of financing by various organizations, including the different producers and users of bituminous materials, will continue for the remainder of the present guarantee period, after which the position will have to be reviewed.

#### Bituminous Binder Research Unit

The Unit has continued to work on a broad programme, embracing both the fundamental problems of binder durability and the practical problems of the use of binders for road surfacing. Progress has, however, been hindered somewhat by staff changes. An increase in the Unit's annual income was referred to in the last *Annual Report*, and during the present year a further producer group, the bitumen emulsion manufacturers, has agreed to contribute to this work and is now represented on the Steering Committee.



*Apparaat vir die meting van die visko-elasticiteitsenskappe van bindstowwe onder vibrasie.*

*Apparatus used for measuring the visco-elastic properties of bitumens under vibration.*

#### Fundamentele Werke oor Bindstowwe in Suid-Afrika Vervaardig

Daar is voortgegaan met die werk oor die oksidasieproses van skalieolie-bitumen, en besondere aandag is gewy aan die chromatografiese adsorpsiemetode vir die ontleding van die verskillende bitumens. Die werk het

#### Fundamental Work on South African-produced Binders

The work on the oxidation mechanism of shale-oil bitumen has been continued with particular emphasis on the adsorption chromatography method for the analysis of the various bitumens. This work



reeds nuttige inligting opgelewer oor die algemene samestelling van die materiaal, maar het nog nie gelei tot uitkenning van die bestanddele wat hoofsaaklik vir oksidasie verantwoordelik is nie.

Werk oor kooksoondtere het 'n ondersoek ingesluit om die relatiewe belang van die twee vernaamste verhardingsprosesse vas te stel, naamlik verdamping van olies en oksidasie. Vir die doel is 'n verweerde teer van een van die Eenheid se proefpaaie in die Karoo wat min verkeer dra, afgehaal deur middel van warmsentrifugering van 'n monster padbolaag en volgens 'n nuwe tegniek ondersoek wat die Eenheid spesiaal vir die doel ontwerp het. Resultate van die eerste ondersoek toon dat verdamping omtrent twee keer soveel soos oksidasie tot verharding bydra. Die werk word uitgebrei tot ander monsters wat van paaie met drukker verkeer geneem is, maar baie meer werk sal hieroor gedoen word voordat algemene gevolgtrekkings gemaak kan word.

Die werk oor die fisiese aspekte van bindstofduursaamheid waarna in die vorige jaarverslag verwys is, het voortgeduur. As deel van die ondersoek is 'n apparaat deur die S.A. Nasionale Fisiese Laboratorium ontwerp waarmee kragte wat deur bewegende verkeer op 'n padbolaag uitgeoefen word, gemeet en aangeteken word en met hul hulp is voorlopige metings reeds met die apparaat geneem deur gebruik te maak van 'n motor wat teen snelhede van tot 70 m.p.u. gery het. In die laboratorium is voortgegaan met metings van die dinamiese eienskappe van bindstowwe en dit is uitgebrei tot verweerde materiale wat van proefpaaie geneem is.

### **Volkskaalse Proefpaaie**

Teen die end van 1954 was die totale lengte van proefpaaie wat deur die Navorsingseenheid vir Bitumineuse Bindstof gelê is, byna 20 myl. Hierdie proefnemings wat ontwerp is om verskillende binstowwe onder verskillende omstandighede te toets, het hoofsaaklik in verband gestaan met die duursaamheid van bindstowwe in bollaagbedekking en in voorafgemengde bolae. Hulle het ook 'n geleentheid gebied om bindstowwe wat as gevolg van laboratoriumnavorsing gewysig is, op die pad uit te toets. Al die proefpaaie is in die betreklik droë hoëveldgebied van Transvaal of die droë Karoogebied van Kaapland gelê.

In Julie 1955 is 'n nuwe proefpad in die kusgebied van Natal gelê, sowat 50 myl ten noorde van Durban op die nasionale pad na Zoeloland. Die doel van die proefneming is om die werkverrigting van sewe verskillende bindstowwe onder klimaatstoestande langs die kus te vergelyk as hulle gebruik word in die herbedekking van 'n bestaande swak teerpad. Die bindstowwe wat gebruik is, sluit in twee bitumens van die nuwe Durbanse olieraffinadery, 'n plaaslik vervaardigde koolteer, twee ingevoerde bitumens en twee bindstowwe in Transvaal vervaardig.

has already yielded useful information about the general composition of this material but has not yet led to identification of the constituents mainly responsible for oxidation.

Work on coke-oven tars has included an investigation to try to establish the relative importance of the two principal hardening mechanisms — evaporation of oils and oxidation. For this purpose a weathered tar, taken from one of the Unit's lightly-trafficked road experiments in the Karoo by hot centrifuging a sample of road surfacing, has been examined by a new technique developed by the Unit for this purpose. Results from this first investigation suggest that oxidation contributes only about half as much to hardening as evaporation processes. This work is being extended to other samples taken from more heavily trafficked roads and much further work on these lines will be needed before general conclusions on this matter can be drawn.

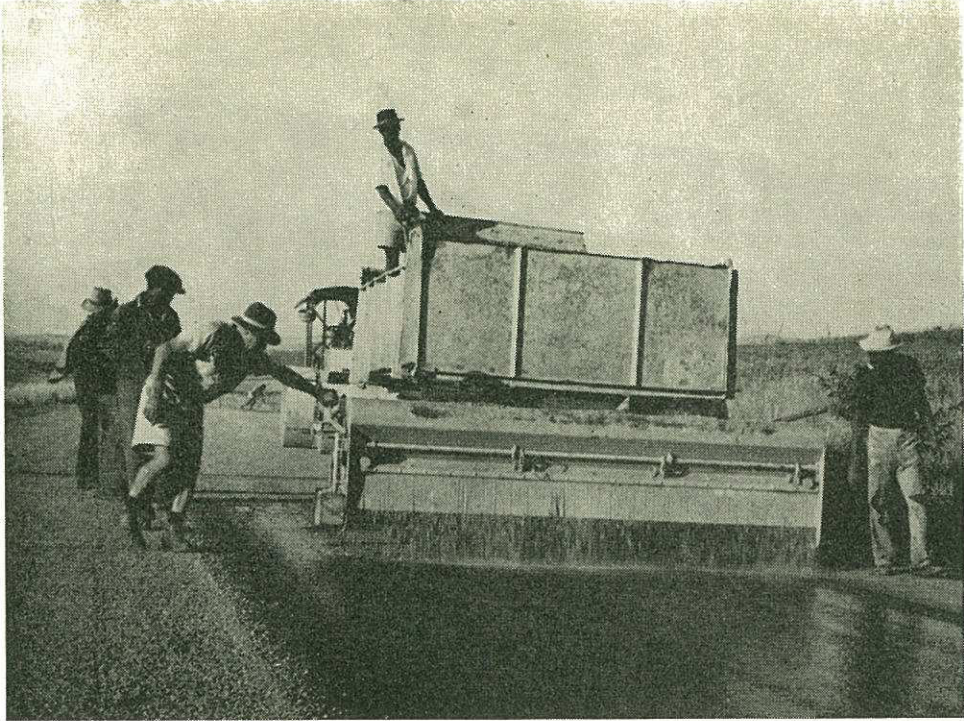
The work on the physical aspects of binder durability referred to in the last report has been continued. As part of the investigation, an apparatus has been designed by the S.A. National Physical Laboratory to enable the forces imposed on a road surface by moving traffic to be recorded and measured, and with their assistance preliminary measurements have already been made with this apparatus using a car at speeds up to 70 m.p.h. On the laboratory side, measurements of the dynamic properties of binders have been continued and extended to weathered materials taken from road experiments.

### **Full-scale Road Experiments**

By the end of 1954 the total length of experimental road surfacing laid by the Bituminous Binder Research Unit had reached nearly 20 miles. These experiments have dealt mainly with problems of binder durability in surface dressings and premixed surfacings, and have been designed to compare the performance of various types of binder under different conditions. They have also provided an opportunity for the testing on the road of binders which have been modified as a result of laboratory research. All these experiments have been laid in the comparatively dry highveld area of the Transvaal or the dry Karoo area of the Cape Province.

In July 1955 a new road experiment was laid in the Coastal belt of Natal, some 50 miles north of Durban on the national road to Zululand. The purpose of this experiment is to compare the performance of seven different binders when used for resealing an existing "black top" road under coastal climatic conditions. The binders used include two bitumens from the new Durban oil refinery, a locally produced coal tar, two imported bitumens and two binders produced in the Transvaal.





*Klipstukkies word oor eksperimentele bindstowwe gestrooi in 'n padtoets onder die klimaatstoestand van die Natalse kusstreek.*

*Laying of stone clippings over experimental binders in a road test under the climatic conditions of the coastal region of Natal.*

#### **Die Werkverrigting van Bindstofsproeiers**

In die vorige verslag is melding gemaak van die belangrikheid van hierdie masjiene en van die besluit om 'n apparaat te bou vir hulle ondersoek en gereelde nasien. Die apparaat wat deur die Transvaalse Provinsiale Administrasie gebou is en by 'n provinsiale paddepot naby Pretoria opgerig is, is gedurende die winter van 1955 deur die Eenheid en die Administrasie gebruik. Die apparaat het geblek so waardevol te wees vir die gereelde toets van die masjiene dat die Administrasie reeds begin het met die bou van 'n tweede wat ten gevolge van ondervinding met die eerste model, heelwat verbeterings insluit.

#### **Publikasies**

'n Geïllustreerde bulletin oor bindstofsproeiers is vir publikasie opgestel om die noodsaaklikheid van gereelde nasien van die masjiene onder die aandag van ingenieurs te bring. Die bulletin beskryf die resultate van die Eenheid se studies oor werkverrigting van 'n aantal verskillende masjiene, illustreer die soorte foute in werkverrigting wat

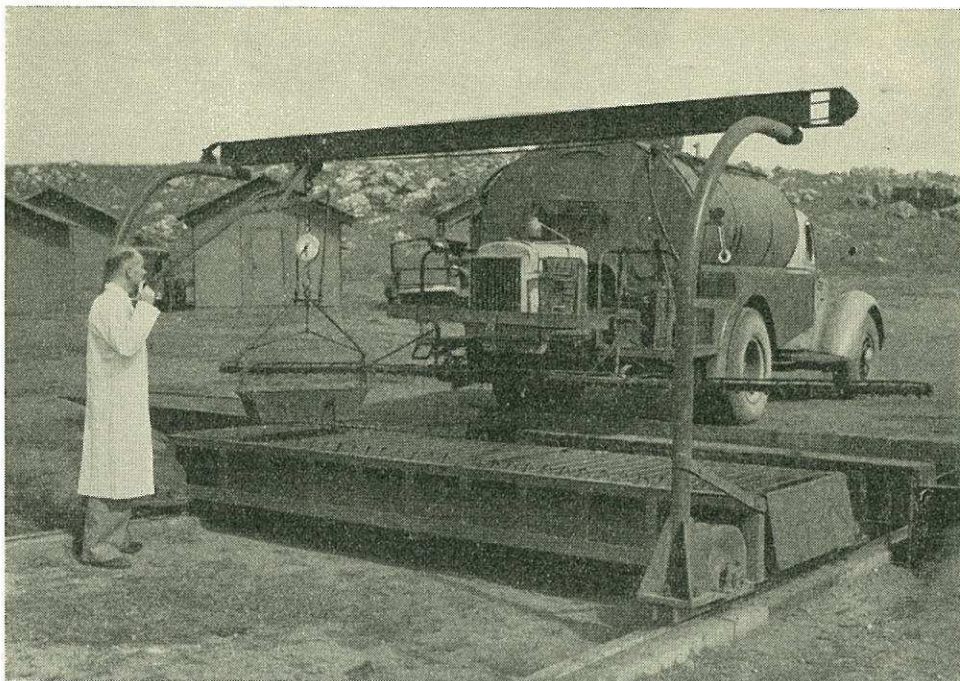
#### **The Performance of Binder Distributors**

The previous report referred to the great importance of this subject and to the decision to build an apparatus for investigation and routine checking of these machines. This apparatus, built by the Transvaal Provincial Administration and installed at a provincial roads depot near Pretoria, has been used by the Unit and by the Administration during the winter of 1955. The value of this apparatus for routine checking has become so obvious that the Administration has already commenced the building of a second apparatus which will incorporate a number of improvements resulting from experience with the first model.

#### **Publications**

An illustrated bulletin on binder distributors has been written for publication, with the object of drawing the attention of engineers to the necessity for constant checking on these machines. The bulletin describes the results of the Unit's performance studies on a number of different machines, illustr-





*'n Toetsapparaat deur die N.E.B.B. ontwikkel om die doeltreffendheid van bindstofsproeiers na te gaan.*

*A test apparatus developed by the B.B.R.U. for checking the efficiency of binder distributors.*

gewoonlik teëgekem word en beskryf metodes vir die yking en nasien van masjiene.

'n Tweede bulletin is opgestel waarin die resultate verkry op die eerste proefpad wat die Eenheid in 1951 naby Pretoria gelê het, beskryf word. Hopelik sal albei bulletins voor die end van 1955 uitgereik word.

ates the types of fault in performance commonly found and describes methods for the calibration and checking of machines.

A second bulletin has been written describing the results of the first road experiments laid by the Unit near Pretoria in 1951. It is hoped to issue both bulletins before the end of 1955.

## Sentrale Werkplaas

*Verantwoordelike Beampte:* MNR. J. VAN DER STAALJ

Hoewel die Sentrale Werkplaas nie instrumente of onderdele vervaardig wat van kommersiële vervaardigers van wetenskaplike instrumente verkrygbaar is nie, het die aanvraag na gespesialiseerde instrumente van nuwe ontwerpe van die W.N.N.R. se laboratoriums gedurende die afgelope jaar verdere personeeluitbreidings nodig gemaak. Daar is nou 45 blanke personeellede, die meeste waarvan ervare tegnisi en instrumentmakers is.

Die vordering met die oprigting van die werkplaas op die nuwe perseel het die verwagtings oortref en die vooruitsig bestaan nou dat hulle gedurende November 1955 betrek sal word.

Die totale waarde van kapitaaltoerusting wat gedurende die jaar vervaardig is, word bereken op £23,000. Dit sluit in 'n groot verskeidenheid van instrumente en masjiene waaronder 'n goniografometer vir die ondersoek van die oppervlakte-eienskappe van materiale in terme van hul weerkaatsingsvermoë, 'n 60° sektor veldmassaspektrometer vir geologiese ouderdomsbepalings met baie klein rotsmonsters; 'n papiermeule vir die fynmaak van banknote; 'n multisel-elektrodialise-apparaat vir die ontsouting van water; kopvelektrodes vir die uitvoerige elektroënsefalograaf-ondersoek van die menslike hersingskors; en apparaat vir die meet en registreer van kragte wat deur bewegende verkeer op 'n padoppervlakte uitgeoefen word.

## Central Workshops

*Officer in Charge:* MR. J. VAN DER STAALJ

Although the Central Workshops does not undertake the manufacture of instruments or components which are available from commercial scientific instrument manufacturers, the demand for specialized instruments of new design from the C.S.I.R. laboratories has necessitated further increases of staff during the past year. The European staff now numbers 45, most of whom are skilled technicians and instrument makers.

Progress in the erection of the workshops at the new site has exceeded expectations, and the prospects are that they will now be occupied during November, 1955.

The total value of capital equipment manufactured during the year is estimated at £23,000. This included a great variety of instruments and machines among which were a goniophotometer for the investigation of the surface properties of materials in terms of their reflecting characteristics; a 60° sector field mass spectrometer for geological age determinations with very small samples of rock; a paper mill for mincing bank notes; a multi-compartment electro-dialysis cell for the demineralization of water; scalp electrodes for detailed electro-nephelographic examination of the human cerebral cortex, and apparatus for measuring and recording forces by moving traffic on a road surface.



# Mediese Navorsing

*Ere-Adviseur:* PROF. S. F. OOSTHUIZEN

## Komitees

Die Raad betuig sy dank teenoor die lede van die Mediese en Tandheelkundige Navorsingskomitee en lede van die nege subkomitees vir mediese navorsing vir hul voortdurende belangstelling en vir hul leiding in verband met die navorsingsprogramme van die mediese navorsings-eenhede. Die Raad wil veral vir dr. T. B. Davie, voorsitter van die Mediese en Tandheelkundige Navorsingskomitee, prof. S. F. Oosthuizen, Ere-Adviseur van die Raad oor Mediese en Tandheelkundige Navorsing en prof. J. Barnetson, wat Prof. Oosthuizen bystaan, bedank vir hul getroue hulp ten spyte van hul baie ander veel-eisende pligte.

Prof. J. F. P. Erasmus het aan die end van 1954 uitgetree as lid van die Mediese en Tandheelkundige Navorsingskomitee en volgens die konstitusie van die komitee is hy vir een jaar nie weer verkiesbaar nie. Sy plek en die van prof. J. C. Middleton Shaw, wat uit die komitee bedank het, is onderskeidelik gevul deur prof. M. van den Ende, dekaan van die mediese fakulteit, Universiteit van Kaapstad en prof. H. W. Snyman, departement van medisyne, Universiteit van Pretoria. Die bedanking van dr. G. W. Gale as 'n plaasvervangende lid van die komitee is met spyt deur die Raad aanvaar. Prof. B. J. Meyer, departement van fisiologie, Universiteit van Pretoria, het ingestem om as plaasvervangende lid in die komitee te dien.

## Fondse

Vir die finansiële jaar 1955/56 is sowat £89,500 vir mediese en tandheelkundige navorsingswerk toegeken. Hiervan was sowat £18,000 bedoel vir individuele mediese en tandheelkundige navorsers aan universiteite, £7,500 vir die Suid-Afrikaanse Instituut vir Mediese Navorsing en sowat £64,000 vir die mediese navorsingseenhede.

## Skenkings

Die Raad erken met dank skenkings ter waarde van £18 5s. 0d. van verskeie persone vir teringnavorsingswerk in die Teringsnavorsingseenheid, Durban.

## Navorsingwerk na die Oorsake van Sterftes onder Narkose

'n Beurshouer is nou aangestel uit die jaarlikse toekenning van £2,000 wat die Transvaalse Provinsiale Administrasie vir drie jaar beskikbaar gestel het.

# Medical Research

*Hon. Adviser:* PROF. S. F. OOSTHUIZEN

## Committees

The Council expresses its gratitude to the members of the Medical and Dental Research Committee and members of the nine medical research sub-committees for their continued interest and for their guidance on the research programmes of the medical research units. In particular, the Council thanks Dr. T. B. Davie, Chairman of the Medical and Dental Research Committee, Prof. S. F. Oosthuizen, Honorary Adviser to the Council on Medical and Dental Research, and Prof. J. Barnetson, who assists Prof. Oosthuizen, for their unfailing help given in spite of their many other onerous duties.

Prof. J. F. P. Erasmus relinquished membership of the Medical and Dental Research Committee at the end of 1954 and, in accordance with the Committee's constitution, was not eligible for re-election for one year. His place, and that of Prof. J. C. Middleton Shaw who had resigned from the Committee, were taken by Prof. M. van den Ende, Dean of the Medical Faculty, University of Cape Town, and Prof. H. W. Snyman, Department of Medicine, University of Pretoria. The resignation of Dr. G. W. Gale as an alternate member of the committee was accepted with regret by the Council. Prof. B. J. Meyer, Department of Physiology, University of Pretoria, agreed to act as an alternate member of the committee.

## Funds

About £89,500 were allocated for medical and dental research during the financial year 1955/56; some £18,000 being allocated to individual medical and dental research workers at universities, £7,500 to the South African Institute for Medical Research, and about £64,000 to medical research units.

## Donations

The Council acknowledges, with thanks, donations from various persons amounting to £18 5s. for tuberculosis research in the Tuberculosis Research Unit in Durban.

## Research into Anaesthetic Deaths

A bursar has now been appointed under the annual grant of £2,000, which the Transvaal Provincial Administration agreed to make available for three years. It is expected that the bursar will shortly start his investigation into the causes of death under anaesthesia.



### Navorsingseenheid vir Pneumokoniose

Nadat 'n departementele komitee, onder voorsitterskap van professor S. F. Oosthuizen en aangestel deur Sy Edele, die Minister van Mynwese, sekere aanbevelings ingedien het, het die Regering beslis dat stappe gedoen moet word om 'n Navorsingseenheid vir Pneumokoniose onder beskerming van die W.N.N.R. in die lewe te roep.

Volgens besluit van 'n vergadering van verteenwoordigers van die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese, die Departement van Mynwese, die Gesamentlike Komitee van die Mynunies, die S.A. Instituut vir Mediese Navorsing en die Raad, is 'n Wetenskaplike Komitee vir Pneumokoniose benoem vir die doel om ondersoek in te stel en breedvoerig aan die Raad verslag te doen oor:

- (a) 'n navorsingsprogram vir die voorgestelde Navorsingseenheid vir Pneumokoniose;
- (b) huisvesting vir personeel en fasiliteite wat verskaf kan word of beskikbaar behoort te wees, en
- (c) finansiële vereistes.

Die Wetenskaplike Komitee het vervolgens besluit om die pligte wat aan hom opgedra is na die volgende subkomitees te verwys:

- (1) Subkomitee oor die ontstaan en bestryding van stof.
- (2) Subkomitee oor die patogenese en patologie van stofsiektes.
- (3) Subkomitee vir die ondersoek van die kliniese kenmerke, versagting van silikose en van ongeskiktheid wat deur stofsiektes veroorsaak word.
- (4) Subkomitee vir biometriese ondersoek.

### Besoekers uit die Buiteland

Prof. Ancel Keys, direkteur van die Laboratorium vir Fisiologiese Higiëne van Minnesota het die Unie van Suid-Afrika in Maart 1955 besoek as gas van die Raad. Die besoek het baie waardevol geblyk te wees vir werkers op die gebied van voedingnavorsing en die Raad is dank verskuldig aan professor Keys vir sy aanvaarding van die uitnodiging.

### Skakeling

Dr. Graham Bull en dr. Robert M. Kark, die Raad se mediese ere-skakelbeamptes in die Verenigde Koninkryk en die Verenigde State onderskeidelik, het weer waardevolle diens aan mediese en tandheelkundige navorsers in Suid-Afrika gelewer deur die W.N.N.R. op hoogte te hou van ontwikkelinge op die gebied van mediese en tandheelkundige navorsingswerk in Engeland en Noord-Amerika.

Gedurende die jaar het prof. Oosthuizen die Verenigde State van Amerika, die Verenigde Koninkryk en Europa besoek, asook verskeie sentrums in Afrika. Sy verslae was baie waardevol.

### Mediese Navorsingseenhede

Verslae deur die direkteure van die mediese navorsings-

### Pneumoconiosis Research Unit

Following on certain recommendations made to it by a Departmental Committee appointed by the Honourable the Minister of Mines under the Chairmanship of Professor S. F. Oosthuizen, the Government directed that steps be taken to establish a Pneumoconiosis Research Unit under the aegis of the C.S.I.R.

A meeting of representatives of the Transvaal and O.F.S. Chamber of Mines, the Department of Mines, the Mining Unions Joint Committee, the S.A. Institute for Medical Research, and the Council, was held, and it was agreed to appoint a Pneumoconiosis Scientific Committee to investigate and report in detail to the Council on:—

- (a) a research programme for the proposed Pneumoconiosis Research Unit;
- (b) staff accommodation and facilities which could and should be provided; and
- (c) financial requirements.

The Scientific Committee subsequently resolved to appoint the following sub-committees to implement its terms of reference:—

- (1) Sub-committee for Dust Production and Suppression.
- (2) Sub-committee for Pathogenesis and Pathology of Dust Diseases.
- (3) Sub-committee to investigate Clinical Features of Silicosis, amelioration thereof and Disabilities produced by Dust Diseases.
- (4) Sub-committee for Biometric Investigation.

### Overseas Visitors

Professor Ancel Keys, Director of the Laboratory of Physiological Hygiene, University of Minnesota, visited the Union of South Africa during March, 1955, as the guest of the Council.

The visit proved to be of great value to workers in the field of nutrition research, and the Council is indebted to Prof. Keys for accepting its invitation.

### Liaison

Dr. Graham Bull and Dr. Robert M. Kark, the Council's honorary medical liaison officers in the United Kingdom and the United States respectively, have continued to give valuable help to medical and dental research workers in South Africa by reporting to the C.S.I.R. on developments in the field of medical and dental research in Great Britain and North America.

During the year, Prof. Oosthuizen visited the United States of America, the United Kingdom and Europe, and also various centres in Africa. His reports proved to be of great value.

### Medical Research Units

Reports by the directors of the medical research



eenhede verskyn hieronder. Die bystand van Provinsiale en Staatsowerhede, die S.A. Instituut vir Mediese Navorsing en van individue wat tot die werk bygedra het, word met dank erken.

#### AMEBIASENAVORSINGSEENHEID

*Hoof van die Eenheid:* DR. R. ELSDON-DEW  
King Edward VIII-hospitaal, Durban.

Die Eenheid se werksaamhede was ietwat ontwrig gedurende die jaar, deels vanweë die uitnodiging wat die Direkteur ontvang het om die Verenigde State van Amerika te besoek vir die bywoning van 'n aantal wetenskaplike konferensies en deels weens die herskommelings van personeel en huisvesting.

Gedurende sy Amerikaanse reis het die Direkteur Boston, New York, Washington, Memphis en Nieu-Orleans besoek en het in al hierdie plekke voordragte en verhandelinge gelewer. Dit het die Direkteur die geleentheid gegee om heelwat van die werk te sien wat in die Verenigde State gedoen word en ook om baie wetenskaplike kontrakte te hernieu. 'n Verhandeling oor die gebruik van antibiotika in amebiase is by die Internasionale Konferensie oor Antibiotika voorgedra en het in *Antibiotics and Chemotherapy* verskyn. 'n Verhandeling oor amebiase is voor die Amerikaanse Vereniging van Tropiese Medisyne in Memphis voorgedra, terwyl 'n ander, oor *Coccidia* ook in Memphis voor die Amerikaanse Vereniging van Parasitoloë gelewer is. Die Direkteur is deur die Amerikaanse Vereniging van Gastroënteroloë genooi om deel te neem aan die Simposium oor Amebiase in Washington. Minder formele lesings is gehou voor universiteitsgroepe in Washington, New York en New Orleans.

Die instelling van 'n Departement van Medisyne by die Universiteit van Natal het 'n groot invloed op die Eenheid gehad. Reëlins is getref waarvolgens die Departement die Eenheid se versameling onderdak sal bring en ook huisvesting sal verskaf aan die navorsings-assistent, biblioteek en kantoorpersoneel. Verwag kan word dat dit die skakeling tussen die Eenheid en die Universiteit nog hegter sal maak.

#### Geneeskundige Proewe

Soos uit die verwysings in Bylaag II gesien sal word, is voortgegaan met geneeskundige proewe. 'n Interessante resultaat wat groot gevolge mag hê, is die werking van *Camoquin*—'n teenmiddel vir malaria—in die behandeling van amebiese lewerabsesse.

#### Laboratoriumondersoek

Proefnemings met die kweking van amebas het voortgegaan. Die metode van Geiman, waarna in die vorige jaarverslag verwys is, was nie baie geslaag nie en die bespreking hiervan met Geiman in Boston het een of twee

units are given in the succeeding sections. The assistance of Governmental and Provincial authorities, the S.A. Institute for Medical Research and individuals who have co-operated in this work, is gratefully acknowledged.

#### AMOEBIASIS RESEARCH UNIT

*Head of the Unit:* DR. R. ELSDON-DEW  
King Edward VIII Hospital, Durban

The activities of the Unit during the year under review have been somewhat mixed, partly due to the invitation received by the Director to proceed to the United States of America to attend a number of scientific conferences, and partly due to the reshuffle of personnel and accommodation.

During the American tour, the Director visited Boston, New York, Washington, Memphis and New Orleans, and gave addresses and papers in all of these places. This gave the Director an opportunity of seeing some of the work being done in the States and also of renewing many scientific contacts. A paper was read at The International Conference on Antibiotics on the use of antibiotics in amoebiasis. This paper has appeared in *Antibiotics and Chemotherapy*. A paper on amoebiasis was given to the American Society of Tropical Medicine at Memphis. A further paper on the *Coccidia* was given to the American Society of Parasitologists, also in Memphis. The Director was invited to take part in the Symposium on Amoebiasis at the American Society of Gastroenterologists at Washington. Less formal addresses were given to university groups in Washington, New York and New Orleans.

The establishment of a Department of Medicine at the University of Natal has had a big impact on the Unit. An arrangement has been made whereby the Department will house the Unit's cases, and provide accommodation for the research assistant, library and office staff. Liaison between the Unit and the University is thus expected to become even closer.

#### Therapeutic Trials

Therapeutic trials have continued as will be seen from the list of references in Appendix II. An interesting result, which may have considerable impact, is the activity of *Camoquin*—an anti-malarial—in the treatment of amoebic liver abscess.

#### Laboratory Investigation

Experiments on the cultivation of amoebae have continued. The method suggested by Geiman, referred to in the last annual report, did not prove very successful, and discussion of this with Geiman in Boston raised one or two points which may have accounted for this failure. Dr. Geiman has kindly



punte aan die lig gebring wat moontlik die mislukking verklaar. Dr. Geiman het goedgegunstiglik 'n paar duplikate van sy apparaat gestuur wat waardevol mag wees.

Studies van ensiemstelsels duur voort maar tot dusver was dit nog nie moontlik om die lewende komplekse waarop die Eenheid in die verlede moes staatmaak, te vervang nie. Publikasie oor kleurmetodes wat gebruik word vir *Entamoeba histolytica* is gereed gemaak en in die stadium kan die mertiolaat-jodium-formalinen wat deur Lawless en Sapero aan die hand gedoen is, aanbeveel word as 'n kleurstof vir die roetine-identifikasie van geheimsinnige amebas. Die metode het die verdere voordeel dat dit gebruik kan word vir die preservering van groot monsters of vir versending deur die pos.

Ondersoek na die moontlikheid om amebas te konsentreer, dui aan dat die kombinasie van die mertiolaat-jodium-formalinen wat hierbo genoem is, met 'n eterflotasietegniek merkwaardige resultate gee; want nie alleen kan die sistiese vorms van amebas hierdeur gedemonstreer word nie, maar dikwels ook die trofosoïete wat deur formalinen gefikseer en gepreserveer en deur die mertiolaat gekleur is. 'n Verhandeling oor die ensiemstelsel wat die amebas omring is gepubliseer. 'n Verhandeling oor die voorkoms van die drie variëteite van *Isopora (Coccidia)* onder plaaslike toestande is opgestel en 'n oorsig van die menslike soorte is voor die Amerikaanse Vereniging van Parasitoloë in Memphis voorgedra.

*Trichomonas vaginalis* kon in suiwer kultuur verkry word, sonder enige lewende bygaande organismes. Geen verdere werk is oor die biofisika van amebas gedoen nie.

## Algemeen

Dit word blykbaar al hoe meer besef dat *Entamoeba histolytica* nie altyd skadelik is nie en dat daar in die verlede baie energie en baie duur middels bestee is aan die bestryding van 'n parasiet wat miskien geen skade aanrig nie. Ongetwyfeld wen die hipotese wat baie jare gelede deur Kuenen en Swellengrebel aan die hand gedoen is, veld en bestaan daar die een of ander onbekende faktor wat 'n ameba van kommensale vorm tot 'n indringende vorm omsit.

Die afname in die voorkoms van amebiase wat voorheen vermeld is, het vermoedelik voortgeduur hoewel geen noukeurige gegewens beskikbaar is nie. Daar was die gewone toename in die aantal gevalle gedurende die somermaande, maar dit was nie so erg soos in vorige jare nie. Afgesien van die uitwerking van die algemene maatreëls kan nie vasgestel word wat hierdie afname teweegbring nie.

sent some duplicates of his apparatus which may prove of value.

Studies of enzyme systems are continuing, but to date it has not been possible to replace the living complexes on which the Unit has had to depend in the past. A paper has been produced on staining methods in use on *Entamoeba histolytica* and at this phase one may recommend, as a stain for the routine identification of mysterious amoebae, the merthiolate-iodine-formalin suggested by Lawless and Sapero. This method has the further advantage that it may be used for the preservation of specimens in bulk or transmission through the post.

Investigations into the possibility of the concentration of amoebae have indicated that the combination of the merthiolate-iodine-formalin, mentioned above, with an ether flotation technique gives remarkable results in that not only can the cystic forms of amoebae be demonstrated, but very frequently the trophozoites which have been fixed and preserved by formalin and stained by the merthiolate. A paper has been published on the subject of the enzyme system surrounding the amoeba. A paper has been produced on the incidence of the three varieties of *Isospora (Coccidia)* under local conditions, and a review of the human species was read to the American Society of Parasitologists reported at Memphis.

It has proved possible to establish *Trichomonas vaginalis* in pure culture with no living concomitants. No further work has been done on the biophysics of the amoeba.

## General

There is apparently a greater appreciation of the fact that *Entamoeba histolytica* need not always be pathogenic and that in the past a considerable amount of energy and a great deal of expensive drugs have been used to eradicate a parasite which may not be causing any damage. There is no doubt that the hypothesis put forward by Kuenen and Swellengrebel many years ago is gaining ground and that there is some factor, at present unknown, which converts a commensal amoeba into an invasive amoeba.

The fall in the incidence of amoebiasis reported previously has apparently continued, though accurate data are not available. There was the usual increase in the number of cases in the summer months, but this did not reach the height of previous years. Apart from the effects of the general measures, it is not possible to determine what is responsible for this decrease.



## NATUURHISTORIESE BILHARZIA-EENHEID

*Hoof van die Eenheid:* DR. B. DE MEILLON  
Suid-Afrikaanse Instituut vir Mediese Navorsing,  
Johannesburg.

### Bilharziase in Proefdiere

#### *Mastomys as 'n Proefdier*

Hierdie diere word deur die Pesnavorsingslaboratorium verskaf, waar hulle gedurig geteel word. *Mastomys* is 'n uitstekende gasheer vir *S. mansoni*, die Suid-Afrikaanse sowel as die Egiptiese stamme, en binne 'n baie kort tyd lewer hulle talle granulome en ontwikkel sirrotiese letsels in die lewer binne vier maande. Die dier is dus besonder geskik vir die studie van hierdie toestand.

#### *Vergelyking van Muise, Mastomys en Ape as Proefgashere*

In muise en *Mastomys* verloop die siekte baie eenders en baie van die groot hoeveelheid granulome wat ontwikkel vorder vinnig tot fibrose en die hele toestand is van 'n progressiewe aard. Aan die ander kant vorder die granulome in ape nie verder as 'n sekere stadium nie en sonder uitsondering ontbind hulle en verdwyn. Tot dusver is geen definitiewe poortaarfibrose in ape waargeneem nie.

#### *Vergelyking van S. Mansoni (Suid-Afrikaanse en Egiptiese Stamme) en S. Bovis in Laboratoriumdiere*

Tot dusver is geen groot betekenisvolle verskille gevind in die patologie of biochemie van hierdie bilharzia-stamme nie. Die werk is egter nog nie breedvoerig ontleed nie.

#### *Histologiese en Biochemiese Patrone in Ape wat van Bilharziase Genees en weer Besmet is*

Dit lyk asof die granulome na suksesvolle behandeling heeltemal ontbind is. Slegs infiltraat van onbepaalde karakter bly agter in die poortaarbaan en die biochemiese reaksies neig om tot normaal terug te keer. By herbesmetting word die hele proses herhaal, granulome verskyn weer en die kenmerkende biochemiese veranderinge kan waargeneem word. Die enigste verskil by herbesmetting, wat mag dui op immuniteit wat deur die eerste besmetting teweeggebring is, is dat die afwykende biochemiese veranderinge nie dieselfde mate van abnormaliteit bereik nie.

#### *Lewerpatologie in Bilharziase*

Die ontwikkeling en soort van sirrose of poortaar-fibrose in menslike bilharziase is 'n twispunt. In die talle ape wat vir etlike jare dopgehou is, is geen sirrose waargeneem nie. In *Mastomys* en muise is egter besliste fibrose van die granulome en 'n bietjie verspreide fibrose in die poortaarbane waargeneem. Die fibrose word breedvoeriger bestudeer deur middel van snitreeks en wasmodelrekonstruksies in verskillende stadiums van die siekte.

## BILHARZIA NATURAL HISTORY UNIT

*Head of the Unit:* DR. B. DE MEILLON  
South African Institute for Medical Research,  
Johannesburg

### Bilharziasis in Experimental Animals

#### *Mastomys as an Experimental Animal*

The animals are supplied by the Plague Research Laboratory where they are bred. Briefly, *Mastomys* is an excellent host for *S. mansoni*, both African and Egyptian strains, producing numerous granulomata in a very short time and developing cirrhotic lesions in the liver, within four months. This animal is therefore particularly well suited for the study of this condition.

#### *Comparison of Mice, Mastomys and Monkeys as Experimental Hosts*

In mice and *Mastomys* the disease runs a very similar course in that many of the numerous granulomata which develop, progress rapidly to fibrosis and the entire picture appears to be a progressive one. In monkeys, on the other hand, the granulomata never progress beyond a certain stage and invariably resolve and disappear. As yet no definite portal fibrosis has been observed in monkeys.

#### *Comparison of S. Mansoni (S. African and Egyptian Strains) and S. Bovis in Laboratory Animals*

As yet no gross significant differences have been found either in the pathology or biochemistry of these strains of bilharzia. However, the work has not yet been analysed in detail.

#### *Histological and Biochemical Patterns in Monkeys Cured of Bilharziasis and then Reinfected*

After successful treatment, the granulomata appear to be completely resolved and only non-specific infiltrate remains in the portal tracts while the biochemical reactions tend to return to normal. On reinfection the whole process is repeated, granulomata reappear and the characteristic biochemical changes are seen. The only difference on reinfection, which might indicate immunity conferred by the first infection, is that the abnormal biochemical changes do not quite reach the same degree.

#### *Liver Pathology in Bilharziasis*

The development and type of cirrhosis or portal fibrosis in human bilharziasis is a matter of controversy. In the numerous monkeys which have been kept under observation for several years, no cirrhosis has been observed. However, both in *Mastomys* and mice, definite fibrosis of the granulomata and some diffuse fibrosis in the portal tracts have been observed. A more detailed study of this fibrosis is being undertaken by means of serial sections and wax model reconstructions in various stages of the disease.



### *Herhaalde Herbesmettings in Ape*

Die uitwerking van herhaalde herbesmetting met die Egiptiese stam van *S. mansoni* op ape is ondersoek deur middel van lewerbiopsie en lewerfunksie verder bestudeer. Tot dusver het weeklikse herbesmetting oor 'n lang tydperk geen betekenisvolle verskille in lewerpatologie getoon van die van enkele besmetting nie.

Biochemies neig die kenmerkende abnormaliteite om voort te duur in plaas van om weer tot normaal terug te keer soos na 'n enkele besmetting. Die latere abnormaliteit is egter effe minder as na 'n eerste besmetting. Dit dui weer op 'n ligte immuniteit wat deur vorige besmetting teweeggebring is. Die hoë graad van immuniteit waaroor ander navorsers berig, is nog nie verkry nie, maar ook is daar geen bewys dat herhaalde herbesmetting weerstand afbreek en groot patologiese en biochemiese veranderinge teweegbring nie.

### *Pogings to Immunisering deur Inplanting van Lewende Volwasse Wurms*

In die proefneming is lewende wurms in die buikvlies van muise ingeplant. Inplanting het nie besmetting en uitskeiding van volwasse wurms en eiers in die ontlasting na 'n normale tydsverloop voorkom nie. Die opvallendste verskil van normale ape kon gesien word in die komplemetbindingsreaksie. In al drie die ape in die proef het die bilharziase-komplementbinding positief geword een tot drie weke na inplanting en voor serkariëbesmetting. Hierna het alle serums antikomplementêr geword en een het so gebly, maar die ander twee het weer positief geword twee tot sewe weke na besmetting met serkarië.

Dit is duidelik dat inplanting van volwasse wurms genoeg teenliggame gevorm het om 'n positiewe komplemetbindingstoets te gee, maar nie genoeg om besmetting te voorkom nie. Dit is in ooreenstemming met ander werk wat toon dat 'n vorige besmetting met serkarië nie voldoende immuniteit verskaf om daaropvolgende besmettings te voorkom nie.

### *Bevolkingsbeweging vir 'n Muisgroep wat met Bilharzia Besmet is*

Die uitwerking van bilharziase van verskillende grade van intensiteit op 'n muisgroep word bestudeer. Vyftig paar muise van 'n standaardstam is geweeg, gepaar na spening en toe met 'n bekende aantal serkarië besmet. Hul gewigstoename, voortplanting, gewig en grootte van werpsels by geboorte en na spening, aantal gespeen en lewensduur is toe vergelyk met 'n kontrolegroep.

'n Proefneming wat voltooi is, het uit die drie groepe bestaan: 1. Kontrolegroep, 2. 'n Groep waar elke muis met 250 serkarië besmet is, en 3. 'n Groep met 50 besmet. Na 92 dae was die aantal werpsels, hul grootte en gewigte by geboorte dieselfde in al drie groepe. Die opvallendste verskil tussen hierdie drie groepe was in die aantal klein

### *Repeated Reinflections in Monkeys*

The effect on monkeys, as judged by liver biopsy and liver function, of repeated reinfection with the Egyptian strain of *S. mansoni* has been studied. So far, weekly reinfection over a considerable period has failed to produce any significant difference in liver pathology from what is to be expected from a single infection.

Biochemically the characteristic abnormalities tend to remain instead of returning to normal as after a single infection. The abnormality, however, is maintained at a slightly lower level than after a first infection. This again points to some slight immunity produced by previous infection. It has not been possible to show the high degree of immunity reported by others, nor is there any evidence that repeated reinfection breaks down resistance to produce gross pathological and biochemical changes.

### *Attempted Immunization by Implantation of Living Adult Worms*

In this experiment living worms were implanted intraperitoneally into monkeys and mice. Implantation did not prevent infection and production of adult worms and ova in faeces after the normal lapse of time. The most striking difference from normal monkeys was reflected in the behaviour of the complement fixation reaction. In each of the three monkeys used, the bilharzia complement fixation became positive one to three weeks after implantation and before cercarial infection; after this all sera became anticomplementary and one has remained so. The remaining two then again became positive two to seven weeks after infection with cercariae.

It seems obvious that implantation of adult worms produced sufficient antibody to produce a positive complement fixation test but not sufficient to prevent infection. This is in accord with other work which shows that a previous infection by cercariae does not produce sufficient immunity to prevent subsequent infections.

### *Population Dynamics in a Bilharzial Infected Mouse Colony*

The effect of bilharziasis of varying intensity is being studied in a mouse colony. Fifty pairs of mice, from standard stock, were weighed, mated at weaning and then infected with a known number of cercariae. Their weight increase, reproduction, weight and size of litters at birth and at weaning, number weaned and longevity were then compared with a control group.

Thus far an experiment has been concluded involving three groups: (1) a control group, (2) a group in which each mouse was infected with 250 cercariae, (3) a group in which each mouse was infected with 50 cercariae. After a lapse of 92 days



muisies wat gespeen is. In die kontrolegroep was dit 94·8%, in die tweede groep 56% en in die derde groep 83%. Die tweede opvallende verskil was in die oorlewingskoers: op 92 dae was almal in die kontrolegroep lewendig, terwyl 33% van groep 2 en 6% van groep 3 dood was.

Dit lyk asof bilharziase nie slegs sterftes vermeerder nie, maar gewigstoename in mannetjies verminder en wat baie opvallend is, ook die aantal kleintjies wat deur moeders gespeen word, verminder.

#### *Geneeskundige Proewe*

In die verlede het die eenheid se pogings om bilharziase in proefdiere met die gewone middels te genees, besonder min sukses gehad. Tans word 'n nuwe middel wat van Farbwerke Hoechst van Frankfurt, Duitsland, ontvang is, uitgetoets. Die middel word deur die mond toegedien en lyk besonder belowend. 'n Enkele dosis het besmetting in muis laat verdwyn maar die werk op ape is nog nie afgehandel nie. Die Suid-Afrikaanse stam van *mansoni* word gebruik.

Patologiese en biochemiese studies word op diere wat genees het uitgevoer om vas te stel of die verandering permanent is en indien wel, in watter stadium van die siekte die patologiese veranderinge onomkeerbaar word.

#### *Parasiete van die Haematobiumgroep in Suidelike Afrika*

In die jaar is 'n parasiet met kenmerke van *S. mattheei* van 'n menslike pasiënt uit Portugees-Oos-Afrika geïsoleer. Slakke is besmet en daarna muis waardeur eiers verkry is wat gemeet en met die van *S. bovis* en *S. Haematobium* vergelyk is. By statistiese ontleding is bevind dat die drie stamme aanmerklik verskil in eiergrootte en hulle kan as drie afsonderlike soorte beskou word. Die eiers van *bovis* kan nie maklik aangesien word vir die van *haematobium* nie, maar *Mattheei* is, volgens grootte, halfpad tussen hulle en kan maklik met *haematobium* verwar word. Moontlik kom *Mattheei* dus meer algemeen in die mens voor as wat in die verlede vermoed is.

#### **Bilharziase in Mense**

##### *Biochemiese Patroon in Tropiese Naturellearbeiders*

In samewerking met dr. Sonnenfeld van die Rand Leases-myn, Johannesburg, is begin met 'n studie van die biochemiese patroon van bilharziase in tropiese naturellearbeiders.

Die Rand bied uitstekende geleentheid vir die soort studie. Twee veranderlike faktore wat in die trope so baie werk bederf, is hier onder strenge beheer, nl. herbesmetting wat hier afwesig is, en dieet wat hier eenvormig, stabiel en gebalanseer is.

the number of litters, their size and weights were the same in all three groups. The most striking difference between these three groups was in the number of baby mice weaned. In the control group this was 94·8 per cent., in the second group 56 per cent., and in the third group 83 per cent. The second striking difference lies in survival rate: at 92 days all of the control group were alive; 33 per cent. of group (2), and 6 per cent. of group (3) had died.

It seems that, apart from increasing mortality, bilharziasis reduces the rate of weight increase in males and most strikingly the number of offspring weaned by mothers.

##### *Therapeutic Tests*

The unit has in the past been singularly unsuccessful in attempts to cure bilharziasis in experimental animals with the usual drugs. At the moment, a new drug sent by Farbwerke Hoechst, of Frankfurt, Germany, is being tested. This drug is administered orally and appears to be very promising indeed. A single dose has cleared infection in mice; the work on monkeys is not completed. The South African strain of *mansoni* is being used.

Pathological and biochemical studies are being made on cured animals to determine whether the changes are permanent and, if so, at what stages of the disease the pathological changes become irreversible.

##### *Parasites of the Haematobium Group in Southern Africa*

During the year a parasite showing characteristics of *S. mattheei* was isolated from a human patient from Portuguese East Africa. Snails were infected and subsequently mice. This has provided ova for measurement and comparison with those of *S. bovis* and *S. haematobium*. When subjected to statistical analysis it was shown that the three strains differ significantly in egg size and they may be regarded as three distinct species. The ova of *bovis* are not likely to be mistaken for those of *haematobium* but *Mattheei* falls, in measurement, halfway between them, and may easily be mistaken for *haematobium*. For this reason *Mattheei* has probably in the past frequently been mistaken for *haematobium*.

#### **Bilharziasis in Human Beings**

##### *Biochemical Pattern in tropical Native labourers*

A study, in collaboration with Dr. Sonnenfeld, of Rand Leases Mine, Johannesburg, of the biochemical pattern in bilharziasis in tropical Bantu labourers, has been initiated. The Rand offers unique opportunities for this type of study. The factors which vary so much in the tropics are constant here—the first is the absence of reinfection and the second a stable, balanced common diet.



*Langtermynwaarnemings van die Komplementbindings-reaksie van Bilharziase in Kinders wat van Bilharziase genes is*

Elke ses maande word waarnemings op 'n aantal skoolkinders gedoen om vas te stel wat die resultaat van behandeling is op die gedrag van die Bilharziase-komplementbindingstoets. Die bevindings toon dat na suksesvolle behandeling die komplementbindingstoets in die meeste gevalle positief bly vir 'n tydperk van minstens twee jaar, en dat 'n negatiewe toets 'n goeie aanduiding is dat die pasiënt heeltemal genes is. Hierdie waarnemings duur voort.

*Lewerfibrose en Sirrose in Verhouding tot Ligte Bilharziase in die Mens*

In 'n reeks van 241 lykskouings in Johannesburg, 'n streek waar ligte schistosoombesmetting voorkom, is die bekkenorgane in sterk alkali verteer en vir Schistosoom-eiers ondersoek. Die aanwesigheid of afwesigheid van eiers is met patologiese veranderinge in die lewer gekorreleer. Geen betekenisvolle verwantskap is gevind tussen die aanwesigheid van *S. haematobium* en fibrose, sirrose, en primêre kanker van die lewer nie.

**KARDIO-PULMONALE EENHEID**

*Hoof van die Eenheid:* PROF. G. A. ELLIOTT  
Universiteit van die Witwatersrand, Johannesburg.

Die navorsingswerk van die Kardio-Pulmonale Eenheid het gedurende 1955 dieselfde patroon as in die afgelope twee of drie jaar gevolg maar het nuwe ondernemings ingesluit, veral op die gebied van longfunksie.

**Hartbloedvatnavorsing**

*Ballistokardiografie*

Normale standaard is vasgestel vir die skommeling van die ballistokardiogram (1950/1955). Die metode wat nou gebruik word skakel sommige van die moeilikhede uit wat voorheen ondervind is toe standaard in verband gebring is met fisiese eienskappe soos liggaamsoppervlakte. 'n Sistematiese studie is gemaak van die ballistokardiogram in siekte en sommige van die resultate is soos volg:

- (i) Die mate van noukeurigheid waarmee dit moontlik is om noukeurig genoeg te onderskei tussen pasiënte met ernstige mitralistenose (wat geopereer kan word) en pasiënte met oorheersende mitralis-insufficiënsie (wat nie geopereer kan word nie) toon dat die ballistokardiogram 'n waardevolle hulpmiddel is by die vraagstuk.
- (ii) Pasiënte met aortavernouing kan deur snykunde gehelp word en die ballistokardiogram blyk al hoe meer 'n waardevolle hulpmiddel te wees om vas te stel hoe ernstig die aortavernouing is.

*Long-term Observations on the Behaviour of the Bilharzia Complement Fixation Reaction in Children Cured of Bilharziasis*

Observations at six-monthly intervals are being made on a number of school children to determine the effect of treatment on the behaviour of Bilharzial Complement Fixation test. The results indicate that, following successful treatment, the complement fixation test remains positive in most subjects to a period of at least two years, and that a negative test is a good indication that the patient has been cured. These observations are being continued.

*Hepatic Fibrosis and Cirrhosis in Relation to Mild Bilharziasis in Man*

In a series of 241 necropsies in Johannesburg, a region of mild schistosome infestation, the pelvic organs were digested in a strong alkali and examined for Schistosoma ova. The presence or absence of ova was correlated with the pathological changes in the liver. No significant correlation was demonstrated between the presence of *S. haematobium* and fibrosis, cirrhosis and primary cancer of the liver.

**CARDIO-PULMONARY UNIT**

*Head of the Unit:* PROF. G. A. ELLIOTT  
University of the Witwatersrand, Johannesburg

The research work of the Cardio-Pulmonary Unit during the year under review followed courses set over the previous two or three years, and included additional ventures, particularly in the pulmonary function field.

**Cardiovascular Research**

*Ballistocardiography*

Normal standards for the deflections of the ballistocardiogram have been established (1950/1955). The method devised eliminates some of the difficulties encountered by relating normal standards to physical characteristics, such as body surface area, which have previously been employed. A systematic study of the ballistocardiogram in disease has been made, and some of the results are as follows:—

- (i) It is possible to distinguish between patients with tight mitral stenosis (who are operable) and patients with predominant mitral incompetence (who are inoperable) with sufficient accuracy to suggest that the ballistocardiogram is a valuable adjunct in this problem.
- (ii) Patients with aortic stenosis can be helped by surgery, and the ballistocardiogram is proving to be a valuable adjunct in assessing the degree of aortic stenosis.



(iii) Die verandering van die ballistokardiogram in koronêre vatsiekte is herhaaldelik in mediese publikasies beskryf. Op die gebied is afbreuk gedoen aan sy waarde deur die feit dat ander toestande soos hoë ouderdom of ontplooiing van die aorta dieselfde bevindinge mag gee. 'n Posing is aangewend om tussen die toestande te onderskei, maar geen afdoende resultate is nog verkry nie. Hierdie werk wat nog voortduur, vereis aansienlike statistiese en wiskundige ontledings wat uitgevoer word beide deur die tegniese personeel wat met die hulp van die W.N.N.R. aangestel is en die professionele mediese personeel van die Eenheid wat gemeenskaplike betrekkings van die Transvaalse Provinsiale Administrasie en die Witwatersrandse Universiteit beklee.

#### *Serotonien*

Die bestanddeel word uit bloedstolsels verkry en blyk 'n diepgaande uitwerking op die pulmonale en liggaamsbloedsomloop te hê. Voorlopige studies gedurende 1954/55 oor die bepaling van die bestanddeel in die bloed het nou voldoende gevorder om te probeer om die konsentrasie vas te stel in normale persone en in pasiënte by wie logies verwag kan word dat die bestanddeel 'n uitwerking sal hê op die bloedsomloop en die longe. 'n Aantal fisiologiese veranderinge wat op 'n bevalling volg, dui op 'n „serotonienagtige” effek en bepaling sal voor en na die bevalling gemaak word. Dit is moontlik dat serotonien wat uit die baarmoeder geabsorbeer word, deels verantwoordelik mag wees vir sommige van die hart-long-aandoenings wat die veiligheid van die moeder, wat so pas die lewe aan 'n kind geskenk het, bedreig. Ander siektes sal ook ondersoek word.

#### *Allerlei Studies*

Die ondersoek in medewerking met die Departement van Radiologie van die Johannesburgse Hospitaal oor die bepaling van hartgrootte en hartkamervergroting, word voortgesit veral waar dit op die moontlikheid van hartchirurgie dui.

Faktore verantwoordelik vir die verskil in voorkoms van koronêre vatsiekte in die blanke en Bantoerasse in Suid-Afrika, word ondersoek. 'n Voorlopige studie van binnevliesdikte van kroonslagare in die twee groepe word onderneem in medewerking met dr. B. J. P. Becker van die Departement van Patologie, Universiteit van die Witwatersrand, wat die belangrikste bydrae tot die navorsingsprojek lewer. Die werk is net so tydrowend as wat dit belangrik is. Becker het, met behulp van die tegniese assistent wat die W.N.N.R. vir die doel aangestel het, gegewens van 164 harte van blankes en Bantoes ingesamel. Van elkeen word vyf mikroskopiese snitte geneem en elke snit word volgens agt metodes ondersoek. Dit is met sekerheid deur andere eenhede en in ander lande vasgestel dat lipiedmetabolisme, soos deur bloedstudies aangetoon, verwant is aan die voorkoms van koronêre vatsiekte en sy kliniese kenmerke. Die studie van die hart

(iii) The deterioration of the ballistocardiogram in coronary artery disease has been repeatedly described in the medical literature. Its value in this respect has been marred by the fact that other conditions or states, such as old age or unfolding of the aorta, may duplicate these findings. An attempt has been made to differentiate these conditions, but no conclusive results have yet been achieved. The work continues and entails considerable statistical and mathematical analysis which is carried out both by the C.S.I.R.-sponsored technical staff and the professional medical staff of the Unit, who hold joint Transvaal Provincial Administration-Witwatersrand University posts.

#### *Serotonin*

This substance is liberated from blood clots and has been shown to have profound effects upon the pulmonary and systemic circulations. Preliminary study of the estimation of this substance in the blood during 1954/55 is now sufficiently advanced to attempt studies on the concentration in normal subjects and in patients when this substance may be logically expected to produce circulatory and pulmonary effects. A number of physiological changes following parturition suggest a “serotonin-like” effect, and estimations will be made before and after delivery. It is possible that serotonin absorbed from the uterus may be partly responsible for some of the cardio-pulmonary episodes which jeopardize the safety of the recently delivered mother. Other diseases will in addition be investigated.

#### *Miscellaneous Studies*

In collaboration with the Department of Radiology of the Johannesburg Hospital, investigations are continuing into the assessment of heart size and chamber enlargement, particularly as these relate to indications for cardiac surgery.

Factors responsible for the different incidence of coronary artery disease in the European and Bantu peoples in South Africa are being investigated. A preliminary study of intimal thickness of coronary arteries is being made in these two groups in collaboration with Dr. B. J. P. Becker, of the Department of Pathology, Witwatersrand University, who is making the major contribution to this research project. This work is as time consuming as it is important. Dr. Becker has, with the services provided by the C.S.I.R. technical assistant appointed for the purpose, collected data from 164 European and Bantu hearts, from each of which five microscopic sections were taken, each section being subjected to eight methods of study. It has been well established in other units and in other countries, that lipid metabolism, as indicated by blood



het minder aandag ontvang as wat dit verdien en die Kardio-Pulmonale Eenheid probeer om aandag op die rigting te vestig, eerder as in die rigting van die veranderinge in lipidmetabolisme wat reeds deur ander met duidelikheid getoon is. Dit word beoog om in die toekoms die verskille in die bloedstollingsfaktore in die blanke en die Bantoe te bestudeer asook die rol, indien enige, van sielkundige faktore in die versnelde totstandkoming van koronêre trombose.

In medewerking met lede van die Hartkliniek en Chirurgiese Borseenheid van die Johannesburgse Algemene Hospitaal duur die opvolgstudies van hartgevalle wat geopereer is, voort. Hierdie werk het 'n uiters belangrike invloed op die keuring van gevalle wat geskik is vir hartchirurgie, aangesien bevind is dat talle gevalle wat geopereer is baie weinig of niks daarby gebaat het nie. Die Kardio-Pulmonale Eenheid probeer die redes vir sukses of mislukking vind.

In medewerking met die Hipertensiekliniek van die Johannesburgse Algemene Hospitaal is gekontroleerde studies van die gebruik van verskeie middels in essensiële hipertensie uitgevoer. Die enigste preparate wat bevind is moontlik doeltreffend te wees, is die Rauwolfia-derivate. Die Kardio-Pulmonale Eenheid besef baie goed dat die natuurlike verskille in die verloop van hipertensiegevalle belangrik is, afgesien van enige behandeling met middels.

### Pulmonale Navorsingswerk

Afgesien van die metodes wat reeds deur die Eenheid bevestig en toegepas word, d.w.s. bepaling van long-volume, intra-pulmonale menging, en bloedgasstudies gedurende rus en oefening, is twee nuwe toetse gedurende die jaar ontwikkel, naamlik:

- (i) meting van die meganika van asemhaling deur asemhalingsvloei met druk in die borskas te vergelyk; en
- (ii) ontwikkeling van 'n oefeningstoets waarin beugtings- en polswisseling by verskillende oefening-ladings ondersoek word. Die toets is oorspronklik aan die hand gedoen deur dr. C. H. Wyndham van die Transvaalse en Oranje-Vrystaatse Kamer van Mynwese se Laboratorium vir Toegepaste Fisiologie.

Dit word ook gehoop dat 'n metode om die diffusievermoë van die longe te meet, ontwikkel sal word sodra die nodige uitrusting aankom.

Met die bogenoemde metodes is die volgende aspekte van longfunksie bestudeer:

- (a) Tot dusver is nêrens in die wêreld 'n bevestigende metode vir die skatting van die alveolêre druk ont-

studies, is related to the incidence of coronary artery disease and its clinical features. The study of the heart has received less attention than it deserves, and the Cardio-Pulmonary Unit is attempting to focus attention in this direction, rather than in the direction of the well-established changes in lipid metabolism that have been demonstrated elsewhere. It is hoped, in the future, to study differences in the blood-clotting factors in the European and the Bantu, and to study the part, if any, that psychological factors play in the precipitation of coronary thrombosis.

In collaboration with members of the Cardiac Clinic and Surgical Thoracic Unit of the Johannesburg General Hospital, the follow-up of cardiac cases subjected to surgery continues. This follow-up has a most important bearing upon the selection of cases suitable for cardiac surgery, as it is being found that numbers of cases who have been operated upon have benefited either very slightly or not at all. The Cardio-Pulmonary Unit is attempting to find the reasons for success and failure.

In collaboration with the Hypertension Clinic, of the Johannesburg General Hospital, controlled studies of the use of various drugs in essential hypertension have been carried out. The only preparations which possibly have been found to be effective are the *Rauwolfia* derivatives. The Cardio-Pulmonary Unit is well aware of the importance of appreciating the varied natural course of cases of hypertension, quite apart from any drug treatment.

### Pulmonary Research

In addition to the techniques already established and applied by the Unit—*i.e.*, estimation of lung volume, intra-pulmonary mixing, and blood gas studies during rest and exercise, two new tests have been developed during the year, namely:

- (i) measurement of the mechanics of respiration by comparing respiratory flow with pressure in the thorax, and
- (ii) development of an exercise test in which ventilatory and pulse responses to varying exercise loads are examined. This test was originally suggested by Dr. C. H. Wyndham, of the Transvaal and Orange Free State Chamber of Mines Applied Physiology Laboratory.

It is also hoped that a method of measuring the diffusing capacity of the lungs will be developed as soon as the relevant equipment has arrived.

Using the techniques mentioned above, the following aspects of pulmonary function have been studied:—

- (a) As yet no satisfactory method for the estimation of the alveolar pressure has been devised anywhere in the world. Its



wikkel nie. Die meting daarvan is noodsaaklik as die verskillende faktore wat die meganika van asemhaling versteur noukeurig beoordeel moet word. Dr. A. R. Bosman het 'n unieke liggaamspletismograaf ontwerp en gebou en in verskeie vorms uitgetoets. Vir die doel het hy 'n W.N.N.R.-beurs gekry. Die verwagting is dat die werk onder die beurs vir minstens die volgende twee jaar sal voortduur.

- (b) In die studie van emfiseem, is die werkverrigting van asemhaling van besondere belang. Hopelik sal hierdie werkverrigting kan geskei word van ander vorms van energieverbruik. As 'n bevredigende metode gevind kan word vir die meet van alveolêre druk, sal dit ook moontlik wees om die verskeie faktore wat verantwoordelik is vir die viskose weerstand teen asemhaling, d.w.s. lugvloeiweerstand en weefselsweerstand, te ontleed.
- (c) Gedurende die afgelope twee jaar is gegewens oor normale persone wat by 'n hoogte van 7,000 voet woon deur die Eenheid ingesamel. Die resultate vir mans is ontleed en die verskillende onderafdelings van longfunksie is afsonderlik gekorreleer met ouderdom, hoogte, gewig en liggaamsoppervlakte. Die resultate is verskillend genoeg van oorsese syfers om duidelik te toon dat die bevredigendste manier om resultate in terme van afwyking van die normale uit te druk, sal wees om elke waarneming uit te druk as 'n persentasie van 'n voorspelde normale waarde gebaseer op die Eenheid se eie werk. Voorspellingsformules gebaseer op hierdie syfers word tans uitgewerk. Die werk bring aansienlike wiskundige en statistiese ontledings mee, maar behoort volgende jaar voltooi te wees, wanneer gegewens oor vroue op dieselfde wyse ontleed sal word.
- (d) In die studies van normale mense is waargeneem dat die intrapulmonale mengingsindeks goed gekorreleer kan word met liggaamslengte. Dit lyk moontlik dat lang persone 'n betreklik goeie diafragmabeweging het wat mag verklaar waarom hul intrapulmonale mengingsindeks relatief meer doeltreffend is. Verdere studies om lig hierop te werp word oorweeg.
- (e) Voorlopige werk oor 'n oefening waarin belugtings- en polsreaksies op verskillende oefeningsladings bestudeer word, het getoon dat die toets suksesvol mag wees om te bepaal of 'n persoon se beperking vir inspanning hoofsaaklik aan die hart of die long te wyte is. Die Eenheid hoop om die toets uit te bou en vas te stel of dit van nut sal wees in die sortering van kardiaale en pulmonale dispneë.
- (f) In medewerking met die Mediese Silikoseburo het measurement is essential if the various factors which disturb the mechanics of breathing are to be accurately estimated. The designing and construction of a unique body plethysmograph and its trial in its various forms has been carried out by Dr. A. R. Bosman, who holds a C.S.I.R. bursary, contributed for this purpose. It is intended that this work continue under the bursary for the next two years at least.
- (b) In the study of emphysema, work of breathing is particularly important. It is hoped that the work of respiration can be separated from other work. If a satisfactory method for measuring alveolar pressure can be found, it will also be possible to analyse the various factors which make up the viscous resistance to breathing, *i.e.*, air-flow resistance and tissue resistance.
- (c) During the past two years data on normal subjects resident at an altitude of 7,000 feet have been collected by the Unit. The results on male subjects have been analysed and the various subdivisions of lung function have been individually correlated with age, height, weight and surface area. The results are sufficiently different from overseas figures to make it apparent that the most satisfactory way of expressing results in terms of deviation from normality will be to express each observation as a percentage of a predicted normal value based on the Unit's own work. Prediction formulae based on these figures are at present being worked out. This work, which entails considerable mathematical and statistical analysis, should be completed during the next year, after which data on female subjects will be analysed in the same way.
- (d) Arising out of the normal studies, it was observed that the intrapulmonary mixing index correlated closely with body height. It seems possible that tall individuals have relatively good diaphragmatic movement which may account for their relatively more efficient intrapulmonary mixing index. Further studies to elucidate this point are under consideration.
- (e) Preliminary work on an exercise test in which ventilatory and pulse responses to varying exercise loads are studied has suggested that this test may be useful in determining whether an individual's limitation for exertion is primarily cardiac or primarily pulmonary. The Unit hopes to develop this test to determine if it will be of use in sorting cardiac from pulmonary dyspnoeas.
- (f) In co-operation with the Silicosis Medical



die Eenheid begin met die ondersoek van byna 200 uitgesoekte mynwerkers met verskillende nywerheidsgeskiedenis en verskillende X-straal-foto's in wie die fisiologiese patroon van ongeskiktheid bestudeer sal word. Die plan is om veral die korrelasie van BCG-patrone met die aard van die fisiologiese ongeskiktheid te bestudeer, asook die verwantskap van die ongeskiktheidspatroon met liggaamstipe. Die Buro het ingestem dat die Eenheid aan die werk deelneem.

Oor die afgelope drie jaar is gegewens oor bilaterale lugpypverwydering voor en na operasie ingesamel. Voorlopige ontledings van die resultate is leersaam en mag 'n idee gee oor hoe noukeurig die verlies van funksie wat waarskynlik op 'n besondere operasie sal volg, voorspel kan word.

#### NAVORSINGSEENHEID VIR KLINIESE VOEDING

*Hoof van die Eenheid:* PROF. J. F. BROCK  
Universiteit van Kaapstad.

Gedurende die jaar is die moontlikheid oorweeg om 'n Kliniese Afdeling van die Nasionale Voedingnavorsingsinstituut op te rig in noue aansluiting by die bestaande Eenheid in Kaapstad. Die finale besluit was om die bestaande Eenheid wat aan die Mediese en Tandheelkundige Navorsingskomitee van die W.N.N.R. verantwoordelik is, te behou en uit te brei vir samewerking met die Nasionale Voedingnavorsingsinstituut. Die Raad het dus die finansiële toekenning vir die jaar 1955/56 verhoog sodat die Eenheid sy werksaamhede onmiddellik kon uitbrei en veral die werk van die metabolismesaal behoorlik kon ontwikkel.

Die metabolismesaal wat volgens ooreenkoms tussen die W.N.N.R. en die Hospitaaladministrasie van Kaapland in die Groote Schuur-hospitaal opgerig is, sal van groot hulp wees vir die bevordering van die Eenheid se werk.

#### Koronêre Hartsiekte

Dr. Ancel Keys van die Universiteit van Minnesota het die Unie in Maart 1955 besoek op uitnodiging van die W.N.N.R. en het die grootste deel van sy tyd gewy aan 'n opname, in samewerking met die Eenheid, van koronêre hartkwaal, serumlipoproteïene en dieetvetinnamte in die drie hoofrassegroepe van die Kaapse Skiereiland. Vir die tydperk van die begin van Februarie tot die end van Mei het die opname 'n belangrike deel uitgemaak van die Eenheid se werksaamhede en die grootste deel van die Eenheid se personeel moes vir lang tye na ure werk. Die bevindinge van die opname stem baie ooreen met die neigings wat deur dr. Keys en ander medewerkers in verskillende dele van die wêreld gevind is. In kort kom dit daarop neer dat daar werklik onder mans in die meer

Bureau, the Unit has commenced a study of almost 200 selected mineworkers with varying industrial history and varying X-ray pictures, in whom the physiological pattern of disability is to be studied. It is planned to study, in particular, the correlation of bilharzia complement fixation patterns with the nature of the physiological disability, also the relation of the disability pattern to somatotype. The Bureau has agreed to the Unit's participation in this work.

- (g) Over the past three years data on cases of bilateral bronchiectasis have been collected before and after operation. Preliminary analysis of the results is informative, and may give some idea of how accurately the loss of function likely to follow a particular operation can be predicted.

#### CLINICAL NUTRITION RESEARCH UNIT

*Head of the Unit:* PROF. J. F. BROCK  
University of Cape Town

Consideration was given, during the past year, to the possibility of setting up a Clinical Section of the National Nutrition Research Institute in close affiliation with the existing Unit in Cape Town. The final decision was to retain the existing Unit responsible to the Medical and Dental Research Committee of C.S.I.R. and to enlarge its scope for collaboration with the National Nutrition Research Institute. The Council has, therefore, increased the financial grant for the year 1955/56 to allow of immediate expansion of the Unit's activities, and particularly to allow of the proper development of the work of the Metabolism Ward.

The Metabolism Ward set up by agreement between the C.S.I.R. and the Hospital Administration of the Cape Province in Groote Schuur Hospital will be of very great assistance to the furtherance of the work of the Unit.

#### Coronary Heart Disease

Dr. Ancel Keys of the University of Minnesota visited the Union in March, 1955, at the invitation of the C.S.I.R. and spent the greater part of his time in a collaborative survey with the Unit of coronary heart disease, serum lipoproteins and dietary fat intake in the three principal racial communities of the Cape Peninsula. For the period February to May inclusive this survey formed a major part of the activities of the Unit and kept most of the personnel of the Unit busy for very long periods of overtime. The findings of the survey fit closely into the trends found by Dr. Keys and other collaborators in various parts of the world. These trends can be summarized as follows. The rising incidence in coronary heart



gegoede gemeenskappe van die wêreld 'n toenemende mate van koronêre hartkwaal voorkom wat gepaard gaan met 'n abnormaal hoë peil van cholesterol en sekere lipoproteïene in die bloed. Statisties is dit nou verwant aan 'n toenemende vetinname soos uitgedruk deur die vetkalorieverhouding van die dieet. Die drie gemeenskappe van die Kaapse Skiereiland pas presies in by die krommes van gemeenskappe op verskillende ontwikkelingspeile in ander dele van die wêreld, d.w.s. koronêre hartkwaal, serumlipoproteïene en vetinname in die dieet is almal hoog by die blanke en almal laag by die Bantoe. Die Kaapse Kleurlinge pas in alle opsigte tussen die blanke en die Bantoe in. Die statistiese verwantskap tussen die stygende vetinname, stygende cholesterol in die bloed en stygende voorkoms van koronêre hartkwaal word dus besonder goed geïllustreer deur hierdie drie gemeenskappe. Daar bestaan weinig twyfel dat die statistiese verwantskap 'n soort oorsaaklike verwantskap weerspieël wat die vermindering van vetinname in die dieet van oorbevoorregte gemeenskappe sou regverdig. Dit moet egter beklemtoon word dat baie ander faktore ongetwyfeld ook in die etiologie van koronêre hartkwaal 'n rol speel en dat die vermindering van vet in die dieet slegs van toepassing is op die ekonomies bevoorregte en meer bejaarde blanke.

#### **Kwashiorkor en Proteïenondervoeding**

Die gesamentlike opname met die Departement van Kindergeneeskunde van die Pretoriase hospitaal en die McCordse Zoeloe-hospitaal, Durban, oor die genesende uitwerking van dieetkundige behandeling van kwashiorkor, was baie bemoedigend. 'n Proefdieet van drie weke vir „voorbereiding tot genesing” is gestandaardiseer en is geskik bevind vir die toets van semi-kunsmatige en kunsmatige plaasvervangers vir afgeroomde melk. Die doel van die voorbehandeling is om vas te stel in watter mate aminosure 'n beperkende faktor is in die dieet wat kwashiorkor veroorsaak of anders, om vas te stel in watter mate verskillende kombinasies van aminosure met glukose en sout gemeng genesing kan aanvoer in die afwesigheid van vitamïene. Dit is bekend dat genesing met kaseïen ingelei kan word al is laktalbumien en die bekende vitamïene, afwesig. Volgens die resultate verkry op die klein groep gevalle wat behandel is met 'n kombinasie van sintetiese aminosure saam met glukose en soutmengsel wat min of meer ooreenstem met kaseïen kan tot die voorlopige gevolgtrekking geraak word dat genesing minstens in sommige gevalle ingelei kan word deur 'n kombinasie van aminosure in die afwesigheid van enige ander voedingstof. As die resultate bevestig word, sal dit die bewys wees dat 'n aminosuurtekort die belangrikste oorsaak van kwashiorkor is. Daar moet op gelet word dat uit die proefnemings geen gevolgtrekkings gemaak kan word oor „konsolidering van genesing” nie wat ongetwyfeld alle essensiële voedingstowwe vereis.

In verband hiermee het professor Brock 'n verhandeling oor „Vordering in Kwashiorkor” voor die Derde Internasionale Kongres van Voeding in September 1954

disease in males in the more privileged communities of the world is real and is linked with abnormally high levels of cholesterol and certain lipoproteins in the blood. It is closely linked statistically with increasing consumption of fats as represented by the fat calorie ratio of the diet. The three communities of the Cape Peninsula fit exactly into the curve of communities at different levels of development in other parts of the world, i.e., coronary heart disease, serum lipoproteins and dietary fat intake are all high in the European and all low in the Bantu. The Cape Coloured people fit in all respects intermediate between the European and the Bantu. The statistical association between rising fat consumption, rising blood cholesterol and rising incidence of coronary heart disease is, therefore, remarkably well illustrated in these three communities. There can be little doubt that the statistical association represents some kind of causal association which justifies reduction of fat intake in the diet in over-privileged communities. It should be emphasized, however, that many other factors undoubtedly enter into the aetiology of coronary heart disease and that the case for dietary fat restriction applies at present only to the economically privileged and middle-aged European.

#### **Kwashiorkor and Protein Malnutrition**

The collaborative survey with the Departments of Paediatrics of the Pretoria Hospital and the McCord Zulu Hospital, Durban, on dietary therapeutic trials in kwashiorkor has been most encouraging. A three weeks test for “initiation of cure” has been standardized and found to be suitable for testing semi-synthetic and synthetic substitutes for skimmed milk. The aim of the testing is to determine the extent to which amino acid deficiency is a limiting factor in the diet which leads to kwashiorkor or, alternatively, the extent to which various combinations of amino acids with glucose and salt mixture can initiate cure in the absence of vitamins. It is clear that cure can be initiated with casein in the absence of lactalbumin and the known vitamins. The results for the small group of cases treated with a combination of synthetic amino acids with glucose and salt mixture, reproducing the pattern of casein, allows the tentative conclusion that, at least in some cases, cure can be initiated by a combination of amino acids in the absence of any other nutrients. If confirmed, these results establish amino acid deficiency as the essential cause of kwashiorkor. It should be noted that no conclusions are drawn from these experiments about “consolidation of cure” which doubtless requires all essential nutrients.

In connection with this programme Professor Brock gave a paper at the Third International Congress of Nutrition at Amsterdam in September, 1954, on “Progress in Kwashiorkor.” In June, 1955, Dr. J. D. L. Hansen represented Professor Brock at a



in Amsterdam voorgedra. In Junie 1955 het dr. J. D. L. Hansen professor Brock by 'n konferensie oor proteïenvereistes in Princeton, New Jersey, verteenwoordig, wat saamgeroep is deur die Wêreldorganisasie vir Gesondheid, die Voedsel- en Landbou-organisasie en die Josiah Macy-stigting. Dr. R. F. A. Dean, direkteur van die Britse mediese navorsingsraad se Eenheid vir die Studie van Kinderondervoeding in Oeganda, het die Eenheid besoek vir gedagtewisseling insake gemeenskaplike belange op die gebied. Vir die projek is milde finansiële steun ontvang van die Williams Waterman-fonds vir die Bestryding van Dieetsiektes, New York, V.S.A. en van Merck Incorporated, Rahway, New Jersey, V.S.A. Na die Internasionale Kongres oor Voeding in September 1954 het professor Brock New York besoek vir same-spreking oor die projek, op uitnodiging van die Williams Waterman-fonds.

#### **Vloeistof- en Elektrolietbalans in Kwashiorkor**

Daar is voortgegaan met die metaboliese balansstudie van vloeistof, stikstof en elektrolietbalans in kwashiorkor voor, gedurende en na verslapping van behandeling. Die studie het duidelik getoon dat daar dikwels 'n ernstige kaliumtekort in kwashiorkor is wat die oorsaak van skielike dood mag wees as die toestand nie binne die eerste 24 uur van behandeling verbeter word nie. Herstel van die kaliumtekort kan lei tot diurese en gedeeltelike oplossing van edeem selfs in die afwesigheid van stikstof en ander organiese voedingstowwe. Die diurese gaan gepaard met uitskeiding van natrium en dit is redelik om te veronderstel dat natrium in 'n sekere mate deur kalium uit die sel verplaas word. Ongetwyfeld is die kaliumvermindering deels te wyte aan diarree, maar 'n onlangse publikasie uit Oeganda bevestig die bevindinge in Kaapstad onder gevalle waar daar min of geen diarree was nie. Dit is dus moontlik dat 'n groot proteïenvermindering gepaard mag gaan met ernstige kaliumvermindering sonder diarree.

#### **Voedingsedeem in Volwassenes**

Werk op die gebied en oor die verwantskap van voedingsedeem met „voedingsharte” duur voort. Die laasgenoemde word in medewerking met die hartkliniek van die Groote Schuur-hospitaal gedoen. Die bevindinge toon dat die edeem van ondervoeding te wyte is aan 'n groot verskeidenheid van skadelike meganismes wat deur baie stelsels van die liggaam werk en insluit versteurde elektrolietbalans, bloedeiwitgebrek, hartspierswiging en moontlik abnormale werking van lewer en nier.

#### **Oplossing van Nefrotiese Simptomegroep**

Werk op die gebied het voortgeduur beide uit die oogpunt van gewone begrippe van etiologie en ook met spesiale betrekking op die moontlikheid dat 'n voedingsletsel aan die nier soms die oorsaak mag wees van die nefrotiese simptomegroep. Die balanstegniek het interessante inligting verskaf oor vloeistof- en elektrolietverskuiwings onder die invloed van kortisone en ander steroïede en het vermoedelik bewys gelewer van 'n voedingsletsel aan die nier in sekere gevalle.

Conference on Protein Requirements in Princeton, New Jersey, called jointly by World Health Organization, Food and Agriculture Organization and Josiah Macy Foundation. Dr. R. F. A. Dean, Director of the British Medical Research Council Unit for the Study of Infantile Malnutrition in Uganda, visited the Unit in order to exchange information on common interests in this field. Generous financial support has been given to this project by the Williams-Waterman Fund for the Combat of Dietary Diseases, New York, U.S.A., and Merck Incorporated, Rahway, New Jersey, U.S.A. Professor Brock paid a visit to New York after the International Congress of Nutrition in September, 1954, at the invitation of the Williams Waterman Fund for consultations on the project.

#### **Fluid and Electrolyte Balance in Kwashiorkor**

The metabolic balance study of fluid, nitrogen and electrolyte balance in kwashiorkor before, during and after remission on treatment has been continued. This study has made it clear that potassium deficiency is often severe in kwashiorkor and may be the cause of sudden death if not corrected within the first 24 hours of treatment. Correction of the potassium deficiency is sometimes capable of leading to diuresis and partial resolution of oedema even in the absence of nitrogen and other organic nutrients. The diuresis is associated with excretion of sodium and it is reasonable to assume that to some extent sodium is displaced from the cell by potassium. Undoubtedly the potassium depletion is due in part to diarrhoea, but a recent publication from Uganda confirms the Cape Town findings among cases in whom there has been little or no diarrhoea. It is possible, therefore, that extreme protein depletion may be associated with serious potassium depletion in the absence of diarrhoea.

#### **Nutritional Oedema in Adults**

Work is continuing in this field and its relationship to “nutritional hearts,” the latter in collaboration with the Cardiac Clinic of the Groote Schuur Hospital. The findings show that the oedema of malnutrition is due to a great variety of pathogenic mechanisms operating through many systems of the body, including electrolyte imbalance, hypoalbuminaemia, myocardial failure, and probably hepatic and renal dysfunction.

#### **Resolution of the Nephrotic Syndrome**

Work in this field has been continued both from the point of view of ordinary concepts of aetiology and also with special relation to the possibility of a nutritional kidney lesion underlying some cases of the nephrotic syndrome. The balance technique has given interesting information about fluid and electrolyte shifts under the influence of cortisone and other steroids. There is presumptive evidence of a nutritional renal lesion in some cases.



## TANDHEELKUNDIGE NAVORSINGSEENHEID

*Hoof van die Eenheid:* PROF. J. T. IRVING  
Universiteit van die Witwatersrand, Johannesburg.

Die Eenheid is op 1 Februarie 1954 in die lewe geroep en is nou feitlik volledig uitgerus. Die histologie-afdeling is voltooi en 'n donkerkamer is uitgerus met alle geriewe vir fotografie en foto-mikrografie. Die afdeling biochemie kan nou alle gewone navorsingsprobleme ondersoek en 'n afdeling bakteriologie word tans opgerig.

### Voedingsfaktore en Glasuurvorming

Dit word al hoe meer besef dat die glasuurorgaan nie een enkele struktuur is nie, maar baie funksies het in sy verskillende dele en baie verskillende dieetkundige vereistes. Uit die oogpunt van die huidige ondersoek kan dit wat die rot betref, in drie afdelings verdeel word: dié wat verantwoordelik is vir grondstofvorming, vir verkalking en vir pigmentafsetting. Dieetgebreke wat een deel aantast, laat die ander onveranderd. In vorige werk is daar gevind dat die eerste twee afdelings baie gevoelig is vir veranderinge in kalsium- en fosformetabolisme, magnesiumtekort en fluorvergiftiging. Onlangse werk het getoon dat die deel wat pigment afsit baie gevoelig is vir 'n tekort aan vitamien E en dat dit die vitamien nodig het om behoorlik te kan funksioneer. Die ander twee dele van die glasuurorgaan het nie vitamien E nodig nie. Ook tas 'n tekort aan proteïene die pigmentafsetting aan en dit lyk asof die proteïenmetabolisme van hierdie deel van die glasuurorgaan onder die invloed van vitamien E staan. Die gevormde pigment bevat ook baie yster en 'n tekort aan vitamien E versteur die ystermetabolisme van die ameloblaste. Dit skyn betekenisvol te wees dat dieselfde sel, die ameloblast, gedurende 'n tydperk van hoogstens 20 dae so baie kan verander in sy werksaamhede, gedurende verskillende tye van sy leeftyd verskillende nutriënte kan nodig hê en gevoelig kan wees vir verskillende tekorte in die dieet. Hierbenewens is getoon dat 'n oormaat vitamien A die beskermende werking van vitamien E kan vernietig.

### Proteïenstudies

'n Personeelid van die Eenheid het vir 'n paar maande in die Nasionale Chemiese Navorsingslaboratorium gewerk aan 'n gesamentlike studie van die samestelling en struktuur van visskubproteïene, beesvelkollageen en kollageen van die menslike tanddentien. Die N-terminale oorblyfsels van igtilepidien, 'n baie onoplosbare proteïen wat in die skubbe van sardyne gevind is, is ondersoek en vergelykende studies word tans uitgevoer met die N-terminale groepe in dentien en huidkollageen. Die resultate sal ook met die van been vergelyk word.

### Mondflora

Dr. A. J. Clement, wat deelydse werk doen, het sekere van hierdie organismes ondersoek. Onlangse werk toon

## DENTAL RESEARCH UNIT

*Head of the Unit:* PROF. J. T. IRVING  
University of the Witwatersrand, Johannesburg

The Unit was established on 1st February, 1954, and is now virtually fully equipped. The histological section is complete and a darkroom has been provided with all facilities for photography and photomicrography. The biochemical section is now capable of undertaking all normal research problems and a bacteriology section is being built up.

### Nutritional Factors and Enamel Formation

It has been increasingly realized that the enamel organ is not one single structure but has many functions in its different parts and many different dietary requirements. From the point of view of the present argument it can, in the rat, be divided into three areas: those responsible for matrix formation, for calcification and for pigment deposition. In previous work it was found that the first two areas are very sensitive to changes in calcium and phosphorus metabolism, magnesium deficiency and fluorine intoxication. Recent work has shown that the pigment-depositing part is very sensitive to vitamin E deficiency and requires this vitamin for its proper working. The other two areas of the enamel organ do not require vitamin E. Protein deficiency likewise affects the deposition of pigment and it appears that the protein metabolism of this part of the enamel organ may be under the influence of vitamin E. Further, the deposited pigment contains much iron and in vitamin E deficiency, the iron metabolism of the ameloblasts is deranged. It seems significant that one and the same cell, the ameloblast, can, during a space of 20 days at the most, vary so much in its activities, require at different period of its life different nutrients and be susceptible to different dietary deficiencies. In addition, it has been shown that vitamin A in excess can abolish the protective action of vitamin E.

### Protein Studies

For several months a member of the Unit's staff worked in the National Chemical Research Laboratory in a collaborative study of the composition and structure of fish scale protein, oxhide collagen and human tooth dentin collagen. The N-terminal residues of ichthyolepidin, a very insoluble protein found in pilchard scale, were investigated and comparative studies of the N-terminal groups of dentin and hide collagen are in progress. In addition it is intended to compare the results with those from bone.

### Oral Flora

Dr. A. J. Clement, working in a part-time capacity, has investigated certain of these organisms.



dat 'n paar verskillende spesies van die laktobasilgroep (nl. *L. casei*, *L. planetarum*, *L. acidophilus*) afsonderlik of gesamentlik geassosieer kan wees met die proses van tandverrotting en die kweekvereistes van die groep is op 'n nuwe medium bestudeer, wat deur Rogosa ontwerp is. Kolonie-eienskappe en die morfologie van organismes van die verskillende tipes kolonies is in verskillende kweekgroepe bestudeer en dit is nou moontlik om die morfologie van die afsonderlike laktobasil met 'n bepaalde kolonietipe te assosieer. 'n Voorlopige kolonieklassifikasie word opgestel en gedurende die volgende fase van die werk sal die gistingsreaksies van die verskillende laktobasille ondersoek word. 'n Poging, tot dusver nie geslaag nie, is aangewend om die laktobasil op 'n verrykte speekselmedium te kweek. Die speekselstreptokokke is op Sherman se medium ondersoek en werk op die organismes sal voortduur.

Met die oog op die moontlike vyandige werking van Gramnegatiewe basille op die suurvormende mondflora en die moontlike verwantskap van die faktor met weerstand teen tandverrotting in primitiewe rasse, is verskillende speeksels op McConkey se medium gekweek en hul uitwerking op die laktobasille ondersoek. Aangesien die Gramnegatiewe basille 'n belangrike bestanddeel van die primitiewe mondflora is, sal die ondersoek verder in die rigting voortgesit word met die oog op die moontlike toekomstige toepassing van die bevinding op buitestudies.

## NAVORSINGSEENHEID VIR GESINSGESONDHEID

*Hoof van die Eenheid:* DR. S. L. KARK  
Instituut vir Gesinsgesondheid, Durban.

Sommige navorsingsvraagstukke wat na vore gekom het in die Eenheid se studies van groei, oorlewing en gesinsgesondheid word aangedui in 'n voorlopige verslag wat nou vir publikasie gereedgemaak word. Die faktore wat gewoonlik geassosieer word met skommeling in kindersterftes word nie in sigself as voldoende beskou om die gereelde verskille te verklaar wat in die verskillende rasse- en kultuurgroepe wat bestudeer is, gevind word nie. Dit is duidelik dat gesamentlike mediese en sosio-antropologiese studies nodig sal wees om lig te werp op die betekenisvolle maatskaplike en biologiese faktore wat die verwantskap van gesinsgesondheid en die groei en oorlewing van kinders beheer.

### Maatskaplike Studie

Die basiese studie van die Hindoes het nou so ver gevorder dat die belangrike maatskaplike en kulturele magte wat hul gesondheidspeil beïnvloed, beskryf kan word. Van die meer interessante waarnemings was die in verband met sorg van die pasgebore baba. Daar is bevind vir die gemeenskappe wat ondersoek is, dat

Recent work indicates that several distinct species of the lactobacillus group (*i.e.*, *L. casei*, *L. Planetarum*, *L. acidophilus*) may be individually or collectively associated with the carious process, and the cultural characteristics of this group have been studied on a new medium devised by Rogosa. Colony characteristics and the morphology of organisms from the various colony types have been investigated in several culture batches, and it is now possible to associate the morphology of the individual lactobacillus with a particular colony type. A provisional colony classification is being drawn up, and during the next phase of the work the fermentation reactions of the various lactobacilli will be investigated. An attempt, unsuccessful as yet, has been made to grow the lactobacilli on an enriched saliva medium. The salivary streptococci have been investigated on Sherman's, medium, and further work will continue on these organisms.

In view of the possible antagonistic effect of the Gram-negative bacilli on the oral acidogenic flora and the possible relationship of this factor to caries immunity in primitive peoples, various salivas have been plated on McConkey's medium and the effect of their presence on the lactobacilli investigated. As the Gram-negative bacilli are prominent components of the primitive oral flora, further investigations will continue along these lines with a view to the possible future application of the findings to field studies.

## FAMILY HEALTH RESEARCH UNIT

*Head of the Unit:* DR. S. L. KARK  
Institute of Family Health, Durban

Some research problems which have emerged in the Unit's studies of growth, survival and family health are indicated in a preliminary report which is being prepared for publication. The factors which are usually associated with variation in infant mortality are not considered sufficient in themselves to explain the consistent differences found in the different racial and cultural groups studied, and it is evident that joint medical and social-anthropological studies will be necessary to elucidate the significant social and biological factors governing the relationship of family health and infant growth and survival.

### Social Study

The foundation study of the Hindus has now progressed to the point where the significant social and cultural forces involved in their health status can be described. Among the more interesting observations have been those concerned with care of the new-born baby. Compared with Bantu and



Hindoebabas met baie groter sorg opgepas word as blanke en Bantoebabas. Afgesien van 'n aangepaste borsvoedingsverhouding, bestaan daar 'n gedurige intieme voeling tussen die moeder en haar baba. Dit sluit in spesiale stelsels van voeding, massering en bad van die baba en gebruik van olie en mediese middels. Die eenheid, moeder-kind, tree duidelik op die voorgrond in hierdie vroeë tydperk en word goedgekeur en bevorder deur tradisionele Hindoeplegtighede.

Na die basiese studie kan die eenheid nou voortgaan met sy voorgestelde studie van gesinsgesondheid en kinderoorlewing in verskillende rasse- en kultuurgroepe.

### Gesinstudies

'n Verskil is gevind in die kromme van gewigstoename vir Bantoe- en Indiërbabas, wat veral baie opvallend is in die eerste lewensmaande—die tydperk waarin die verskille in hul onderskeie sterftesyfers die duidelikste is. Bantoebabas groei in die tydperk baie vinniger as Indiërbabas waarskynlik ook vinniger as blanke babas van die ouderdom. Nogtans is dit die tyd wanneer hul sterftesyfer baie hoër is as die van blankes of Indiërs. Die Indiër se gewig, aan die ander kant, neem baie stadig toe sodat die gevolglike gewigskromme baie platter loop as vir die ander groepe. Dit gaan gepaard met 'n lae sterftesyfer.

Die Instituut vir Gesinsgesondheid se program van gesondheidsopvoeding het die voorkoms van Kwashiorkor aansienlik verminder. Noukeurige studies van babatjies en jong kinders het getoon dat gesinsverhoudings baie belangrik is in die simptomegroep. 'n Verslag word opgestel oor 'n geval wat as voorbeeld geneem kan word, waar die dood van die moeder die wegstuur van kinders na 'n inrigting en verbreking van die familieverband veroorsaak het, waarop Kwashiorkor in een kind en ernstige bloeddarmoede in 'n ander gevolg het. Dit lyk dus asof emosionele versteuring, saam met ontneming van die moeder, 'n belangrike faktor is in Kwashiorkor en ander simptomegroepe van ernstige ondervoeding in kinders.

### Groeistudies

Die groeistudies wat deur dr. Emily Kark en E. Salber uitgevoer is terwyl hulle beursouers van die Eenheid was (1950-53) verskaf nog materiaal vir studie en vir verslae deur die werkers.

Dr. Emily Kark is nou besig met die voltooiing van 'n verhandeling wat die invloede toon van sosiale stand op die ouderdom waarop die maandstonde begin. Haar vorige materiaal het 'n twyfelagtige resultaat hieroor gelewer, maar met die gestadige toename in gevalle kon sy 'n betekenisvolle verskil waarnem in puberteitsouderdom in verskillende sosiale stande van Indiërdogters.

European societies observed, a remarkable elaboration of infant care has been found in Hindu homes. The continuous close association of the mother with her baby, apart from an adjusted breast-feeding relationship, includes special treatments of a nutritional and medicinal nature, as well as a regime of manipulation of the baby by massage, oiling and bathing. The entity, mother-baby, is conspicuously demonstrated in this early period, sanctioned and promoted by traditional Hindu ritual.

With this foundation study the Unit is in the position of being able to further its proposed interracial and cross-cultural study in family health and child survival.

### Family Studies

A difference has been found in the curve of weight growth of Bantu and Indian babies, which is particularly marked in the early months of life—a period in which the difference in their respective mortality rates is most marked. The growth of the Bantu baby in this period is very much more rapid than is that of the Indian, and it would appear that it is more rapid than that of European babies at this age. And yet, this is the time when their mortality rate is so much higher than that of European or Indian babies. The Indian, on the other hand, has a very slow rate of weight increase, the resulting curve being very much flatter than in other groups. This is associated with a low mortality.

The Family Health Institute's programme of health education has reduced the incidence of kwashiorkor cases very considerably. Careful case studies of infants and young children have indicated that family relationships are of considerable significance in this syndrome. A report is being prepared of an illustrative case in which death of the mother, institutionalization and subsequent family disharmony was associated with kwashiorkor in one child and profound anaemia in another. It would thus seem that emotional disturbance associated with maternal deprivation is a significant factor in kwashiorkor and other syndromes of acute nutritional failure in children.

### Growth Studies

The growth studies carried out by Drs. Emily Kark and E. Salber while bursars in the Unit (1950-53) are still providing material for study and reports by these workers.

Dr. Emily Kark is now completing a paper showing the effects of social class on the age of menarche; her previous material produced a doubtful result in this connection, but with the steady accumulation of further cases she has been able to demonstrate a significant difference in puberty age in different social class groups of Indian girls.



## HARTNAVORSINGSEENHEID

*Hoof van die Eenheid:* DR. H. W. SNYMAN  
Algemene Hospitaal, Pretoria.

Die Eenheid is nog besig om opgebou te word om sy doelwitte te kan bereik, maar lewer reeds 'n taamlike groot diens aan die hospitaal in roetine diagnostiese werk. Hy het hom tot nog toe veral toegespits op 'n studie van die anatomiese en histologiese bevindings van die kroon-aarstelsel in allerlei leeftydsgroepe en by albei hoofrasse.

Die bedoeling is om die kliniese en veral die elektrokardiografiese beeld te probeer korreleer met die anatomiese en histologiese bevindings na dood. Daar word gebruik gemaak van Röntgen-kontrasopnames van die vatstelsel volgens die Schlesinger-tegniek. Aan die kliniese kant beskik die Eenheid ruimskoots oor materiaal en is gelukkig dat Blanke, Kleurling-, Bantoe- en Indiër-groepe in die hospitaal aanwesig is.

'n Bykomstige rigting van studie was die voorkoms van pulmonale hipertensie. Hier is veral getrag deur kateterstudies om die fisiologiese wisseling in die pulmonale vate en hulle verskeie invloede na te gaan en sodoende die aandeel van spasme in vergelyking met organiese vernouing in die etiologie van hipertensie te ondersoek.

Tuberkulose perikarditis was 'n interessante studie-bron en 'n vyftiental gevalle kon noukeurig gevolg word, klinies en met kateterstudies voor en na perikardiëktomie. Die bedoeling hier is veral om te probeer vaslê in watter tydperk van die ontwikkelingsgang van perikarditis die operatiewe ingreep gedoen behoort te word.

Voor die totstandkoming van die Harteenheid, gedurende 1952-54, is biochemiese studies gedoen by allerlei etiologiese groepe van hartversaking in 'n poging om die groep waarin geen duidelike oorsaak aangedui kon word nie, biochemies uit te ken. In die ondersoek is veral klem gelê op die pirodruiwesuur-stofwisseling.

Bondeltakblokbeelde in die elektrokardiogram is tans ontleed in verband met die diagnostiese en prognostiese waardes van die verskillende tipes.

## NAVORSINGSEENHEID VIR MENSLIKE BIOCHEMIE

*Hoof van die Eenheid:* DR. A. R. P. WALKER  
Suid-Afrikaanse Instituut vir Mediese Navorsing,  
Johannesburg.

### Kalsiummetabolisme van die Suid-Afrikaanse Bantoe *Chemiese samestelling en digtheid van been*

Vroeëre studies van die ribbe van Bantoes (babas, kinders en volwassenes) het getoon dat die persentasiesamestelling (as, kalsium, fosfor) binne dieselfde grense lê as wat gevind is vir blanke kontroles. Slegs in gevalle van ernstige ragitis by jong kinders was die minerale baie minder. Persentasiesamestelling verskaf egter min

## HEART RESEARCH UNIT

*Head of the Unit:* PROF. H. W. SNYMAN  
Pretoria General Hospital

The Unit is still being developed to be able to fulfil its functions properly. It fulfils an important function in the hospital in routine diagnostic work in which field it has concerned itself with a study of the anatomic and histological findings of the aorta-system in all age groups and in both main races.

The aim is to correlate the clinical and particularly the electrocardiographical picture with the anatomical and histological findings after death. Röntgen contrast surveys of the vascular system according to the Schlesinger technique are being used. On the clinical side the Unit has at its disposal ample material and is fortunate in that European, Coloured, Bantu and Indian groups are represented in the hospital.

A subsidiary line of study was the incidence of pulmonary hypertension. In particular, attempts were made to investigate by means of catheter studies the physiological variation in the pulmonary vessels and their different effects, and thus to determine the rôle of spasm in comparison with organic narrowing in the etiology of hypertension.

Tuberculous pericarditis was an interesting field of study and about fifteen cases were followed accurately by clinical and catheter studies before and after pericardiectomy, the main object being to determine in which stage of the development of pericarditis the operation should be done.

Before the inception of the Unit biochemical studies were done during 1952-54 in miscellaneous etiological groups of cardiac failure in an attempt to identify biochemically the group in which no obvious cause could be indicated. In this investigation particular attention was paid to the pyruvic acid metabolism.

Bundle branch block types in the electrocardiogram have now been analysed in connection with the diagnostic and prognostic values of the different types.

## HUMAN BIOCHEMISTRY RESEARCH UNIT

*Head of the Unit:* DR. A. R. P. WALKER  
South African Institute for Medical Research,  
Johannesburg

### Calcium Metabolism of the South African Bantu *Chemical composition and density of bone*

Previous studies on ribs from Bantu infants, children and adults, have shown the percentage composition (ash, calcium, phosphorus) to lie within the same ranges as have been observed for European controls. Only in cases of severe rickets in young children was the mineralization appreciably reduced.



inligting oor die digtheid en sterkte van Bantoebene in vergelyking met blanke bene. Die Eenheid is derhalwe besig met die insameling en ondersoek van 'n reeks vyfde ribbes van persone van albei rasse en bepalings word uitgevoer op beendigtheid sowel as chemiese samestelling. Later sal toetse vir breek- en trekrag in medewerking met die W.N.N.R. se Nasionale Fisiese Laboratorium uitgevoer word.

#### *Die voorkoms van ragitis in stedelike, omstedelike en plattelandse gebiede*

Aangesien die geleentheid daar is, word die ondersoek uitgevoer in medewerking met dr. Falcke, Cohen en Nestadt van die Coronation-hospitaal, Johannesburg. Verdere waarnemings het indrukke wat in verlede jaar se verslag vermeld is, bevestig, naamlik dat ernstige ragitis nie so dikwels in plattelandse as in stedelike bevolkings-groepe voorkom nie. Dit lyk asof verskille in blootstelling aan die beskikbare straling in groter mate verantwoordelik is as verskille in die dieet. 'n Aansienlike hoeveelheid bykomende inligting word terselfdertyd ingewin oor die voorkoms en duur van borsvoeding, belangrike statistieke oor gesinne, voorkoms van nawelbreuk, skurfte, ens.

#### *Die verhouding tussen lengte en gewig in Bantoemynwerkers*

In die loop van 'n onlangse ondersoek oor die invloed van kalsiumopname op die aanwas in lengte is die lengte en gewig van 'n paar duisend mynwerkers wat pas in verskeie gebiede gewerf is, verkry. Waarnemings het getoon dat vir 'n gemiddelde lengte van 5 vt. 6 dm. en 'n gemiddelde ouderdom van 23 jaar, die gemiddelde gewig 131 lb. was. Die hoogtesyfer is slegs 1-1½ duim minder as die gemiddelde syfers vir groepe militêre rekrute in die Verenigde State en Engeland tydens die laaste oorlog. Vir die genoemde gemiddelde hoogte en ouderdom van die Bantoe, is die ooreenkomstige gewig wat deur Amerikaanse standaardtabelle gegee word, sowat 138 lb. Hierdie waarnemings toon dat Bantoemynwerkers nie aanmerklik verpot of ondergewig is nie in vergelyking met blanke bevolkingsgroepe. Die moontlikheid dat die mynwerkers 'n uitgesoekte groep verteenwoordig, word byna heeltemal uitgesluit deur die ernstige arbeidstekort op die myne. Algemeen gesproke is die gevolgtrekking dus geregtig dat die kalorie-inname van die Bantoe van Suidelike Afrika nie onvoldoende is nie, hoewel dit ongetwyfeld deur seisoentekorte aan kos beïnvloed word.

#### **Ystermetabolisme van die Suid-Afrikaanse Bantoe**

##### *Die korrelasie tussen yster in die serum en lewersiderose*

In gevalle waar lewerbiopsie vir diagnostiese doeleindes onderneem word, word ook bepalings van yster in die serum en totale vermoë om yster te bind uitgevoer, om te sien of daar korrelasie bestaan tussen dié gegewens

Percentage composition data, however, give no information on the density and strength of Bantu bones as compared with those of Europeans. Accordingly, the Unit is collecting and examining a series of fifth ribs from subjects of both races, determinations of bone density being carried out, as well as of chemical composition. Later, tests for breaking and tensile stress will be undertaken in collaboration with the C.S.I.R. National Physical Laboratory.

#### *The incidence of rickets in urban, peri-urban and rural areas*

This investigation is being carried out, as opportunity offers, in collaboration with Drs. Falcke, Cohen and Nestadt of Coronation Hospital, Johannesburg. Further observations have confirmed impressions mentioned in last year's report, namely, that severe rickets occurs less frequently in rural populations as compared with urban populations. Differences in exposure to the available radiation would seem more responsible than differences in diet. Considerable additional data are being acquired at the same time concerning incidence and duration of breast feeding, vital family statistics, incidence of umbilical hernia, scabies, etc.

#### *The height-weight relationship in Bantu mine-workers*

In the course of a recent investigation bearing on the rôle of level of calcium intake on the attainment of height, the height and weight of several thousand newly recruited mineworkers from various regions were obtained. Observations showed that for their mean height of 5 ft. 6 ins. and mean age of 23 years, the mean weight was 131 lb. The height figure is only 1 to 1½ in. less than mean figures for groups of military recruits in the United States and Britain during the last war. For the stated mean Bantu height and age, the corresponding weight given by standard American tables is approximately 138 lbs. These observations demonstrate that Bantu mine-workers are neither seriously stunted nor underweight when compared with white population groups. The possibility that the mine-workers represent a selected group is almost excluded by the acute shortage of labour on the mines. It would therefore seem reasonable to consider that, speaking generally, the calorie intake of the Bantu of Southern Africa is not inadequate, although the position is doubtless affected by seasonal shortages of food.

#### **Iron Metabolism of the South African Bantu**

##### *The correlation between serum iron and hepatic siderosis*

On occasions when liver biopsy is undertaken for diagnostic purposes, determinations of serum iron and total iron binding capacity have been carried out in order to assess the measure of cor-



en die graad van siderose soos histopatologies van die biopsiemonster bepaal. Die ondersoek, wat in medewerking met dr. J. Higginson en A. Keeley van die Baragwanath-hospitaal uitgevoer word, is hoofsaaklik 'n langtermynstudie. Resultate wat tot dusver verkry is, toon 'n noue, maar nie konstante korrelasie tussen die peil van serum-yster en intensiteit van ysterafsetting in die lewer.

*Yster in die serum en melk van die moeder en in die lewer van babas*

Yster in moederserum is die bron van die element in die fetus en moedersmelk. Aangesien die ysterinhoud in die serum van Bantoemoeders dikwels hoog is, is dit as die moeite werd beskou om die ysterkonsentrasie van 'n reeks lewers van Bantoebabas by ouderdomme tussen geboorte tot een jaar te bepaal, asook die ysterkonsentrasie in moederserum en moedersmelk in 'n groep Bantoemoeders. Gegewens oor 30 sulke Bantoebabas het getoon dat ysterwaardes tussen dieselfde grense lê as die vir blanke babas alhoewel dit taamlik laag was. Ook dui die paar waarnemings wat tot dusver gemaak is nie op enige verband tussen die konsentrasie van yster in moederserum en in moedersmelk nie. Dit lyk dus asof die oormaat van yster in die Bantoemoeder nie 'n groot invloed het op die ystervoorraad van haar baba voor of na geboorte nie.

*Die histopatologie en ysterkonsentrasie van werwelliggame van volwasse Bantoes gewoon aan hoë ysteropname*

In 'n vorige verhandeling (1953) in die Amerikaanse „Journal of Pathology” is die aandag gevestig op die algemene voorkoms van makrofage wat hemosiderien bevat in die borsbeenmurgsmere van volwasse Bantoe-pasiënte. In 'n paar gevalle is verspreide idiopatiese osteoporose, met instorting van die werwels met 'n intense bruin kleur te wyte aan abnormale ysterafsetting, waargeneem. Met die oog op die moontlikheid dat 'n groot oormaat van yster in sommige gevalle die instorting van die werwels mag veroorsaak, is daar besluit op 'n studie van die histopatologie, die konsentrasie van yster, as en kalsium, en die digtheid van vyfde borswerwelliggame afkomstig van 'n reeks lykskouings van volwasse Bantoes, met materiaal van volwasse blankes as kontrole. Die studie is in medewerking met dr. B. J. P. Becker en dr. G. A. Grobbelaar (S.A.I.M.N.) onderneem en materiaal van lykskouings by die Baragwanath- en Johannesburgse Algemene Hospitaal is gebruik. Daar is bevind dat (a) buitengewoon hoë ysterkonsentrasies algemeen voorkom—15 persent van die liggame van agtereenvolgende lykskouings het konsentrasies van meer as een persent yster (droë gewig) getoon, d.w.s. sowat 30 keer meer as die normale syfer, en (b) daar geen duidelike korrelasie bestaan tussen konsentrasie, die persentasie of hoeveelheid van yster en die van as of kalsium nie,

relation between these data and the degree of siderosis present, as assessed histopathologically from the biopsy sample. This investigation, which is being carried out in association with Drs. J. Higginson and A. Keeley, of Baragwanath Hospital, is essentially a long-term study. Results obtained up to the present indicate a close, although not invariable, correlation between level of serum iron and intensity of iron deposition in the liver.

*Maternal serum iron, breast milk iron, and infant hepatic iron concentrations*

Maternal serum iron is the source of foetal iron, and of breast milk iron. Since the serum iron level of Bantu mothers is frequently elevated, it was thought worth-while to determine the iron concentration of a series of livers from Bantu infants aged from birth to one year, and the maternal serum iron and breast milk iron concentrations in a series of Bantu mothers. Data on 30 such Bantu infants have shown values to be somewhat low, although lying within the same range as has been reported for European infants. Furthermore, the few observations undertaken thus far suggest that there is no correlation between maternal serum iron and breast milk iron concentrations. It would seem, therefore, that iron “overload” in the Bantu mother does not markedly affect the iron stores of her infant before or after birth.

*The histo-pathology and iron concentration of vertebral bodies from Bantu adults habituated to a high iron intake*

In a paper published in the *American Journal for Pathology* in 1953, attention was drawn to the commonness of haemosiderin-containing macrophages in the sternal marrow smears from adult Bantu patients. In a small number of cases, generalized idiopathic osteoporosis, with collapse of the vertebrae have been noted, such vertebrae showing intense brown coloration, due to abnormal iron deposition. In view of the possibility that under certain conditions gross iron “overload” may promote collapse of the vertebrae, it was decided to study the histo-pathology, the concentration of iron, ash, and calcium, and the density of 5th thoracic vertebral bodies from a series of necropsies of Bantu adults and also from European adults to act as controls. This study has been undertaken in collaboration with Dr. B. J. P. Becker and Dr. G. A. Grobbelaar (S.A.I.M.R.) using necropsy material from Baragwanath Hospital and the Johannesburg General Hospital. Briefly, it has been found that (a) extremely high iron concentrations are common: 15 per cent of bodies from consecutive necropsies had concentration exceeding 1 per cent iron dry weight, i.e., about 30 times the normal proportion present; and, (b) there appears to be no clear-cut correlation between iron concen-



d.w.s. ernstige siderose gaan nie noodwendig gepaard met lae mineraalkonsentrasie nie. Dit wil dus voorkom dat siderose nie die belangrikste oorsaak is nie van die instorting van werwels wat soms in volwasse Bantoes gevind word; of dit daartoe bydra sal egter verder ondersoek word.

#### **Dieet, Cholesterolkonsentrasie in Serum en Aterosklerose**

*'n Vergelyking van patologiese gradering en chemiese samestelling van aortas van bejaarde Bantoes en blankes*

Die huidige patologiese gradering van aterosklerotiese letsels aan die aorta word gedoen deur waarnemings met die blote oog. Daar 'n groot subjektiewe faktor hierby betrokke is, word gepoog om iets uit te vind omtrent die verskille in die chemiese samestelling van Bantoe-aortas (wat gewoonlik slegs klein letsels toon) en blanke aortas (wat letsels van ernstige graad mag wys). Die ondersoek word uitgevoer in medewerking met dr. B. J. P. Becker en dr. J. Higginson (S.A.I.M.N.). Die Chemiese studies sluit in bepalinge van kalsium, vet, fosfolipied, cholesterol, elastien, kollageen en muko-polisakkarides. Hoewel die ondersoek nog aan die gang is, is dit reeds duidelik dat toenemende ouderdom slegs betreklik klein veranderinge veroorsaak in die gewig en samestelling van aortas van volwasse Bantoes in teenstelling met die groot veranderinge wat dikwels in die aortas van blankes gevind word. Die gegewens dui daarop dat, algemeen gesproke, die aortas van selfs bejaarde Bantoes ooreenstem met die van jeugdige blankes. Die ondersoek duur voort.

#### *Waardes van serumcholesterol in swaarlywige Bantoevroue*

Terwyl dit betreklik seldsaam is vir Bantoomans om baie vet te word, gebeur dit taamlik algemeen onder Bantoevroue, veral na hulle kinders gehad het. Dit is dus as die moeite werd beskou om serumcholesterolkonsentrasies in 'n groep van sulke vroue te bepaal, in medewerking met dr. A. Keeley, Baragwanath-hospitaal. By dieselfde hospitaal is dr. J. Higginson besig om by lykskouings gegewens in te samel oor die aard en uitgebreidheid van aterosklerotiese letsels in swaarlywige Bantoevroue en dit te vergelyk met die in ooreenstemmende Bantoevroue wat egter nie vet is nie. Die bevinding tot dusver is kortliks dat vetsug in Bantoevroue—wat eerder toegeskryf moet word aan die eet van 'n oormaat koolhidraat as van te veel vet—gepaard gaan met betekenisvolle hoë cholesterolkonsentrasies in die serum. Dit is teenstrydig met waarnemings gemaak op Amerikaanse vroue waar vetsug skynbaar geen verband het met serumcholesterol nie.

tration and ash and calcium concentrations reckoned on either percentages or total basis i.e., severe siderosis is not necessarily associated with low mineral concentration. It would therefore appear that siderosis is not the major causal factor in the collapse of vertebrae occasionally seen in adult Bantu; as a promotive factor, however, the rôle of siderosis will be investigated further.

#### **Diet, Serum Cholesterol Concentration and Atherosclerosis**

*A comparison of pathological grading and chemical composition of aortae from elderly Bantu and European subjects*

The present pathological grading of atherosclerotic lesions of the aorta is based on naked eye observations. In view of the measure of subjectivity involved, an endeavour is being made to learn something of the differences in the chemical composition of Bantu aortae with minimal lesions normally present, and European aortae which have lesions of varying severity. This investigation is being carried out in collaboration with Dr. B. J. P. Becker and Dr. J. Higginson (S.A.I.M.R.). Chemical studies include determinations of calcium, fat, phospholipid, cholesterol, elastin, collagen and muco-polysaccharides. Although the investigation is still in progress, it is already clear that relatively small changes occur in the weight and composition of adult Bantu aortae with increasing age, in contrast to the gross changes which usually occur in the aortae of Europeans. Data give the impression that, speaking generally, Bantu aortae, even from aged subjects, resemble the aortae of young Europeans. Further work is proceeding.

#### *Serum cholesterol values in obese Bantu women*

Whilst it is relatively uncommon for Bantu men to become obese, it is common for Bantu women, particularly after child bearing. It was therefore thought worthwhile to determine serum cholesterol levels in a group of such women, this work being undertaken in collaboration with Dr. A. Keeley, Baragwanath Hospital. At the same hospital, Dr. J. Higginson is collecting data on the nature and extent of atherosclerotic lesions in obese as compared with non-obese, but otherwise comparable, Bantu women observed at necropsy. Briefly, it has been found that obesity in Bantu women, which is likely to arise from the ingestion of excessive carbohydrate rather than increased fat, is associated with significantly elevated serum cholesterol levels. This finding stands in contrast to observations on American women, among whom obesity does not correlate with elevated serum cholesterol concentrations.



## Voedingstudies op Bantoebabas en Jong Kinders

### *Metionienkonsentrasie in die Melk van Bantoe moeders*

Daar is berig dat Wes-Afrikaanse moeders in Dakar 'n laer konsentrasie metionien in hul melk het as Amerikaanse moeders. Aan die ander kant is bevind dat die konsentrasie van die aminosuur in die melk van Indiese moeders normaal was, selfs al het hul babas aan kwashiorkor gely. Metionienkonsentrasies in die melk van Bantoe moeders is dus ondersoek. Dit is gevind dat die skommelinge en gemiddelde waardes normaal is. Moontlik is die tekort wat in die melk van die Dakarmoeders gevind is, te wyte aan die bepalingmetode wat gebruik is.

### *Die seldsame voorkoms van kinderskeurbuik in Bantoe babas en jong kinders*

'n Uitgebreide ondersoek het getoon dat die gewone graanpappe en soortgelyke kosse waarmee Bantoe babas gespeen word, min of geen vitamien C bevat. Aangesien sulke kosse dikwels die enigste bron van voeding is, sou 'n mens verwag dat duidelike kinderskeurbuik baie algemeen sou voorkom. Dit is egter nie die geval nie, en voorkoms van dié gebreksiekte word selde aangemeld. Om dit te verklaar is kliniese en radiologiese ondersoeke op 'n groep ondervoede babas, beide hospitaal en buitepasiënte, uitgevoer in medewerking met dr. H. C. Falcke, senior kindergeneesheer aan die Coronation-hospitaal. Geen tekens van skeurbuik is gevind nie en vitamien C-waardes van die plasma was in ooreenstemming met die afwesigheid van die siekte. Dit dui op 'n bron van vitamien C, dieetkundig of endogeen in oorsprong, wat nog nie verklaar kan word nie.

### *Die metabolisme van voedingstowwe deur jong Bantoe kinders wat aan kwashiorkor ly*

Die vraagstuk word bestudeer met behulp van 'n metaboliese bed, in medewerking met dr. E. Kahn, senior kindergeneesheer van die Baragwanath-hospitaal. Ongelukkig was manlike pasiënte, geskik vir intensiewe ondersoek (d.w.s. vry van toring, ens.), skaars en minder werk is gedoen as wat beplan was.

## VOEDINGNAVORSINGSEENHEID

*Hoof van die Eenheid:* PROF. J. GILLMAN

Universiteit van die Witwatersrand, Johannesburg.

### Voeding

#### *Aanvulling van mieliediëte*

Die ontleding van die groot massa materiaal wat ingesamel is, vorder geleidelik, maar dit het langer geduur as

## Nutritional Studies of Bantu Babies and Young Children

### *Methionine concentration of Bantu breast milk*

West African mothers living in Dakar have been reported to have lower concentration of methionine in their breast milk when compared with values reported for American mothers. On the other hand, the concentration of the amino acid in the milk of Indian mothers, even when their babies were suffering from kwashiorkor, has been reported to be normal. Accordingly, methionine levels in Bantu breast milk were investigated. Determinations have revealed the range and mean value to be normal. It is considered possible that the deficiency reported in the milk of the Dakar mothers is due to the method of determination employed.

### *The rarity of infantile scurvy among Bantu infants and young children*

Extensive investigation has shown that the usual cereal "paps" and similar foods used in the weaning of Bantu infants contain little or no vitamin C. Since such foods quite frequently provide the sole source of nourishment, frank infantile scurvy would be expected to be common. This is not the case, however, for reports of the deficiency disease occurring are extremely rare. To throw more light on the subject and in collaboration with Dr. H. C. Falcke, Senior Paediatrician, Coronation Hospital, clinical and radiological examinations have been carried out on a series of malnourished hospitalized and out-patient infants. No evidence of scurvy was found; moreover, plasma vitamin C values were consistent with an absence of the disease. These findings point to a source of vitamin C, of either dietary or endogenous origin, which cannot be explained at present.

### *The metabolism of nutrients by young Bantu children suffering from kwashiorkor*

Studies on this problem are being carried out using a metabolic bed, in collaboration with Dr. E. Kahn, Senior Paediatrician, Baragwanath Hospital. Unfortunately, male patients appropriate for intensive investigation (i.e. free from tuberculosis, etc.) have been few, and less work has been carried out than was planned.

## NUTRITION RESEARCH UNIT

*Head of the Unit:* PROF. J. GILLMAN

University of the Witwatersrand, Johannesburg.

### Nutrition

#### *Supplementation of maize diets*

The analysis of the great mass of material which has been accumulated is proceeding steadily, but has taken longer than anticipated. Every effort



wat vermag was. Alle pogings word aangewend om die werk so gou as moontlik af te handel.

#### *Invloed van dieet op die lewensgang van die rot*

Proefnemings om die invloed van drie verskillende diëte op die lewensgang van meer as 1,000 rotte te ondersoek, is voltooi. Dit is duidelik dat dieet die uitbreek van 'n paar verskillende soorte siektes kan bevorder of terughou, veral hart- en nieraandoenings en die voorkoms van gewasse in die buislose kliere. Dit is ook merkwaardig dat 'n besonder groot aantal skildklierkarsinome in rotte voorkom wat op een van die proefdiëte gevoer is. Elke stadium in die ontstaan van skildklierkarsinoom is in hierdie rotte geïdentifiseer en dit kom nou ooreen met die wat vir die mens aangeneem word.

Met een van die diëte is gewasse van die hipofise heeltemal onderdruk, in teenstelling met 'n voorkoms van 20% in rotte van vergelykbare ouderdom wat op 'n ander dieet gevoer is. Hierdie waarnemings toon dat dieet 'n belangrike rol speel by die bevordering, vertraging of uitskakeling van hipofise gewasse en dit bevestig ander proefwaarnemings wat hieronder aangehaal word. Ook kon die ontwikkeling van retikulosarkoom van die timusklier deur dieetkundige tegniek uitgeskakel word.

'n Voorlopige ontleding van die groeikromme van mannetjie- en wyferrotte toon 'n opvallende verband tussen groeisnelheid en lewensverwachting. As die maksimumgewig in 'n vroeë stadium bereik word, is die lewensverwachting ooreenkomstig korter.

#### *Program in samewerking met dr. Loustalot (Basel) en dr. Saxen (Helsinki)*

Die projek is in 1952 begin maar nog nie voltooi nie omdat baie van die proefdiere nog lewe. Dit is egter reeds duidelik dat genetiese faktore ongetwyfeld die kosbenutting verander. Dit word nou ondersoek of genetiese faktore in ons laboratoriumtoestande nog in derde en vierde geslagte van die rotte wat uit Switserland en Finland verkry is, 'n invloed sal hê.

#### *Vitamiën A-metabolisme*

Die studies in samewerking met die Nasionale Chemiese Navorsingslaboratorium vorder goed. Die verbeterde metode vir die biobepaling van vitamien A, wat deur die Eenheid uitgewerk is, skakel al die nadele van die gewone genesende metodes uit en het baie noukeurige bepalings van die vitamien A-vereiste van die rot moontlik gemaak. Daar is getoon dat die vitamien A-vereiste nie 'n funksie van die proteïengehalte van die dieet of van groei is nie, hoewel groei deur die hoeveelheid vitamien A in die dieet en ook deur proteïene beheer kon word.

Dit is getoon dat die ontstaan van nierverskalking in rotte met 'n tekort aan vitamien A 'n funksie is van die hoeveelheid kalsium en fosfor in die dieet, asook van die

is being made to complete this work as soon as possible.

#### *Effect of diet on the life-track of the rat*

Experiments designed to examine the effects of three different diets on the life-track of over 1,000 rats have been concluded. It is evident that diet is capable of promoting or retarding the onset of several different kinds of diseases, notably cardio-renal disease and the incidence of tumours of the endocrine glands. Noteworthy too is the remarkably large number of thyroid carcinomata occurring in rats fed on one of these experimental diets. Every stage in the pathogenesis of thyroid carcinoma has been identified in these rats and is remarkably similar to the pathogenesis suggested for Man.

On one of the diets, pituitary tumours have been completely suppressed in contrast to a 20% incidence on a different diet in rats of comparable ages. The latter observation indicates that diet plays an important part in promoting, retarding or eliminating the incidence of pituitary tumours and adds confirmation to other experimental observations to be cited below. In addition, it has been possible to exclude the development of thymic reticulosarcomata by dietary techniques.

A preliminary analysis of the growth curves of male and female rats reveals a striking correlation between speed of growth and expectation of life. When maximum weight is achieved at an early age, the expectation of life is correspondingly shortened.

#### *Collaborative programme with Dr. Loustalot (Basel) and Dr. Saxen (Helsinki)*

This project, which was initiated in 1952, is not yet completed owing to the fact that many of the experimental animals are still alive. It is already apparent, however, that genetic factors unquestionably alter the utilization of food. Whether genetic factors will continue to operate, under the conditions of our laboratory, in third and fourth generation offspring of the rats obtained from Switzerland and Finland, is now being investigated.

#### *Vitamin A Metabolism*

The collaborative work with the National Chemical Laboratory is continuing smoothly. The improved method for the bio-assay of vitamin A, elaborated by the Unit, eliminates all the disadvantages of the widely-used curative methods and has enabled very precise determinations to be made of the minimum vitamin A requirements of the rat. It has been shown that the vitamin A requirements are not a function of the protein content of the diet nor of growth, although growth can be regulated by the amount of vitamin A in the diet no less than by proteins.

The production of nephrocalcinosis in vitamin A deficient rats has been shown to be a function of

geslagshormone. Dit lyk asof oormatige groei van die galbuis in diere met 'n tekort aan vitamien A, wat voorheen deur die Eenheid beskryf is, gepaard gaan met 'n versteuring in kalsium- fosfor- en ystermetabolisme.

#### *Kalsium-, fosfor-, yster- en vitamien D-metabolisme*

As gevolg van die Eenheid se werk oor ystermetabolisme in die mens, het dr. Hegsted en Finch van die Harvard-Universiteit, 'n reeks proefnemings gedoen om die faktore wat ysterabsorpsie beheer, te verklaar. Hulle het tot die gevolgtrekking geraak dat die peil van fosfor in die dieet op die een of ander manier die ysterabsorpsie wysig. Deur sy werk uit te brei, kon die Eenheid daarin slaag om die ysterabsorpsie te beïnvloed deur die minerale inhoud van die dieet te wysig.

Tydens ondersoeke in 1954 het die Eenheid vitamien D gebruik en het getoon dat in ysterryk diëte met 'n lae kalsiuminhoud, 'n oormaat yster in die elastiese lae van die aorta en in ander slagare ophoop. Terselfdertyd het dit duidelik geword dat vitamien D, kalsium en fosfor 'n belangrike rol speel by die instandhouding van die gladde spiere van die slagare, maag, grootderm en die hartspier. Die werking van vitamien D en die rol van kalsium en fosfor in metabolisme het verskeie belangrike rigtings van ondersoek aangedui. Die inligting word nou gereedgemaak vir publikasie.

#### *Dieet en karsinoom van die lewer*

In die verslag vir 1953-54 is vermeld dat een van die diëte wat in die laboratorium uitgewerk is ernstige hiperplasia van die galbuis kon veroorsaak wat nie onderskei kon word van die wat in rotte ontstaan het wat met bottergeel gevoer is nie. 'n Groot klomp rotte is op dieselfde dieet geplaas om vas te stel of die galbuisreaksie in kanker sou verander. Die rotte is nou reeds vir 'n jaar op die dieet en toon reeds ernstige lewerbeskadiging.

#### *Pigmentmetabolisme in ondervoeding*

Tot dusver is min aandag bestee aan die pigmentveranderinge wat voorkom in ondervoede natuurlike kinders en volwasse natuurlike. Met die oog op die moontlike skakel tussen voeding en pigmentmetabolisme is besluit om die chemiese samestelling van die melanienkorreltjie te ondersoek.

- (a) Die melanienkorreltjie bestaan nie net uit pigment nie, maar het 'n samestelling wat net so ingewikkeld is soos die van mitochondrië of mikrosoom. Proteïen, lipied, nukleïensuur, koper, yster en sink vorm saam met die pigment die melanienkorreltjie.
- (b) Die pigment van die melanienkorreltjie het fisies-

the level of calcium and phosphorus in the diet as well as of the sex hormones. The bile duct hyperplasia in vitamin A deficient animals, previously described from the Unit, appears to be associated with a disturbance in calcium, phosphorus and iron metabolism.

#### *Calcium, phosphorous, iron and Vitamin D metabolism*

As a result of the Unit's work on iron metabolism in Man, Drs. Hegsted and Finch of Harvard University conducted a series of experiments to elucidate the factors regulating the absorption of iron. They concluded that the level of phosphorus in the diet in some way modified the absorption of iron. In extending their work the Unit has been able to influence the absorption of iron by altering the mineral content of the diet.

In the course of investigations in 1954, the Unit used vitamin D and has demonstrated that, in low calcium-high iron diets, iron accumulates excessively in the elastic laminae of the aortae and in other arteries. At the same time, it has become apparent that vitamin D, calcium and phosphorus play a crucial rôle in maintaining the integrity not only of the smooth muscle of the arteries but also of the smooth muscle of the stomach and large bowel and of the cardiac muscle. The action of vitamin D and the rôle of calcium and phosphorus in metabolism has disclosed several important avenues of investigation. This information is now being collated for publication.

#### *Diet and carcinoma of the liver*

In the 1953-1954 report, it was mentioned that one of the diets elaborated in the laboratory was capable of inducing severe hyperplasia of the bile ducts, indistinguishable from that occurring in the rats fed butter yellow. A large series of rats was put on to the same diet in order to ascertain whether the bile duct reaction would undergo a cancerous change. These rats have now been on the diet for one year and are already showing severe liver injury.

#### *Pigment metabolism in malnutrition*

The pigmentary changes occurring in malnourished infants and adult Bantu have hitherto received little attention. In view of the possible link between nutrition and pigment metabolism, it was decided to investigate the chemical structure of the melanin granule.

- (a) The melanin granule does not consist merely of pigment but possesses a structure having the complexity of the mitochondria or the microsome. Protein, lipid, nucleic acid, copper, iron and zinc are associated with pigment in the melanin granule.
- (b) The pigment of the melanin granule pos-



chemiese eienskappe soortgelyk aan die van die pigmente wat deur die ensimatisiese en nie-ensimatisiese oksidasie van tirosien en 'n derivaat daarvan gevorm word.

- (c) Uit 'n oorsig van die beskikbare inligting oor die meganisme van die omvorming van tirosien na sintetiese melanien, kan afgelei word dat daar tussen sekere melaniens verskille mag wees wat spektrofotometries vasgestel en moontlik toegeskryf kan word aan wisselmetilering van tussenverbindings tydens die polimerisering van tirosien.
- (d) Die chemiese bestanddele wat in die melanien-korreltjie gevind is, speel moontlik elk 'n bepaalde rol in melanogenese. 'n Uitgebreide meganisme vir melanogenese is oorweeg.
- (e) Die vorming van melanienpigment mag òf die belangrikste funksie òf slegs 'n toevallige neuprodukt wees van die werking van die melanien-korreltjie.

Met die oog op die moontlikheid dat verskille tussen melaniens die gevolg mag wees van wisselmetilering van tussenverbindings tydens die polimerisering van tirosien, bestaan daar 'n moontlikheid dat die kleurveranderinge in die vel van ondervoede persone afhang van die metabolisme van metionien en sistien.

#### **Ekperimentele Kankerverwekking**

##### *Voorkoming van retikulosarkoom wat deur tripanblou veroorsaak word*

Dit is nou met sekerheid vasgestel dat tripanblou retikulosarkoom kan veroorsaak. Vorige werk van die Eenheid het getoon dat retikulosarkoom wat eksperimenteel veroorsaak word, voorkom kan word deur skildklierwerking te onderdruk deur middel van medisyne of skildklierverwydering. Selfs ondervoeding wat soos bekend, 'n invloed op die skildklierwerking uitoefen, onderdruk die ontstaan van retikulosarkoom. Die werk verskaf eksperimentele bewyse ter steuning van Casal se waarnemings dat die voorkoms van retikulose in Frankryk afgeneem het gedurende die tweede wêreldoorlog met 'n afname in die voedingspeil. Dit moet vermeld word dat as retikulosarkoom eers verskyn het, krimpings van die gewas nie teweeggebring kan word deur die skildklierwerking te onderdruk nie.

##### *Rol van die Skildklier in onderdrukking van hipofise gewasse wat deur estrogeen veroorsaak is*

In opvolging van die studies wat getoon het dat dieet op die een of ander manier in verband staan met die bevordering of onderdrukking van die ontwikkeling van gewasse van die hipofise in rotte, is proewe opgestel om die vorming van hipofise gewasse te verklaar. Weer is getoon dat onderdrukking van die skildklierwerking deur tioüreum, tioürasil of skildklierverwydering oormatige groei van die hipofise en gewasvorming onderdruk het in

sesses physico-chemical properties similar to those pigments formed by the enzymic and non-enzymic oxidation of tyrosine and of a derivative thereof.

- (c) From a review of the available information on the mechanism of the transformation of tyrosine into synthetic melanin, it is suggested that differences may exist between certain melanins, these differences being detectable spectro-photometrically, and being due, possibly, to a differential methylation of intermediate compounds during the polymerisation of tyrosine.
- (d) Possible roles in melanogenesis are assigned to the chemical constituents found in the melanin granule. An extended mechanism for melanogenesis has been considered.
- (e) The formation of melanin pigment may prove to be the most important function, or only an incidental by-product, of the activity of the melanin granule.

In view of the possibility that differences existing between melanins are due to a differential methylation of intermediate compounds during the polymerisation of tyrosine, a possibility exists that the colour-changes in the skin of malnourished subjects are dependent on the metabolism of methionine and cystine.

#### **Experimental Carcinogenesis**

##### *Prevention of trypan blue induced reticulosarcoma*

The production of reticulosarcoma by trypan blue is now well established. Previous work of the Unit has demonstrated that it is possible to prevent experimentally induced reticulosarcoma by depressing thyroid function, either with the aid of drugs or by thyroidectomy. Even underfeeding, which is known to affect thyroid activity, suppresses the emergence of reticulo-sarcoma. This work provides experimental evidence in support of Casal's observations that the incidence of the reticulososes declined in France during World War II, with a decline in the level of nutrition. It should be mentioned that once the reticulum sarcoma has appeared, it is not possible to cause involution of the tumour by depressing the functional activity of the thyroid gland.

##### *Rôle of thyroid in suppressing oestrogen-induced pituitary tumours*

Following up the studies which demonstrated that diet is in some way concerned with promoting or inhibiting the development of pituitary tumours in rats, experiments were designed to elucidate the mechanism involved in the production of pituitary tumours. Again it was shown that depression of thyroid function either by thiourea, thiouracil or thyroidectomy inhibited pituitary hyperplasia and

rotte wat met estrogeen behandel is, terwyl tiroksien die teenoorgestelde uitwerking het. Ondervoeding van die rotte het ook gelei tot onderdrukking van die gewasvormende uitwerking van estrogeen. Dit is dus duidelik dat sommige van die invloede van ondervoeding deur die skildklier oorgedra word.

#### **Eksperimentele Fisiologie van die Bobbejaan**

##### *Watermetabolisme in die bobbejaan*

Langtermynstudies van watermetabolisme in bobbejane is nou voltooi en die manuskripte is in die pers. Kortliks, daar is getoon dat in 13 normale volwasse wyfie-bobbejane wat daagliks vir 1 tot 4 jaar lank gewee is, die gewigtoename in die tydperk van die siklus voor ovulasie gewissel het van 0.7 tot 6.3 kg. en gewoonlik tussen 1/9 en 1/6 van die totale liggaamsgewig was. Die toename in liggaamsgewig gedurende die opswelling kon gekorreleer word met die werklike gewig van die boudnaat volgens sy volume bereken. Met balansstudies is getoon dat die metabolisme van water in die bobbejaan 'n patroon volg soortgelyk aan die wat in vroue beskryf is. In beide bobbejane en vroue kon terughouding van water onmiddellik voor of tydens ovulasie voorkom, gevolg deur oormatige urienafskieding binne die volgende paar dae. Verder het onreëlmatighede in watermetabolisme in die bobbejaan en in vroue voorgekom gedurende die laaste week van die siklus, in die vorm van kortstondige wisselings in liggaamsgewig in die bobbejaan, en, in uitsonderlike gevalle, as voormenstruasie-edeem in vroue. Dit is getoon dat die sikliese veranderinge in watermetabolisme in bobbejane en in vroue van dieselfde basiese endokriënwerking afhanklik is.

##### *Chemie van damvloeistof in die bobbejaan*

Twee nagraadse studente het spesifiek die beweging van water in en uit die damweefsels chemies en histologies ondersoek. Bestudering van die chemiese samestelling van die damvloeistof het getoon dat die vloeistof in die boudnaat nie van weefselvloeistof in die algemeen verskil nie. Dié belangrike waarneming maak 'n ondersoek moontlik van die faktore wat weefselvloeistowwe beheer op 'n manier wat nie maklik moontlik is in enige ander dier nie. Dit is van besondere betekenis met die oog op die huidige belangstelling in die aard van die basiese bestanddeel en sy verhouding tot bloedplasma.

##### *Lipied- en vetmetabolisme in die bobbejaan*

Die werk oor vetmetabolisme van die bobbejaan is ywerig voortgesit en vyf verhandelinge oor die onderwerp is tans in die pers. Hulle gaan onderskeidelik oor proteïengebonde jodium in die serum van die bobbejaan, *in vitro*-jodering van serumproteïene en melkproteïene, hoeveelhede van proteïengebonde jodium in die serum van soogbobbejaantjies voor en na abortsie, en die invloed van verwydering van die hipofise op totale en proteïengebonde jodiuminhoud van die serum en skildklier van die bobbejaan.

tumour formation in oestrogen-treated rats whereas thyroxin has the reverse effect. Underfeeding of the rats also resulted in an inhibition of the tumour, producing effects of oestrogen. It is therefore apparent that some of the effects of underfeeding are mediated in part via the thyroid gland.

#### **Experimental Physiology in the Baboon**

##### *Water metabolism in the baboon*

Long-term water metabolism studies in baboons have now been completed and the manuscripts sent to press. In brief, it was shown that in 13 normal adult female baboons, weighed daily for 1 to 4 years, the amount of weight gained in the preovulatory part of the cycle varied from 0.7 to 6.3 kg. and usually represented between 1/9 and 1/6 of the total body weight. The amount of body weight accumulated during turgescence could be closely correlated with the actual weight of the perineum calculated from its volume. From balance studies, it was demonstrated that the metabolism of water in the baboon followed a pattern similar to that described in women. Both in baboons and women, water retention could occur immediately before or at the time of ovulation, followed by diuresis within the next few days. Furthermore, instabilities in water metabolism occurred in the baboon and in women during the last week of the cycle, manifest as transitory fluctuations in body weight in the baboon, and, in abnormal instances, as premenstrual oedema in women. It was shown that the cyclical changes in water metabolism in baboons and in women are dependent upon basically similar endocrine mechanisms.

##### *Chemistry of perineal fluid in the baboon*

The specific movement of water in and out of the perineal tissues has been examined chemically and histologically by two postgraduate students. Analysis of the chemical composition of the perineal fluid demonstrated that the fluid in the perineum is no different from tissue fluid generally. This important observation permits an investigation of the factors regulating tissue fluids in a way which is not easily possible in any other animal and has particular significance in view of current interest in the nature of the ground substance and its relationship to blood plasma.

##### *Lipid and fat metabolism in the baboon*

The work on fat metabolism in the baboon has been actively pursued, and five papers dealing with this subject are at present in the press. These deal respectively with protein bound iodine in the serum of the baboon, *in vitro* iodination of serum proteins and milk proteins, pre- and post-absorptive serum PBI values in suckling baboon infants and the influence of hypo-physectomy on total and protein-bound iodine content of the serum and thyroid of the baboon.



#### *Duur van die funksie van die corpus luteum van swangerskap*

Noukeurige waarnemings het ons in staat gestel om die ovulasietydperk in die bobbejaan so kort te stel as 24 tot 48 uur. Ten gevolge hiervan kon parings op presies die regte tyd gereël word en die samestelling van die eierstok gedurende vroeë swangerskap waargeneem word. Daar is bevind dat die corpus luteum (geelliggaam) op die 25ste dag *na bevrugting* verwyder kon word sonder om die voortbestaan van die ingeplante embrio in gevaar te bring. Dit is gesuggerer dat met die vatvorming in die vlokke 'n nuwe embrio-moeder-verhouding intree waardeur die voortduur van die embrio-ontwikkeling nie meer afhanklik is van die uitskeidings van die geelliggaam nie.

#### **Algemeen**

Die Wêreldorganisasie vir Gesondheid het reëlings getref vir professor M. Payet, Professor in die Medisyne en Dekaan van die Mediese Skool in Dakar en professor J. Gillman om samesprekings te voer oor die vraagstuk van lewercancer. Professor Payet het die Eenheid in April 1955 besoek en twee weke in die laboratoriums deurgebring. Hy het ook samesprekings gevoer met ander werkers in Johannesburg wat in kanker belang stel.

Die Wereldorganisasie vir Gesondheid het nou weer professor Gillman versoek om 'n besoek aan Dakar te bring om die beplanning en die werk wat in Johannesburg aangevoer is 'n stap verder te voer.

Die Direkteur van die Kankernavorsingseenheid in Nieu-Seeland, dr. F. Bielschowsky, het in Desember 1954 'n besoek van drie weke aan die Eenheid gebring.

#### **TERINGNAVORSINGSEENHEID**

*Hoof van die Eenheid:* DR. B. A. DORMER  
Koning George V-hospitaal, Durban.

#### **Tipering van Monsters anders as van Longmateriaal**

Gedurende die jaar is baie werk gedoen oor die indeling van *M. tuberculosis* in menslike en beesstamme. Dit is van belang om te weet of beestering in mense in die Unie so ongewoon is as wat dit wil voorkom volgens die beskikbare syfers en of dit te wyte is aan die planlose monsterneming wat tot dusver gedoen is.

Altesaam 106 positiewe kulture is verkry van 3,417 monsters. In geen een hiervan is die beesteringbasil geïsoleer nie.

Die Eenheid beoog verdere ondersoeke om uit te vind of daar minder tering is in die vee van plattelandse Bantoes en of daar iets in die dieet van die plattelandse Bantoe is wat die kans vir besmetting met bees-*M. tuberculosis* verminder.

#### **Kenmerke van Afwykende Suurbestande Basille**

Navorsingswerk oor die morfologiese, biologiese en kweekeienskappe van afwykende suur- en alkoholbestande basille wat in die kulture gevind is, het voortgeduur. Van die 1,021 kulture wat vir die ondersoeke geneem is, is bevind dat 150 makroskopiese kweakgroepe gevorm het

#### *Duration of function of corpus luteum of pregnancy*

Careful observations have permitted the narrowing down of the time of ovulation in the baboon to a period of 24 to 48 hours. As a consequence, it has been possible to obtain accurately timed matings and to observe the structure of the ovary during early pregnancy. It has been found that the corpus luteum can be removed on the 25th day *after conception* without endangering the continued existence of the implanted embryo. It was suggested that the vascularisation of the villi inaugurated a new embryo-maternal relationship whereby the continuation of embryonic development was no longer dependent upon the secretions of the corpus luteum.

#### **General**

The World Health Organisation arranged for Professor M. Payet, Professor of Medicine and Dean of the Medical School at Dakar, and Professor J. Gillman to exchange views on the problem of liver cancer. Professor Payet visited the Unit during April, 1955, and spent two weeks in the Laboratories. Discussions took place between Professor Payet and other workers interested in Cancer in Johannesburg.

The World Health Organisation has asked Professor Gillman to visit Dakar in order to extend the discussions and work initiated in Johannesburg.

Dr. F. Bielschowsky, Director of the Cancer Research Unit in New Zealand, visited the Unit for three weeks in December, 1954.

#### **TUBERCULOSIS RESEARCH UNIT**

*Head of the Unit:* DR. B. A. DORMER  
King George V Hospital, Durban

#### **Typing of Non-pulmonary Specimens**

A considerable amount of work has been done during the year on the typing of *M. tuberculosis* into human and bovine strains. It is important to know whether bovine tuberculosis in humans is as rare in the Union as appears to be the case from the figures available, or whether this is due to the haphazard and random sampling employed hitherto.

In all, 106 positive cultures were obtained from 3,417 specimens. In none of these was bovine TB isolated.

Further investigations by the Unit are planned to find out whether there is less tuberculosis in the cattle of the Bantu in rural areas, or whether there is something in the diet of the rural Bantu which lessens the changes of infection with bovine *M. tuberculosis*.

#### **Characteristics of Atypical Acid-fast Bacilli**

Research into morphological, biological and cultural characteristics of atypical acid- and alcohol-fast bacilli found on culture has been continued. Of the 1,021 cultures taken for these investigations, 150 were found to have macroscopic colonies

wat 'n sterk ooreenkoms toon met die van *M. tuberculosis* maar wat volgens mikroskopiese bevinding nie bestand is teen sure nie. Sowaat 566 kulture was van menslike tuberkulose en 26 was suurbestande saprofiete. Die res is nie geïdentifiseer nie, vanweë 'n tekort aan personeel en werk wat tans dringender is.

#### **Toets vir Patogeniteit**

Gedurende die toetse is 44 stamme van *M. tuberculosis* wat ongevoelig was vir 10  $\mu$  gm. isonikotiensuur hidrosied (I.N.S.H.) vir virulens getoets. Dit het weer die vraagstuk geskep van aanhoudende inenting van bakterieë en 'n turbidimetrie metode vir die bepaling van bakteriekonsentrasies is ondersoek. Vir die doel is vooraf gegradeerde suspensies van B.C.G. van die Suid-Afrikaanse Mediese Navorsingsinstituut gebruik. Die voorlopige resultate toon dat die metode nuttig sal wees vir die bepaling van die benaderde konsentrasie van verdagte basille.

#### **Serum/C.S.F.-Bromiedverhoudings**

Deur 'n bemaking in die testament van wyle Salmon Ornstein aan die S.A. Rooikruisvereniging vir navorsingswerk oor tering, kon die ondersoek deur Taylor, Smith en Hunter na die bromiedverhouding in serum en breinen rugmurgvloeistof as 'n diagnostiese toets vir tuberkulose meningitis uitgebrei word. 'n Ervare biochemikus is spesiaal aangestel om die ondersoek uit te voer onder leiding van die Direkteur van die Eenheid. Tot dusver het die werk hoofsaaklik in verband gestaan met die herwinnings wat verkry word as normale serum as 'n oplosmiddel vir bekende hoeveelhede bromied gebruik word en as hoeveelhede bromied by die etanolfiltraat gevoeg word.

#### **Voorkoms van Swamme**

Die projek om die voorkoms van swambesmetting van die asemhalingsgange te ondersoek, het voortgeduur. Tot dusver is twee gevalle van aktinomikose van die long, een bewese geval van *Aspergillus fumigatus* en twee moontlike gevalle van *Aspergillus fumigatus* gevind.

#### **Dunsnitte van Heel Organe**

Die Eenheid het voortgegaan om groot dunsnitte van patologiese monsters te lewer vir verwysings- en onderrigdoeleindes. Ses-en-twintig snitte is gesny uit twee gevalle wat ontwikkeling van siste in die long getoon het na I.N.S.H.-behandeling, uit een geval van jagsiekte in 'n skaap en uit een geval van longabsesse.

#### **Onderskeiding van Saprofiete van *M. Tuberculosis***

Werk oor die gebruik van para-aminosalisieluurverkleuring met of sonder 'n stremmingsmiddel vir die onderskeiding van saprofiete van *M. Tuberculosis*, is byna afgehandel en sal binnekort vir publikasie ingedien word.

strongly resembling those of *M. tuberculosis*, but which were proved to be non-acid-fast on microscopy. Some 566 cultures were found to be human tuberculosis and 26 to be acid-fast saprophytes. The remainder were not identified owing to shortage of staff and pressure of more urgent work.

#### **Tests for Pathogenicity**

During the course of these tests, 44 strains of *M. Tuberculosis* that were insensitive to 10 $\mu$  g. of isonicotinic acid hydrazide (I.N.A.H.) were tested for virulence. This, in turn, raised the problem of constant inoculation of bacteria, and an investigation of a turbidimetric method for estimating concentrations of bacteria was carried out. For this purpose, previously enumerated suspensions of B.C.G. from the South African Institute for Medical Research were used. The preliminary results indicate that the method will be useful for the purpose of estimating the approximate concentration of suspected bacilli.

#### **Serum/C.S.F. Bromide Ratios**

A bequest in the will of the late Salmon Ornstein to the S.A. Red Cross Society for research in tuberculosis has made possible an extension of the investigation by Taylor, Smith and Hunter into the serum/cerebro spinal fluid bromide ratio as a diagnostic test for TB meningitis. An experienced biochemist has been appointed specifically to carry out this investigation under the Director of the Unit. Thus far the work carried out has been concerned mainly with the recoveries obtained when normal serum is used as a solvent for known quantities of bromide, and when amounts of bromide have been added to the ethanol filtrate.

#### **Incidence of Fungus**

The project to investigate the incidence of fungus infection of the respiratory tract has continued. So far two cases of actinomycosis of the lung, one proved *Aspergillus fumigatus* case, and two probable cases of *Aspergillus fumigatus* have been found.

#### **Thin Sections of Whole Organs**

The Unit has continued to produce large sections of pathological specimens for reference and teaching purposes. Twenty-six sections were cut from two cases showing development of cysts in lung following I.N.A.H. treatment, a case of jagsiekte in sheep and a case of lung abscesses.

#### **Differentiation of Saprophytes from *M. Tuberculosis***

Work on the use of para-aminosalicylic acid discoloration, with or without an inhibitory agent for the differentiation of saprophytes from *M. tuberculosis*, is almost complete and will be submitted for publication shortly.



## VIRUSNAVORSINGSEENHEID

*Hoof van die Eenheid:* PROF. M. VAN DEN ENDE  
Universiteit van Kaapstad.

### Oplosbare Antigene

Klem het nog steeds geval op die ondersoek van die oplosbare antigene van 'n verskeidenheid van virusse:

#### *Bloutong*

Inligting is ingewin wat bewys dat oplosbare antigene uit deeltjies bestaan van verskillende groottes, wat moontlik saamgestel is uit kleiner deeltjies met 'n minimum gemiddelde deursnee van 8 tot 10 m $\mu$ . Die spesifisiteit van die oplosbare antigene van 'n verskeidenheid van bloutongvirusse word ondersoek. Dit wil voorkom asof die oplosbare antigene grotendeels verantwoordelik is vir die komplementbinding en dat daar minder tekens is van stamspesifisiteit in die *in vitro*-reaksie as in *in vivo*-neutraliseringstoetse. Die spesifisiteit van ongesuiwerde soutekstrakte en van ekstrakte van brein wat met asetoon-eter behandel is, word ook vergelyk.

#### *Hondsdolheid*

Die aard van die oplosbare komplementbindende antigeen word bestudeer deur die uitwerking van verskillende suiweringsmetodes en van ensieme daarop te ondersoek. Dit lyk asof dit min beïnvloed word deur tripsien, desoksiribonuklease, ribonuklease, verhitting tot 56°C, voorlopige asetoon- en eterekstraksies, ens. Dit skyn ook asof dit in sigself antigenies is in hase en muise en dit mag van belang wees in die aktiewe immunisering teen hondsdolheid.

#### *Poliomiëlitis*

Daar is bevind dat die oplosbare antigeen verantwoordelik was vir die meeste van die komplementbinding wat voorkom in met MEF<sub>1</sub>-besmette breinemulsies van soogmuise. Uitsaksels van sulke emulsies kon gewas word totdat die oordekkende vloeistof vry was van komplementbindende antigeen. Die neerslag het toe byna al die besmettingsvirus bevat, maar het 'n betreklik klein komplementbindingsvermoë gehad. Daar was geen binding met die antiserum vir MEF<sub>1</sub> virus wat voorkom in die brein van volwasse muise nie, ook nie met Lansingse immune aapserum of met antisera van Tipes I en III van die poliovirusse nie.

Hierdie oplosbare antigeen is stabiel in hitte en bestand teen eenvoudige chloroform- en eterbehandeling.

### Steuringstudies met UV-bestraalde Virus van Sinkdalkoors

In titrasies van suspensies van ingewandsliewende sindalkoors-virus wat met geskikte dosisse ultravioletlig bestraal was, het die mees gekonsentreerde dosisse geen siekte veroorsaak nie, maar waar dit tien tot honderd keer verdun was, kon die teenwoordigheid van lewensvatbare virus getoon word. Die gekonsentreerde be-

## VIRUS RESEARCH UNIT

*Head of the Unit:* PROF. M. VAN DEN ENDE  
University of Cape Town

### Soluble Antigens

Emphasis has remained on investigations of the soluble antigens of a variety of viruses:

#### *Blue Tongue*

Evidence has been obtained that soluble antigens of several particle sizes occur, and it is possible that these represent aggregates of particles with a minimum average diameter of 8 to 10 m $\mu$ . The specificity of the soluble antigens from a variety of blue tongue viruses is under investigation. It appears as if the soluble antigens are largely responsible for the complement fixation, and that there is less evidence of strain specificity in this *in vitro* reaction than in *in vivo* neutralization tests. A comparison is being made also of the specificity of crude saline extracts, and extracts from acetone-ether treated brains.

#### *Rabies*

The nature of the soluble antigen is being investigated by studying the effect of various methods of purification and of enzymes on the complement fixing soluble antigen. It appears to be little affected by trypsin, desoxyribonuclease, ribonuclease, heating to 56°C., preliminary acetone and ether extractions, etc. It appears in itself to be antigenic in rabbits and mice, and may be of significance in active immunization against rabies.

#### *Poliomyelitis*

It was found that the soluble antigen was responsible for most of the complement fixation which occurs with brain emulsions of suckling mice infected with MEF<sub>1</sub> strain of poliomyelitis. Deposits of such emulsions could be washed until the supernatant fluid was free from complement fixing antigen. The deposit then contained practically all the infective virus but had relatively little complement fixing power. There was no fixation with the antiserum to the MEF<sub>1</sub> virus as it occurs in adult mouse brains, nor Lansing monkey immune serum, nor antisera to Types I and III poliomyelitis viruses.

This soluble antigen is heat stable, and is resistant to simple chloroform and ether treatment.

### Interference Studies with UV-irradiated Rift Valley Fever Virus

In titrations of viscerotropic Rift Valley Fever virus suspensions, irradiated with appropriate doses of ultra-violet light, most concentrated inocula give rise to no disease but ten or hundredfold dilutions show the presence of normal viable viscerotropic virus. The concentrated irradiated inocula, after

straalde entstof kon, na lang inkubasie, slegs verskynsels in die sentrale senuweestelsel verwek, hoewel die virus wat uit sulke muise herwin word, nog die ingewande sal aanval. Die feit dat die virus herwin kan word uit die brein en miokard van sulke muise maar nie uit die lewer nie, mag 'n rol speel in die verklaring van die verskynsel van immuniteit teen virusbesmettings. Dit mag ook baie belangrik wees om die soort hindernisverskynsel in gedagte te hou by die bereiding van skadelose virusentstof vir menslike gebruik.

#### **Steurings- en Herverbindingstoetse met Poliovirusse**

Steuering tussen verskillende serologiese tipes van poliovirus kan in weefselkultuur verkry word mits die viruskonsentrasie in die primêre entstof hoog genoeg is om al die beskikbare selle te besmet gedurende die kontaktydperk wat toegelaat word voor die byvoeging van die tweede virus. In die geval van rolbuis-kultuurtoetse met ape moet  $10^6$  of  $10^6$  weefselkultuur-besmettingsdosisse van MEF<sub>1</sub>-virus by die  $\pm 300$  selle gevoeg word om herkenbare hindernis te veroorsaak met Brunhilde-virus wat twee tot ses uur later bygevoeg word.

Geen herkenbare herverbindings is verkry van weefselkultuur wat gelyktydig met twee serologies-afsonderlike poliovirusse besmet is nie.

#### **Grootte van Besmetlike Virusdeeltjies**

In suspensies van virusbesmette weefsels kom besmetlike virusdeeltjies van verskillende groottes voor. Die verskynsel is bevestig deur 'n metode waarvolgens die beweging van deeltjies in agarjelle van verskillende konsentrasies gemeet word. Die metode is met welslae toegepas om die kleinere besmetlike bestanddele van die groteres te skei en om vas te stel dat die verskynsel eerder verskille in grootte as verskille in soortlike gewig toon.

#### **Gewasvirusse**

Daar is begin met die kweek van die virus van Rous se Sarkoom in eiers en weefselkultuur met die oog op 'n studie van die verwantskap tussen latente virusbesmetting en die groei van gewasse. In die verband lyk dit asof daar ooreenstemming is met lisogeniese stamme van bakterieë.

#### **Bakteriofage**

In 'n vorige verslag is verwys na die onderdrukking van fage 5 en 14 sowel as stimulering van faag 13 deur stowwe aan die oppervlakte van *Ps. aeruginosa*, stam LII. Sommige aspekte is nou breedvoeriger bestudeer.

Proefnemings met verskillende metodes van plaatkweeking het aan die lig gebring dat stimulering van faag 13 slegs by lae konsentrasies van bakterieë voorkom. By hoë

long incubation periods, elicit central nervous system manifestations only, although the virus recovered from such mice is still viscerotropic. The fact that the virus can be recovered from the brains and myocardium of such mice, but not from the liver, may be of significance in elucidating the phenomenon of immunity to virus infections. It may be of great importance to keep this type of interference phenomenon in mind also for the preparation of inactivated virus vaccines for human use.

#### **Interference and Recombination Experiments with Poliomyelitis Viruses**

Interference between different serological types of poliomyelitis virus can be achieved in tissue culture, provided the concentration of virus in the primary inoculum is sufficiently high to cause infection of all available cells during the period of contact which is allowed before the addition of the second virus. In the case of monkey tests in roller tube cultures  $10^5$  or  $10^6$  tissue culture infective doses of MEF<sub>1</sub> virus added to  $\pm 300$  cells is required to cause recognizable interference with Brunhilde virus added 2-6 hours later.

No recognizable recombinants have been obtained from tissue culture simultaneously infected with two serologically distinct polio viruses.

#### **Particle Sizes of Infective Virus**

In suspensions of virus-infected tissues infective virus of different particle sizes occur. Confirmation of this phenomenon has been obtained with a method involving measurement of the movement of particles into agar gels of different concentration. The method has been used successfully to separate the small infective component from the larger ones and to determine that the phenomenon reveals difference in size rather than difference in specific gravity.

#### **Tumour Viruses**

A start has been made with the culture of Rous Sarcoma virus in eggs and tissue culture with the view to studying the relationship between latent virus infection and tumour growth. In this connection there appear to be analogies with lysogenic strains of bacteria.

#### **Bacteriophages**

Inhibition of phages 5 and 14 as well as "exhibition" of phage 13 by substances present at the surface of *Ps. aeruginosa* strain LII have been previously reported. Some aspects have been studied in greater detail.

Experiments using different methods of plating have revealed that exhibition of phage 13 occurs



konsentrasies van die bakterieë is plaatkweking baie doeltreffend en is daar geen stimulering nie. Onderdrukking van faag 14 deur bakteriese ekstrakte is groter as dit op 'n stam met 'n lae plaatkwekdoeltreffendheid getoets word, maar onderdrukking word nie deur hoë bakteriekonsentrasies uitgeskakel nie.

Pogings om die aard van die onderdrukker en opwekker te bepaal het voortgeduur en elektronmikroskopie is nuttig gevind vir die werk. In die verband is ekstrakte met trichloorasynsuur (TCA) en selwande van bakterieë wat meganies of outolities verskeur is, gebruik.

Met verskeie bakteriefraksies, insluitende proteïene wat van TCA-ekstrakte verkry is, het suurhidrolise twee aktiewe ninhidrien stowwe (X en Y) gelever wat onderskeibaar is van al die gewone aminosure en al die seldsame aminosure wat tot dusver vir vergelyking beskikbaar was. Daar word gehoop om die stowwe te identifiseer en om hul verwantskap met die verskynsel van bakteriofaagwerking vas te stel.

'n Apparaat vir deurlopende elektroforese op water-verkoelde papier met „vloeistof“-elektrodes is vir die isolering van X en Y gebruik. Die oorspronklike kenmerke van die apparaat is sedertdien gepubliseer. 'n Heeltemal herontwerpte apparaat vir tweedimensionele ionoforesis is byna gereed vir uittoetsing.

#### Afsondering van Virusse

Verskeie pogings is aangewend om virus van gevalle van Hodgkin se siekte af te sonder deur die metode van Bostick, maar sonder sukses. 'n Virusstam is van Bostick ontvang. Met filterings- en sentrifugerings-toetse is bevind dat dit sowat 19  $\mu$  in deursnee is.

Verskeie stamme van poliovirus is deur weefselkultuurmetodes van die ontlasting van poliogevalle herwin. Hulle is serologies geïdentifiseer en aan die laboratoriums van die Poliostigting gegee vir verdere studie.

In medewerking met dr. J. H. S. Gear is pogings aangewend om 'n smetstof van gevalle van 'n „geheimsinnige siekte“ in die Paarl af te sonder. Geen sukses is behaal nie.

#### Tetanustoksien

Daar word gewerk aan die suiwing en konsentring van tetanustoksien deur gebruik te maak van verskillende metodes, o.a. multimembraan-elektrodekantasië.

only at low bacterial concentrations. At high bacterial concentrations plating efficiency is high and exhibition absent. Inhibition of phage 14 by bacterial extracts is greater when tested on a strain with low plating efficiency, but inhibition is not eliminated by using high bacterial concentrations.

Attempts to determine the nature of the inhibitor and exhibitor have also continued, and in this work electron microscopy has been found useful. In this connection trichloroacetic acid (TCA) extracts and cell walls from mechanically or autolytically disrupted bacteria have been used.

From various bacterial fractions, including proteins obtained from TCA extracts, acid hydrolysis has yielded two ninhydrin reactive substances (X and Y) which are distinguishable from all the usual amino acids and those unusual ones which have so far been available for comparison. It is hoped to identify these substances and to determine their relationship to the phenomenon of bacteriophage action under investigations.

Apparatus for continuous electrophoresis on water-cooled paper using “fluid” electrodes was used for the isolation of X and Y. The original features of this apparatus have since been published. A completely redesigned apparatus for two dimensional ionophoresis is nearly ready for test.

#### Isolation of Viruses

Several attempts to isolate virus from cases of Hodgkin's disease according to the method suggested by Bostick have failed. A strain of virus has been received from Bostick. In filtration and centrifugation experiments it has been found to be approximately 19  $\mu$  in diameter.

Several strains of poliomyelitis virus have been recovered by tissue culture methods from the stools of polio cases. They have been identified serologically and submitted to the Poliomyelitis Foundation Laboratories for further study.

Attempts have been made, in collaboration with Dr. J. H. S. Gear, to isolate an infective agent from cases of a “mystery disease” in Paarl. No success has been achieved.

#### Tetanus Toxin

Work is in progress on the purification and concentration of Tetanus toxin, using the multimembrane electrodecantation and other methods.

## Nywerheidsnavorsings- institute

In die volgende paragrawe word 'n kort oorsig gegee van die werk wat gedurende die jaar deur nywerheidsnavorsingsinstitute gedoen is. Die institute is as maatskappye sonder winsbejag geïnkorporeer en word deur Beheerrade bestuur. Hulle is dus nie institute van die W.N.N.R. nie en reik afsonderlike jaarverslae uit.

Aangesien die Raad hulle egter finansiële steun op die £ vir £-grondslag, in die verskillende rade verteenwoordig is en nou met hulle saamwerk, is dit wenslik dat opsommings van hul jaarverslae in die van die Raad ingesluit word.

### LEERNYWERHEID-NAVORSINGSINSTITUUT

*Direkteur: DR. S. G. SHUTTLEWORTH*

#### Patente

Ses provinsiale patente is gedurende die jaar geregistreer. Die eerste vier het geblyk nuwe gebiede te wees wat nie voorheen in Suid-Afrika of in die buiteland aandag geniet het nie. Aansienlike besparings word teweeggebring deur hul plaaslike gebruik. Onderhandelings word gevoer vir vrystelling in die buiteland.

#### Fundamentele Navorsingswerk

Werk het voortgeduur oor die chemiese samestelling en fisiese eienskappe van die uittrekbare proteïene van velle, oor die ekstrakte van verskillende wattlesoorte, oor die komplekse basiese soute van chroom en oor die teorieë van bas- en chroomlooierij. Die hoofstuk oor die meganisme van chroomlooierij wat op versoek van die Amerikaanse Chemiese Vereniging opgestel is vir 'n nuwe monografie, is sonder wysigings vir publikasie aanvaar. Die Instituut het 'n handleiding van 200 bladsye gepubliseer onder die titel *Wattle Tannin and Mimosa Extract* en die Wattlekwekers- en Ekstrakvervaardigersvereniging het 1,000 eksemplare bestel vir verspreiding in die buiteland. Die Donald Burton-prys van die Britse Vereniging van Leerskeikundiges is aan 'n lid van die personeel toegeken vir sy werk oor die molekulêre gewigte van watteltanniene. Van die ses toekennings wat sedert die instelling van die prys gemaak is, is drie aan lede van die Instituut se huidige personeel toegeken. Wanneer 'n ander personeelid aan die end van die jaar van die Universiteit Cambridge terugkeer, sal daar hopelik meer aandag gewy word aan fundamentele proteïennavorsing.

## Industrial Research Institutes

In the following paragraphs a brief description is given of the work undertaken by Industrial Research Institutes during the year under review. These institutes are incorporated as non-profit companies and are managed by Boards of Control. They are thus not institutes of the C.S.I.R. and issue separate annual reports.

However, since the Council contributes to their financial support on the £ for £ basis, is represented on the various boards and works in close collaboration with them, it is considered desirable to include summaries of their annual reports in the Annual Report of the Council.

### LEATHER INDUSTRIES RESEARCH INSTITUTE

*Director: DR. S. G. SHUTTLEWORTH*

#### Patents

Six provisional patents have been registered during the current year. The first four of these have been proved to be novel and not previously anticipated in South Africa or overseas, and are being used locally to effect considerable savings. Franchise arrangements are being negotiated overseas.

#### Fundamental Research

Work has continued on the chemical composition and physical properties of the extractable proteins of hides, the extracts of various species of wattle, and the complex basic salts of chromium, as well as on the theories of vegetable and chrome tannage. The chapter on the mechanism of chrome tannage, prepared by request of the American Chemical Society for a new monograph, has been accepted for publication without modification. The Institute has published a 200-page handbook entitled *Wattle Tannin and Mimosa Extract*, and 1,000 copies have been ordered by the Wattle Growers' and Extract Manufacturers Association for overseas distribution. The Donald Burton Prize of the British Society of Leather Trades' Chemists has been awarded to a member of the staff, for his work on the molecular weights of the wattle tannins. Of the six awards made since the inception of the prize, three have been awarded to members of the current Institute staff. With the return from Cambridge University of another member of staff, at the end of this year, it is hoped to give added attention to fundamental protein research.



## Algemene Tegnie se Vordering

Op die gebied van looiery het die bedreiging van mededingende plaasvervangers gelei tot 'n groter toespitsing op metodes om waterdigtheid, duursaamheid en eenvormigheid van snywaarde van die leer te verbeter. Die nywerheid as 'n geheel benader hul proses al hoe meer wetenskaplik en hul oë gaan oop vir die moontlikhede van nuwe prosesse en nuwe chemiese hulpmiddels in die vorm van kunsharse en silikoon-olies om die gehalte en voorkoms van leer te verbeter. Die meeste van die Unie se looierye het verskeie looi prosesse van die Instituut by hul vereistes aangepas. Van besondere belang was die ontwikkeling van looi prosesse om binnesool- en voeringleer sweetdig te maak, wat al hoe meer noodsaakliker word weens die moderne neiging om nie leersole te dra nie. Die ontwikkeling van waterdigte mynstewels vir die nat toestande in die Vrystaatse myne was ook van belang.

In die skoelsnywerheid was die belangrikste gebeurtenis van die jaar die ontwikkeling van skoenneuse van kunshars en middels om skoenhakke stewig te maak. Dit is veral van belang as 'n duidelike bewys van die voordele van 'n koöperatiewe nywerheidsnavorsingsinstituut. Om te verseker dat die nuwe ontwikkeling nie, soos met baie wetenskaplike uitvindings gebeur, vir baie jare opsy geskuif word nie, het die Instituut self die sleutelgrondstof in groot hoeveelhede vervaardig, spesiale masjiene ontwikkel waarmee fabriek die tegniek kon toepas, en amptenare na die fabriek gestuur om die prosesse te demonstreer en die voordele daarvan te toon. Dit het ook die navorsers in staat gestel om die eerste moeilikhede van die nuwe prosesse te oorkom deur in die fabriek gedagtes met die nywerheid oor die wysiging van materiale en masjiene te wissel. Die nuwe metodes word reeds toegepas in die vervaardiging van meer as twee-derdes van die land se skoelsel, wat buitengewoon gou is vir die aanvaardiging van 'n nuwe ontwikkeling deur 'n nywerheid wat van nature versigtig is.

## Bedryfsnavorsing

Die werk in die fabriek oor kunshars-skoenreuse en hardmaakmiddels, en die buitemuurse toetsing van looi prosesse en droogproesse van huide en velle, val in hierdie rubriek.

Personeel en produksievermoë was nog steeds die vernaamste gebiede van bedryfsnavorsing. Hier het 'n groot omwenteling gekom in loonstelsels en in koste- en begrotingsbeheer, grotendeels vanweë die betaalde werk van 'n produktiwiteitsgroep van die Navorsingsinstituut. Hierdie diens sal binnekort gestaak word en 'n suiwer navorsingsgroep sal dan 'n unieke massa gegewens tot hul beskikking hê waaruit formules kan ontwikkel word vir die belangrikste onbestendige faktore van materiële aard, asook vir bewegingstudies, fabrieksbeplanning en werkswaardering.

## General Technical Advances

In the tanning field, the competitive threat of substitutes has led to a greater concentration of methods for increasing water resistance, durability, and uniformity of cutting value of leather. The industry as a whole is becoming more scientific in its approach to its processes, and more alert to the possibilities of new processes and new chemical aids in the form of synthetic resins and silicone oils for improving the quality and appearance of leather. Various Institute tanning processes have been adopted by most of the Union's tanneries to suit their requirements. Of special interest has been the development of perspiration-proof tannages for insole and lining leathers, which are becoming increasingly necessary due to the modern trend away from leather soles; also the development of more water-resistant miner's boots for the wet conditions of the Free State Mines.

In the footwear industry the main event of the year has been the development of synthetic resin toepuffs and heel stiffeners in footwear. This is of special interest in that it provides a clear case of the advantages of the cooperative industrial research institute system. To ensure that these developments would not be pigeon-holed — the fate of so many scientific discoveries — the Institute mass-produced the key raw material, developed special machines for factory application of the techniques, and sent officers round the industry to demonstrate and prove the advantages of the techniques. This enabled the research staff to overcome the teething troubles of the new processes by sharing ideas with the industry on the factory floor and by modifying the materials and machines. The new techniques are now applied in the production of more than two thirds of the country's footwear which would appear to be incredibly rapid for the acceptance of a new development in a naturally cautious industry.

## Operations Research

The factory floor work involved in the synthetic resin toepuff and stiffener applications and in extramural tanning processes and hide and skin curing trials belong to the category of operations research.

The main field of operations research has continued to be in the personnel and productivity fields, where a major revolution in systems of wage remuneration and accurate cost and budget control has taken place largely through a fee-earning Research Institute productivity team. This service will shortly be discontinued, and a purely research team will have at its disposal a unique mass of data upon which to develop formulae for the main material variables and also motion study, factory lay-out and job evaluation.

'n Ander interessante ontwikkeling is die opvolgstudie van die Instituut se Afdeling Ekonomie en Markte se vasstelling dat byna 50% van die skoene in ons land deur nie-blankes gekoop word. Verskillende nie-blanke groepe word nou bestudeer om vas te stel watter rol skoel-aankope in hul gesingsbegroting speel.

#### **Publikasies**

Gedurende die afgelope jaar het die Instituut een handboek en 28 verhandelinge in tegniese en wetenskaplike tydskrifte gepubliseer en 14 gedrukte en 18 mimeograafverslae uitgereik.

### **VISNYWERHEID-NAVORSINGSINSTITUUT**

*Direkteur: DR. G. M. DREOSTI*

Gedurende die jaar geëindig 31 Maart 1955 het die Instituut se inkomste met sowat 14% gestyg om 'n totaal van £42,200 te bereik.

Werk gedurende die jaar was weer hoofsaaklik toegespits op die praktiese probleme van die visnywerheid wat op sy beurt meer as ooit gebruik gemaak het van die navorsingsgeriewe van die Instituut. In die kort oorsig word slegs die belangrikste ondersoeke wat gedurende die jaar begin of voltooi is, aangestip.

#### **Vars Vis**

As deel van die program vir die meganisering van die hantering van vis, het die toetse getoon dat dit moontlik is om vis van die treilerruim na die kaai deur 'n watergeut te stoot as water met 8% sout gebruik word en die opwaartse stroom een tot vyf voet per minuut beweeg. 'n Belangrike vordering in die program was die ontwikkeling van 'n visgeut vir treilers, wat die skoonmaak en opberging van die vis op see baie vergemaklik.

Werk oor die hoeveelheid en verdeling van ys wat in treilerruime gebruik word, het getoon dat dit voordelig is om die hoeveelheid te vermeerder tot een deel ys vir een deel vis (per gewig) maar dat 'n verdere vermeerdering te duur is in verhouding tot die verdere klein temperatuurvermindering. Ander ondersoekte het gegaan oor die snelheid van verkoeling in ys, die isolering in spoorwegvstrokke, die ontwerp van 'n toestel om 'n laag ys aan die kante van die trokke te hou, en die toestand van snoek wat by Walvisbaai gevang word.

#### **Soutvis en Droë Vis**

Werk oor die vraagstukke wat opgelewer word deur chromogeniese, soutliewende bakterieë wat dikwels in Suid-Afrikaanse sonsoute natuurlik voorkom, het voortgeduur. Aandag is veral geskenk aan die ontwikkeling van 'n bevredigende metode om hierdie organismes te onderskei.

Another development of interest is a follow-up of the Institute's Economics and Markets Section's discovery that nearly 50 per cent of footwear in this country is bought by the non-European. Various non-Europeans groups are being studied to ascertain the position of footwear purchases in their family budgets.

#### **Publications**

During the past year the Institute has published one text book and 28 publications in technical and scientific journals. It has also issued 14 printed and 18 mimeographed reports.

### **FISHING INDUSTRY RESEARCH INSTITUTE**

*Director: DR. G. M. DREOSTI*

During the year ended 31st March, 1955, the Institute's income increased by approximately 14 per cent, reaching a new total of £42,200.

Work was again characterized by accent on the practical problems of the fishing industry, which, in turn, has made greater use of research facilities at the Institute than ever before. This brief review touches only on the main investigations begun or completed during the year.

#### **Fresh Fish**

As part of a programme for mechanizing the handling of fresh fish, tests established that the fluming of fish from trawler holds to the quayside is feasible, using water containing 8 per cent salt at a flow rate of from one to five feet per minute. An important advance in this programme has been the development of a trawler fish flume which greatly facilitates the work of cleaning and stowing the catch at sea.

Work on the amount and distribution of ice used in trawler holds has shown that it is advantageous to increase the amount up to one part of ice, by weight, to one part of fish, but that further increases are relatively costly for the small temperature advantage gained. Other work included investigation of rates of cooling in ice, the insulation of railway fish trucks, design of devices for providing a layer of ice at the sides of these trucks and the conditions of snoek caught at Walvis Bay.

#### **Salted and Dried Fish**

Work continued on the problems created by chromogenic halophilic bacteria, which occur naturally in many South African salts produced by solar evaporation. In particular, attention was given to the development of a satisfactory method for identifying these organisms.



## **Ingemaakte Vis**

Moeilikhede wat ondervind word met die eenvormige insouting van verpakte vis, deur pekeling, is in die 9de Jaarverslag beskryf. Met die oog hierop is die gebruik van soutpilletjies ondersoek. Hoewel dit belowend lyk, moet 'n praktiese metode vir die toediening van die pille onder fabriekstoestande nog ontwikkel word.

Gedurende die jaar is 'n proefneming gedoen met die toepassing van prosesbeheer in Suid-Afrikaanse visinmaakfabrieke. Agt fabrieke het ingestem om hul uitrusting te wysig volgens die spesifikasies van die Visnywerheid-navorsingsinstituut en om amptelike inspeksie vir 'n proeftydperk van ses maande toe te laat. Die gegewens wat op die manier ingewin is, word nou ontleed en beoordeel. Tydens die werk het die Instituut 'n apparaat ontwikkel vir die yking van retorttemperatuur-registreerders.

Die moeilikhede wat visinmakers ondervind met die verwydering van aangebakte visolie van die oppervlaktes van verpakte blikke, het gelei tot die toets van twee-entwintig kommersiële middels vir die skoonmaak van blikke. Slegs vyf is as volkome bevredigend beskou op grond van hul prys en geskiktheid vir die doel.

Ondersoek van die seewatervoorrade wat in visinmaakfabrieke gebruik word, het getoon dat 'n industriële apparaat vir die sterilisasie van water deur middel van ultravioletstraling bevredigende resultate gee by troebelheidsgrade van so hoog as 7.5 d.p.m. (silikaskaal). Werk op die gebied duur voort.

Die vervaardiging van tamatiepasta met 'n lae skimmelinhoud, soos deur visinmakers benodig wat na kieskeurige markte uitvoer, het sekere probleme opgelewer wat gedurende die jaar ondersoek is. Daar is bevestig dat die skimmelinhoud nou verwant is aan die toestand van die grondstof, sodat die verwydering van gevlekte en gekneusde vrugte noodsaaklik is. Baie van die afgekeurde vrugte kan egter met veiligheid gebruik word as die merke uitgesny word.

## **Kreef**

Gedurende die jaar is verdere proefnemings gedoen oor die bewaring van kreef en spesiale behandeling van die vleis voordat dit ingemaak word. Dis gevind dat deur kreefsterte in 'n oplossing van 0.3% sitroensuur te week, kleur en geur gunstig beïnvloed word en die ingemaakte produk langer gebêre kan word voordat 'n „inmaakreuk” ontwikkel.

## **Vismeel**

'n Uitvoerige studie is gemaak van die verspreiding van proteïen en vet in sardyne van verskillende groottes, beide voor en na die voorkookproses. Dit lyk asof daar 'n verwantskap is tussen grootte en proteïeninhoud, want in die kleinste visse is die proteïeninhoud die hoogste op 'n droë vetvrye basis bereken. Wat vet betref, skyn daar geen verwantskap te wees nie. Hoewel die grootste deel van die sardyn se vet in die rompspiere voorkom, is die

## **Canned Fish**

Difficulties in securing uniform salting of canned fish packs by brining were recorded in the Ninth Annual Report. To overcome these, the use of salt pellets was investigated. Although promising, a practical method of introducing tablets under factory conditions has yet to be devised.

An experiment on the application of process control in South African fish canneries was conducted during the year. Eight factories agreed to modify their equipment to conform to Fishing Industry Research Institute specifications, and to submit to official inspection for a trial period of six months. The data thus accumulated are currently being analysed and assessed. In the course of this work the Institute developed an apparatus for calibrating retort temperature recorders.

Difficulties experienced by fish canners in removing baked-on fish oil from the surface of processed cans, led to the testing of twenty-two commercial can-cleaning agents. Only five were considered thoroughly satisfactory on the basis of both cost and performance in this special field.

Work on the sea-water supplies used in fish canneries showed that an industrial apparatus for the sterilization of water by ultra-violet irradiation gave satisfactory results with turbidities of up to 7.5 p.p.m. (silica scale). Work in this field is still in progress.

The production of tomato paste of low mould content, as is required by fish canners exporting to critical markets, created certain problems which were studied during the year. It was confirmed that the mould count is closely correlated with the condition of the raw material, so that sorting out of blemished fruit is essential. However, much of the discarded fruit can safely be used if trimmed.

## **Rock Lobster**

Further experiments were carried out during the year on precanning storage of rock lobster and special treatments of the flesh for canning. Soaking tails in 0.3 per cent. citric acid solution was found to have a favourable effect on colour and flavour and to prolong the length of time for which the canned product can be held without developing a storage odour.

## **Fish Meal**

A comprehensive study was made of the distribution of protein and fat in the bodies of pilchards of various sizes, both before and after pre-cooking. It appears that there is a correlation between size and protein content, the latter being highest (on a dry fat-free basis) in the smallest specimens, but no such correlation emerged for fat. Although most of the pilchard's fat is stored in the muscles

kop ook 'n belangrike bron van olie. Die bevinding wat verlede jaar vermeld is, dat die verhouding tussen die wateroplosbare en totale proteïeninhoud nie 'n betroubare maatstaf vir die „volheid” van 'n meel is nie, is gedurende die jaar deur verdere proewe bevestig. Aandag is bestee aan proteïenverlies wat in sardyne plaasvind gedurende opberging in lug en water wanneer geutvervoer gebruik word.

Die Afdeling Visserye beplan die grootskaalse merk van visse en die Instituut het begin met ondersoek na moontlike metodes om die etikette in fabriek te herwin. Die werk is nog aan die gang.

Verdere inligting is ingewin oor die neiging van vismeel tot spontane ontbranding en 'n uitvoerige studie-program hieroor is aangevoer. Die navorsing oor die higroskopisiteit van konsentrate van visafvalwater wat met dromdroërs verkry is en van volmele wat op verskillende maniere berei is, asook oor verlies aan vitamien tydens verskillende verwerkingsmetodes, is voortgesit.

Navorsingswerk oor visfynmeel het die stadium bereik waar verdere laboratoriumwerk voorafgegaan moet word deur proefinstallasietoetse, om uit te vind watter moeilikhede gedurende kommersiële vervaardiging mag voorkom. 'n Reuklose, smaaklose fynmeel wat die volle biologiese waarde van die oorspronklike vismeel behou en wat nie merkbaar is as tot 8% daarvan in bruinbrood ingebak word nie, kan nou in die laboratorium vervaardig word.

### Roetinewerk

Soos in vorige jare het die Instituut roetine-ontledingsdienste en inspeksiedienste vir ledefirmas verrig. Meer as 1,700 monsters (soos byvoorbeeld vis- en kreefmele, olies, perskoeke, visafvalwater en sy konsentrate, sout en tamatiepasta) is gedurende die jaar ontleed. Watervoorrade van visinmaakfabrieke by Walvisbaai en monsters van sout wat vir die behandeling van vis bedoel was, is gereeld bakteriologies ondersoek.

Roetine-vitamienbepalings het ingesluit 9 vir riboflavine, 19 vir vitamien B<sub>12</sub> en 11 vir vitamien A.

Bevrore kreefsterte en ingemaakte produkte vir uitvoer is ook ondersoek. Die kreefsterte het 28 besittings van die Unie, vyf van Tristan da Cunha en ses uit Suidwes-Afrika ingesluit. Vir alle ontledingsdienste of inspeksies word apart betaal deur die firmas wat dit aanvra.

of the trunk, the head is also an important source of oil. The finding, reported last year, that the ratio of water-soluble to total protein is not a dependable index of the fullness of a meal, was confirmed in further experiments during the current year. Attention was given to protein losses which occur in pilchards during storage in air and water during fluming.

On behalf of the Division of Fisheries, which plans a large-scale fish-tagging programme, the Institute began investigations into possible methods of recovering the tags in factories. This work is still in progress.

Further information was obtained on the liability of fishmeal to spontaneous heating, and a comprehensive research programme in this sphere was set under way. The studies of hygroscopicity of concentrates of drum-dried solubles and of full-meals prepared in different ways were continued, as were losses in vitamin content under different methods of processing.

Fish flour research was brought to a stage where further laboratory work should be preceded by pilot-plant tests, to indicate such snags as may arise in commercial production. It is now possible to produce, in the laboratory, an odourless and tasteless fish flour which retains the full biological value of the original meal and which remains undetectable when up to 8 per cent. is incorporated in brown bread.

### Routine Work

As in previous years, the Institute provided routine analytical and inspection services on behalf of member firms. Over 1,700 samples (such as fish and rock lobster meals, oils, press-cakes, stickwater and concentrates, salt and tomato paste) were analysed during the year. Regular bacteriological examinations were made on cannery water supplies at Walvis Bay and on samples of salt intended for fish-curing.

Routine vitamin assays included 9 for riboflavin, 19 for vitamin B<sub>12</sub> and 11 for vitamin A.

Inspection of frozen rock lobster tails and canned products intended for export was also carried out, the former covering twenty-eight shipments from the Union, five from Tristan da Cunha and six from South West Africa. All inspection and analytical services are paid for separately by the firms requesting them.



## SUIKERMEULE-NAVORSINGSINSTITUUT

*Direkteur: DR. K. DOUWES DEKKER*

Gedurende die verslagjaar het suikermeule 'n toenemende aantal versoeke vir hulp met die oplossing van moeikhede wat in fabriek ondervind of verwag kon word, tot die Suikermeule-navorsingsinstituut gerig. Een van die meule het 'n afvalverwyderingsproses van sap-suiwering (defecation) ingevoer vir die vervaardiging van rusuiker en amptenare van die S.M.N.I. het saamgewerk om die uitwerking van verskillende wysigings van die proses op die eindresultaat te ondersoek. Die proses, waarin 'n klein hoeveelheid kalk gebruik word vir die suiwering van gemengde sap, is goedkoper as die gewone sulfatasiemetode wat meer kalk, swaweldioksied en fosforpasta nodig het. Die suiweringsproses word nou (1955) deur vier rusuiker-fabriek met bevredigende resultate gebruik, alhoewel dit nie gesê kan word dat alle vraagstukke reeds opgelos is nie.

In 'n ander ondersoek wat in twee meule uitgevoer is, is die brymetode vir die korreling van die C-kooksele ondersoek. Die metode lewer 'n meer egalige korrel en sal uiteindelik lei tot kleiner verlies aan sukrose in finale melasse.

'n Spesiale ondersoek wat by een van die meule uitgevoer is, het gelei tot 'n vermeerdering van ons kennis van die hoeveelheid sukrose wat verlore gaan in die tandemeul.

Kleinere ondersoek is uitgevoer oor die bepaling van vesel in suikerriet met die beskikbare metodes, die styselinhoud van verskillende rietvariëteite, die samestelling van Natalse strope, sommige aspekte van die chemie van sapverheldering en die voorkoms van 'n onbepaalde verlies van sukrose by een van die meule.

In die jaar is voortgegaan met die sistematiese toets van weeklikse suikermonsters wat deur al die meule goedgunstiglik verskaf word. Spesiale aandag is geskenk aan die bepaling van die witheid van wit meulsuikersoorte deur die refleksiekurve te meet.

Die publikasie van weeklikse en maandelikse *Verslae van Vervaardigingsgegewens* het voortgeduur en die *Jaarlikse Opsomming van Chemiese Laboratoriumverslae* is opgestel vir die kongres van die Vereniging van S.A. Suikertegnoloë.

Agt-en-veertig besoeke is aan fabriek gebring om verwerkingsmetodes en die vereiste installasies daarvoor te bespreek. Hierdie besoeke het gewoonlik gelei tot 'n verslag oor een of meer tegniese onderwerpe. 'n Opsomming daarvoor word gegee in die reeks *Mededelings van die Suikermeule-navorsingsinstituut*.

Benewens vyf *Mededelings* wat in 1954 gepubliseer is, is vier verhandelinge deur amptenare van die S.M.N.I. in die *Proceedings* van die Kongres van die S.A.V.S.T. gepubliseer, twee in die *Internasionale Suikerjoernaal* en vyf in die *Suid-Afrikaanse Suikerjoernaal*.

Die Direkteur het die elfde sitting van die Inter-

## SUGAR MILLING RESEARCH INSTITUTE

*Director: DR. K. DOUWES DEKKER*

During the year under review there was an increase in requests from sugar mills for assistance from the Sugar Milling Research Institute in overcoming actual or anticipated difficulties in factory operation. One of the mills introduced the defecation method of juice clarification for the production of raw sugar, and S.M.R.I. officers co-operated by studying the effect of various modifications of this method on the overall result. The defecation method, in which a small quantity of lime is used for the clarification of mixed juice, is more economical than the traditional sulphitation method, which requires more lime, sulphur dioxide and phosphoric paste. The defecation method is now (1955) applied by four raw sugar factories with satisfactory results, although it cannot be said that all problems have been solved.

In another investigation, actually carried out at two mills, the slurry method of graining C strikes was studied. This method results in a more even grain and will eventually lead to smaller losses of sucrose in final molasses.

A contribution to our knowledge of the extent of the loss of sucrose in the milling tandem was the result of a special investigation carried out at one of the mills.

Smaller investigations dealt with the available methods of determining fibre in cane, the starch content of various cane varieties, the composition of Natal syrups, some aspects of the chemistry of juice clarification, and the occurrence of undetermined loss of sucrose at one of the mills.

The systematic testing of weekly samples of the sugar produced, and kindly provided by all mills, was continued during the year. Special attention was paid to the determination of the whiteness of mill white sugars by the measurement of the reflection curve.

The publication of weekly and monthly *Reports of Manufacturing Data* was continued, and the *Annual Summary of Chemical Laboratory Reports* was prepared for the S.A. Sugar Technologists' Association Congress.

Forty-eight visits were paid to factories to discuss processing and the required plant. These visits usually led to reports on technical subjects, and a summary thereof is to be found in the series *Communications from the Sugar Milling Research Institute*.

In addition to five *Communications* published in 1954, four papers by S.M.R.I. officers were published in the *Proceedings of the S.A.S.T.A. Congress*, two in the *International Sugar Journal*, and five in

nasionale Kommissie vir Eenvormige Metodes van Suikerontleding in Parys bygewoon en suikernavorsingslaboratoriums in Engeland, Duitsland, Holland en België besoek. Die doel van die meeste van die besoeke was om inligting in te win oor die toepassing van die deurlopende diffusieproses in die beetsuikernywerheid, 'n proses wat ook vir die rietsuikernywerheid van belang mag word.

#### VERFNYWERHEID-NAVORSINGSINSTITUUT

*Direkteur: MNR. G. M. HAMILTON*

Die Verfnywerheid-navorsingsinstituut het gedurende die afgelope jaar gestadige vordering gemaak. Die buitelugse blootstellingspos by die Reunion-lughawe is uitgebrei en 'n begin is gemaak met 'n bykomende pos by Congella. Die laasgenoemde verteenwoordig betreklik ernstige industriële besoedeling.

Die Buro vir Standaard het die Instituut gevra om 'n uitvoerige reeks toetse uit te voer vir die werkverrigting van verwe onder Suid-Afrikaanse toestande en om te probeer om hierdie toetse met versnelde toetse te korreleer. Die werk is van nasionale belang en die Wetenskaplike en Nywerheidsnavorsingsraad het ingestem om die ondersoek as 'n aparte projek te finansieer. 'n Aanvang is gemaak met die werk van die bykomende toerusting wat benodig is, insluitende 'n nuwe Atlas-dubbelboogverweringsmeter, is geïnstalleer.

Gedurende die jaar het die studie van Suid-Afrikaanse grondstowwe weer die meeste aandag geniet. Die toets van produkte met 'n dienstydsperk van drie jaar en langer is klaarblyklik 'n langtermynstudie en interimverslae word jaarliks uitgereik. Die volgende is belangrike werk wat tot dusver gedoen is:

#### Pigmente

Daar is begin met uitgesoekte plaaslike wit pigmente wat met ingevoerde ekwivalente vergelyk is. Terselfdertyd is ander wit pigmente wat uit die buiteland verkry kan word, maar nog nie in die Unie gemaak word nie, getoets. Die plaaslik vervaardigde sinkoksied het goed vertoon en het gelyk gestaan aan ingevoerde produkte. Die werking van die verskillende tipes titaanoksied het goed ooreengestem met die verwagte, terwyl basiese loodsulfaat 'n ietwat beter werkverrigting as witlood getoon het. Dit is feitlik onmoontlik om die stowwe in volgorde van verdienste te gradeer, aangesien so baie afhang van die medium waarvan die verf gemaak is.

'n Verdere toetsreeks is uitgevoer met rooi-oksiede, chroomgele en chroomgroene, wat almal in Suid-Afrika beskikbaar is. Die plaaslike materiale vertoon oor die algemeen bevredigend, maar die toetsing het nog nie lank genoeg geduur om enige opvallende verskille te toon nie.

the *South African Sugar Journal*.

The Director attended the Eleventh Session of the International Commission for Uniform Methods of Sugar Analysis in Paris and visited sugar research laboratories in England, Germany, Holland and Belgium. The purpose of most of these visits was to acquire information on the application of the continuous diffusion process in the beet sugar industry, a process which may become important to the cane sugar industry too.

#### PAINT INDUSTRIES' RESEARCH INSTITUTE

*Director: MR. G. M. HAMILTON*

The Paint Industries' Research Institute has made steady progress during the last year. The exterior exposure facilities at Reunion Airport have been extended and an additional site at Congella has been started. This latter represents industrial pollution of a fairly severe nature.

The Institute has been asked by the Bureau of Standards to carry out a comprehensive series of tests for the performance of paints under South African conditions and to attempt to correlate these with accelerated tests. This work is of a national character and the Council for Scientific and Industrial Research agreed to finance the investigation as a separate project. The work has been started and much of the additional equipment required, including a new Atlas Twin-Arc Weatherometer, has been installed.

During the year under review the major effort has again been directed towards the study of South African produced raw materials. The testing of products having a service life of three years and upwards is obviously a long-term measure and interim reports are issued annually. The following are the salient points to date:

#### Pigments

A start was made with selected local white pigments which were compared with imported equivalents. At the same time, other white pigments available from overseas, but not produced in the Union, were tested. The locally produced zinc oxide behaved well and was equal to imported products. The various types of titanium oxide behave in much the way as would be anticipated, while basic lead sulphate tended to give a rather better performance than white lead. It is virtually impossible to grade these materials in any particular order of merit, as so much depends on the medium from which the paint is made.

A further series of tests was carried out with red oxides, chrome yellows and chrome greens, all of which are available in South Africa. The local materials are, on the whole, behaving satisfactorily,



## Mediums

Wat mediums betref, kan die program natuurlikerwys in olies en sintetiese stowwe ingedeel word. Van die vyf olies wat getoets is, was drie van Suid-Afrikaanse oorsprong. Algemene gevolgtrekkings is dat geskeide sonneblomsaadolie omtrent die ekwivalent is van lynsaadolie sover dit blootstelling betref. Oor die algemeen is glasolieverwe egter nie baie geskik vir buitelugse blootstelling nie, in elk geval nie in Durban nie, en 'n baie langer leeftyd kan verkry word deur die gebruik van sintetiese stowwe. 'n Uitgesoekte groep van die laasgenoemdes wat in ons land beskikbaar is, word getoets, maar die leeftyd is sodanig dat dit 'n paar jaar sal duur voordat finale gevolgtrekkings gemaak kan word. Intussen kan gesê word dat uitstekende produkte in die Unie beskikbaar is.

'n Werksprogram, opgestel om grondverwe wat bestand is teen verwerking, te ondersoek, het getoon dat sinkchromaatgrondverwe wat geskik saamgestel is, uitstekend is wat betref weerstand teen soutsprei. Buitelugse blootstelling van die materiale duur voort.

Die Instituut het werk gedoen oor die wysigings wat nodig is om die gehalte van sonneblomsaadolie en kasterolie te verbeter. Die resultate tot dusver verkry is gepubliseer.

In sommige opsigte kan die evalueringsmetodes vir verf vereenvoudig en verbeter word. Die Instituut het 'n hoeveelheid werk oor die onderwerp gedoen, deels in medewerking met die Suid-Afrikaanse Buro vir Standaarde. Onder die onderwerpe wat ondersoek en verslag oor gedoen is, was 'n vereenvoudigde metode vir die bepaling van ftaalsuuranhidried, meting van dekvormoë en herhaalbaarheid van kolorimetriese bepalinge.

Op 'n vergadering van die Adviserende Navorsingsraad van die Instituut in Augustus, is oor die toekomstige werksprogram besluit. Die resultate van die werk sal aan lede van die Instituut bekend gemaak word namate hulle verkry word.

'n Besonder belangrike gebeurtenis vir die Instituut was die uiters goedgunstige en bemoedigende aanbod van die Raad om groter finansiële hulp te verleen indien die inkomste uit die nywerheid tot 'n meer bevredigende peil styg. Met weinig uitsonderings het die nywerheid hierop gereageer en die nodige bedrag is ingesamel.

## SUID-AFRIKAANSE WOLTEKSTIEL-NAVORSINGSINSTITUUT

*Direkteur:* DR. C. C. KRITZINGER

In die jaar het mnr. R. C. Palmer bedank en dr. C. C. Kritzinger, voorheen hoofnavorsingsbeampte aan die Leernywerheid-navorsingsinstituut, is in sy plek as Direkteur aangestel. Die verandering van direkteurskap

but testing has not yet been in progress long enough to show any marked differences.

## Media

So far as media are concerned, the programme has divided itself naturally into oils and synthetics. Of the five oils tested, three were of South African origin. General conclusions are that in many ways segregated sunflower seed oil is about equivalent to linseed oil, so far as outside exposure is concerned. However, gloss oil paints are generally not very suitable for outdoor exposure, at least in Durban, and a very much greater life is to be obtained by the use of synthetics. A selection of these latter available in this country is being tested, but the life is such that it will be some years before final conclusions can be reached. Meanwhile, it can be stated that excellent products are available from Union sources.

A programme of work, designed to examine anti-corrosive primers, revealed an excellent performance of suitably compounded zinc chromate primers, so far as resistance to salt spray is concerned. Outside exposure of these materials is proceeding.

The Institute has been carrying out work on the modification of sunflower seed oil and castor oil with a view to upgrading these materials. The results to date have been published.

In some respects the methods of evaluation of paint can be simplified and improved. The Institute has carried out a certain amount of work on this subject, some in conjunction with the South African Bureau of Standards. Among the subjects investigated and reported were a simplified method of determination phthalic anhydride, measurement of hiding power and repetition precision of colorimetric determinations.

At a meeting of the Research Advisory Council of the Institute held in August, the future programme of work was decided. The results of this work will be communicated to the members of the Institute as they accrue.

An event of the greatest importance to the Institute was the most generous and encouraging offer of additional financial support made by the Council should the industrial income rise to a more satisfactory level. With very few exceptions the Industry responded and the necessary sum was raised.

## SOUTH AFRICAN WOOL TEXTILE RESEARCH INSTITUTE

*Director:* DR. C. C. KRITZINGER

During the year Mr. R. C. Palmer resigned and Dr. C. C. Kritzinger, formerly Principal Research Officer of the Leather Industries Research Institute, was appointed Director in his place. This change

het noodwendig 'n mate van ontwrigting veroorsaak, maar desnieteenstaande is uitstaande werk gedoen, veral wat betref die was van ru wol en die gemeganiseerde verwerking van vesels.

### Fundamentele Navorsingswerk

In medewerking met die Grootfonteinse Landboukollege is daar begin met 'n studie van voedings- en groeifaktore wat die lengte/deursnee-verhouding van wolvesels op 'n skaap se rug beïnvloed, en die ontwikkeling van wolwas en verskille in wolsweet bewerk. Die projek is so opgestel dat dit eers na 'n paar jaar voltooi sal wees.

Op die gebied van ru wol is wasstudies uitgevoer om vas te stel watter uitwerking verskille in die wolwas en die wolsweet op die wasproses sal hê. Terwyl die werk begin is as 'n projek om slegs feite in te samel, het die verkreë inligting gou van praktiese belang geword en op die noodsaaklikheid gedui om verskillende wolsoorte met heeltemal verskillende wasmetodes te behandel.

Daar is reeds ver gevorder met die ontwikkeling van wiskundige teorieë om kort- en langtermynvariasies in drade te verklaar en die teorieë het dit moontlik gemaak om masjienfoute vas te stel slegs deur metings te neem op die finale gare. Daar is ook voortgegaan met die werk oor die samestelling van kambolle om die variasies wat periodiek voorkom, te verklaar.

'n Begin is gemaak met 'n studie van die skeikunde van bokhaar en die eerste projek staan in verband met die reaksie van bokhaar op sure. In teenstelling met die algemene mening is bevind dat bokhaar nie so maklik soos wol deur suur beskadig word nie.

### Tegniese Ondersoeke

Gedurende die jaar is toenemende gebruik gemaak van die Instituut se tegniese dienste. Afgesien van talle versoeke vir ontledings van materiale, is die personeel dikwels genader om raad te gee oor fabrieksvraagstukke in verband met wolwassery, behandeling van afvloeisels, herwinning van wolwas, onreëlmatigheid van drade, kleuring en afwerking. Wat wassery betref, is 'n aantal ontledingsmetodes ontwikkel om die doeltreffendheid van wolvetverwydering, afspoeling en suiwering van uitvloeisels na te gaan en te beheer. Verwag word dat hierdie algemene gebied van werksaamhede gedurende die volgende paar jaar sal uitbrei om die Instituut en die fabriek in nouer voeling met mekaar te bring.

### Publikasies

Gedurende die jaar is drie *Tegniese Verslae* en agt verhandelinge in verskeie tydskrifte gepubliseer. Verskeie ander verhandelinge is persklaar of word gereed gemaak vir publikasie.

of directorship inevitably caused a certain amount of dislocation, but some outstanding work was nevertheless done, particularly on the fields of raw wool scouring and the mechanical processing of fibres.

### Fundamental Research

A start has been made, in collaboration with Grootfontein College of Agriculture, on a study of factors in feeding and growth which affect the length diameter ratio of wool fibres on a sheep's back and the development of wool grease and variations in suint (sweat). This project is designed to be completed only after several years.

In the field of raw wool, scouring studies have been undertaken on variations in the grease and suint content in wool and the effect of such variations on the scouring process. Whilst this work was initiated as a purely fact-finding project, the information obtained soon assumed practical importance and has thrown considerable light on the necessity for treating different wools by drastically different methods.

Considerable progress has been made in the development of mathematical theories to account for short and long term variations in yarns, these theories have made it possible to diagnose machine faults purely from measurements on the final yarn. Work has also continued on the structure of tops to elucidate the periodic variations encountered.

An investigation has been started on the chemistry of mohair, the first project being concerned with its reaction to acids. Contrary to general belief it was found that mohair is less susceptible to acid damage than wool.

### Technical Investigations

During the year, increasing use was made of the Institute's technical service. Apart from numerous enquiries for analysis of materials, the staff has often been called upon for advice on factory problems in connection with scouring, effluent treatment, grease recovery, yarn irregularity, dyeing and finishing. With regard to scouring, a number of rapid analytical methods have been developed for following and controlling the efficiency of wool grease removal, rinsing and effluent purification. It is anticipated that this general field of activity will expand during the next few years to bring the Institute into the factory and factory problems into the Institute.

### Publications

During the year three Technical Reports and eight papers in various Journals have been published. Several more papers are in the Press or being prepared for publication.





# Research Bursaries and Assistantships

awarded by the C.S.I.R. during 1955

## Navorsingsbeurse en Assistenteskappe

wat deur die W.N.N.R. gedurende 1955 toegeken is

### GENERAL RESEARCH — ALGEMENE NAVORSING

#### BURSARIES — BEURSE

##### (i) Senior Bursaries/Senior Beurse (£200-£1,000)

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
BARKER, Prof. W. H. B.Sc., Ph.D., F.R.I.C., F.R.S.S.A. Professor of Chemistry £800	Rhodes University	Techniques of soil and plant analysis—particularly for trace elements.
BOOYENS, J. B.Sc., B.Sc. (Hons.) Fisioloog £200	Potchefstroomse Universiteit vir C.H.O.	Watermetabolisme ten opsigte van hitte.
BOTTO, Dr. G. Dr. L., Dr. Ph., Research Bursar £480	Transvaal Museum, Pretoria	Catalogue and check lists of S.A. Coleoptera. (Previous award in 1954.)
BRENNER, Dr. M. W. B.A., B.A. (Hons.), M.A., Ph.D. Research Bursar £500	National Institute for Personnel Research, Johannesburg	An investigation on how the temperament variable of "Secondary Function" manifests itself in the perception of certain usual phenomena.
CROMPTON, Prof. R. H. B.A., M.A., F.R.S. (S.A.), S.A. Medal and Grant— S.A.A.A.S. Research Bursar £400	—	The collection and the taxonomic and ecological study of the phanerogamic and pteridophytic flora of Swaziland.
EWER, Dr. (Mrs.) R. F. B.Sc., Ph.D. Research Bursar £400	University of Natal	Neuromuscular physiology of vertebrates other than frog and mammal. (Previous awards: 1948, 1950, 1951, 1953, 1954.)
FOURIE, Dr. D. J. B.Sc., M.Sc., D.Sc., Lektor £600	Physikalische Institut van die Technische Hochschule, Darmstadt	Elektron-mikroskopiese ondersoek van dun metaallagies.
FREEDMAN, L. B.Sc., Research Bursar £720	Transvaal Museum, Pretoria	A monograph of "The fossil cercopithecoidea of South Africa." (Previous awards: 1953, 1954.)



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
HOUSEHAM, K. O. B.Sc., M.Sc., M.A., Lecturer £500	Institute for Advanced Study, Princeton, U.S.A.	Measure-preserving transformations on a measure space by applying the deeper results of topology to the metric space associated with the measure space.
Hovy, Dr. J. W. Biologisch Candidaat (Utrecht), B.Sc., B.Sc. (Hons.), Ph.D., Lecturer £400	Physiological Institute, University of Bern, Switzerland	Investigations on the isolated orthosympathetic and para-sympathetic nerve fibres of the amphibian heart.
OMER-COOPER, Dr. (Mrs.) J. B.A., Ph.D., Honorary Lecturer in Zoology £550	Rhodes University	The dytiscidae of the Eastern Cape.
SCHUMANN, D. E. W. B.Com., M.Com.— (cum laude), Research Bursar £400	Virginia Polytechnic Institute, U.S.A.	The efficiencies of experiments with special reference to sensory difference tests of food qualities.
SCOTT, Dr. (Mrs.) K. M. F. B.Sc., M.Sc., Ph.D., F.R.E.S. Research Bursar £800	University of Cape Town	Taxonomic study and description of the trichoptera of S.A. (Previous award: 1954.)
SEARS, Prof. D. B. D.Sc., D.Phil., Professor of Pure mathematics £800	University of Princeton, U.S.A.	Differential equations.
SMITH, Prof. J. L. B. B.A., M.Sc., Ph.D., F.R.S.S.A. Research Professor £1,300	Rhodes University	Fishes (Previous awards: every year since 1946.)
TAGER, Dr. J. M. B.Sc. (Agric.), Ph.D., Navorsingsbeurshouer £900	Universiteit van Pretoria	Chemiese omsettings gedurende asemhaling en verwante prosesse in plantweefsels. (Vorige toekening: 1954.)
VAN DER SPUY, Dr. E. B.Sc., Ph.D., Research Physicist £400	University of Manchester, England	The interaction of particles and neutrons in relation to nuclear forces.
VAN ZYL, A. B.Sc., Secondary Teacher's Dipl., M.Sc., Lecturer £600	Medical Research Institute, Mill Hill, London, Eng- land	Metabolism of iodide with special reference to the synthesis of iodinated compounds by the thyroid gland.
WEINBRENN, (Miss) C. B.Sc., B.Sc. (Hons.), M.Sc., Research Bursar £400	University of the Witwatersrand	Problems concerning the functions of amphibian heart with special reference to the refractory period of the heart under varying conditions.

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
KUPER, Dr. C. G. B.Sc., B.A., M.A., Ph.D., I.C.I. Fellow, Liverpool University £200 (Oct.-Dec. 1955)	Liverpool University, England	Theory of the effects of low temperatures on the solid state.
WRIGHT, Dr. (Mrs.) W. G. B.Sc., D.I.C., Ph.D., Research Bursar £200	University of Natal	Alkaloids of Amaryllidaceae. (Previous awards: 1951, 1953, 1954.)

(ii) Student Bursaries/Studentebeurse

<i>Physics/Fisika</i>		
ALLSOPP, H. L. B.Sc. (Hons.), M.Sc.	H. H. Wills Physical Lab., Bristol	Dielectric properties of ferro-electric materials. (Previous awards: 1953, 1954.)
ARCHER, S. F. H. J. B.Sc.	University of Cape Town	Monohydrate of iodide of 1) Benzylidene; 2) Isopropylidene hydrazine.
BAART, E. E. B.Sc.	Rhodes University	Scintillation decay times and pulse shapes and photo-fluorescence decay times using a high speed oscilloscopic technique.
BARNARD, E. B.Sc.	Universiteit van Stellenbosch	Die kwantitatiewe bepaling van Ag, Pt, Pb en Al in silikaatryke ertse.
BISHOP, J. E. L. B.Sc.	University of Natal	Cloud chamber study of condensation on nuclei produced by ultra-violet light.
CAMERON, A. J. W. B.Sc., B.Sc. (Hons.)	Rhodes University	Energy exchange processes in fluorescent organic phosphors. (Previous award in 1954.)
CILLIERS, W. A. B.Sc.	Universiteit van Stellenbosch	Die ontwerp en bou van 'n registreerapparaat vir kosmiese straalmesone.
CONCER, D. B. B.Sc., B.Sc. (Hons.)	University of the Witwatersrand	Some theoretical problems of heat flow associated with mine ventilation. (Previous award in 1954.)
HAMILTON, T. D. S. B.Sc., B.Sc. (Hons.)	Rhodes University	Photofluorescence decay times of organic phosphors. (Previous award: 1954.)
KRUGER, P. J. B.Sc.	Potchefstroomse Universiteit vir C.H.O.	Tydvariasies van die neutron-komponent van kosmiese strale.
MATTHEWS, J. W. B.Sc.	University of the Witwatersrand	Migration of kink bands in zinc and cadmium crystals.
MCCARTHUR, I. A. B.Sc., B.Sc. (Hons.)	University of Natal	The heat of adsorption of ethylene on alkali halide crystals.
MCELHINNY, M. W. B.Sc., B.Sc. (Hons.)	Rhodes University	Ionospheric Studies of the annular solar eclipse, Xmas Day 1954. (Previous award: 1954.)
MCMURRAY, W. R.	Oxford University, England	Some problems concerning photo-disintegration cross-section measurement. (Previous award: 1954.)
O'CONNOR, B. B.Sc.	University of Natal	Study of secondary electron emission produced by high energy photo-electrons.
PIETERSE, P. H. B.Sc., M.Sc.	Universiteit van Stellenbosch	Die bepaling van die F-waardes van Fe 1 lyne met hoë opwekkingspotensiale. (Vorige toekening: 1954.)



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
PLATT, M. R. B.Sc.	Rhodes University	A quantitative investigation of fluorescence decay times and fluorescence of organic phosphors when irradiated in the Schumann region.
VAN DER WALT, RICHARD B.Sc.	Potchefstroomse Universiteit vir C.H.O.	Onderzoek in verband met mumesoniese vangs deur kerne. (Vorige toekenning: 1954.)
VAN DER WALT, ROELOF	Potchefstroomse Universiteit vir C.H.O.	„Electronic circuits for operating a Wilson cloud chamber and applied to a research problem.”
WOOD, I. D. B.Sc., B.Sc. (Hons.) (Phys.), B.A. (Hons.) (Maths.)	Cambridge University, England	Electronics or nuclear physics.
<b>Chemistry/Chemie</b> BATES, (Miss) A. B.Sc.	University of Natal	Alkaloids with hypertensive action (S.A. plants).
BODY, R. A. F. B.Sc.	University of Natal	Alkaloids from South African plants which may have hypertensive action.
CAMPBELL, W. E. B.Sc., B.Sc. (Hons.)	Rhodes University	The synthesis and condensation of resorcinylic alcohols. (Previous award: 1954.)
CLUR, D. A. B.Sc.	Rhodes University	Solubility of mercurous chloride from 5° to 55°C.
CRUYWAGEN, J. J. B.Sc.	Universiteit van Stellenbosch	Faktore wat die presipitasie van ammoniumfosfomolibdaat beïnvloed.
DE VILLIERS, J. P. B.Sc., M.Sc.	Oxford University, England	Synthetical experiment in the group of the alkaloids of Amaryllidaceae. (Previous awards: 1953, 1954.)
EHLERS, A. B.Sc., M.Sc.	Universiteit van Pretoria	'n Vergelykende chemiese en biochemiese ondersoek van die uitskeidingsprodukte van ceroplastes heliocrysis van sinofae wat op die doringboom voorkom. (Vorige toekennings: 1953, 1954.)
EVE, D. J. B.Sc., B.Sc. (Hons.)	Rhodes University	A statistical examination of methods for the determination of zinc in soils and plants. (Previous award: 1954.)
FINKELSTEIN, N. P. B.Sc.	Rhodes University	Boundary potentials of salt bridges of varying composition.
GOOSEN, A. B.Sc.	University of Natal	Alkaloids from South African plants with possible hypertensive action.
GOVINDEN, H. S. B.Sc., B.Sc. (Hons.)	Rhodes University	Construction of a wide frequency range double super-heterodyne conductance bridge. (Previous award: 1954.)
HAHN, H. H. B.Sc., M.Sc.	Technische Hochschule, Karlsruhe, Duitsland	Navorsing op die gebied wat van belang is vir die organies-chemiese nywerheid.
HIGGINS, T. H. S. B.Sc., B.Sc. (Hons.) M.Sc.	University of Natal	The kinetics of the reaction between gaseous boron trichloride and calcium fluoride. (Previous awards: 1953, 1954.)
HOBBS, R. N. B.Sc.	University of Natal	Resins from euphorbia species.
HOTZ, M. C. B. B.Sc.	University of Cape Town	Physico-chemical studies on certain hydrazine salts and their derivatives.
JACH, J. B.Sc., M.Sc., A.R.I.C.	Oxford University, England	Kinetics of gaseous reactions. (Previous awards: 1952, 1953.)

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
KRYNAUW, G. N.	Universiteit van Pretoria	(1) Die titrasie van $Ca^{++}$ en $Mg^{++}$ en bepaalde oplossings met versenaat om te dien as vinniger metode van analise. (2) 'n Verrykte natuurlike mielondersoek en maonlike verband tussen die $Ca^{++}$ en $Mg^{++}$ -gehalte vas te stel. (3) Fosforgehalteondersoek met die oog op die verband met die $Ca^{++}$ en $Mg^{++}$ -inhoud.
KYLE, E. B.Sc.	University of Natal	Thermal diffusion in gaseous boron trifluoride-nitrogen and boron trichloride-nitrogen mixtures.
LOTZ, C. R. B.Sc. (Applied and Industrial Chemistry)	University of Cape Town	A comparative study of the effects of the nitrides of the transition elements on the activation energy for the ammonia synthesis. (Previous award: 1954.)
O'SULLIVAN, D. J. M. B.Sc., B.Sc. (Hons.)	Rhodes University	Ion-exchange resins from optically active materials. (Previous award: 1954.)
PINFOLD, T. A.	University of Cape Town	Polarography in anhydrous formic acid.
ROSSOUW, A. J. B.Sc., B.Sc. (Hons.), M.Sc.	University of Natal	Studies in infra-red spectroscopy.
SCHÜLER, B. O. G. B.Sc., B.Sc. (Hons.)	University of Natal	Study of the structure of alkaloids with special reference to their infra-red absorption spectra.
VAN DEN HEEVER, H. H. B.Sc.	University of Natal	Triterpenes from euphorbia species.
VERBEEK, A. A. B.Sc.	University of Natal	Structure of alkaloids with special reference to their infra-red spectra.
WATLING, K. H. M.Sc.	University of Natal	Euphorbia resins.
WHITE, E. G. M.Sc., F.R.I.C.	University of the Witwatersrand	Prevention of pollution-treatment of sewage and industrial wastes.
WIGILL, J. B. B.Sc., A.R.I.C., F.R.S.A., A.M.S.A.C.I.	University of Cape Town	Reaction kinetics.
<i>Zoology/Dierkunde</i> ALEXANDER, (Miss) A. J. B.Sc.	University of Natal	Neuro-muscular physiological studies on the earthworms or the arachnida.
ALEXANDER, L. R. B.Sc., B.Sc. (Hons.)	University of Natal	Active ion transport in Crustacea. (Previous award: 1954.)
ALLANSON, B. R. B.Sc., B.Sc. (Hons.)	University of Cape Town	A new method for the determination of osmotic pressure of micro volumes and its application to the determination of the osmotic pressure of invertebrate body fluids in relation to the environment.
BALINSKY, J. B.	University of the Witwatersrand	Quantitative analysis of the nitrogen excretion during the development of amphibians correlated with stage of development and as indication of protein metabolism.
BUSH, B. M. H. B.Sc.	University of Natal	Studies on the myoneural physiology of either reflex inhibition in crabs or the anterior legs of locusts.
ECCLES, D. H. B.Sc.	University of Cape Town	Biology of estuarine fishes of the genus atherina.



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
EDMONSTONE-SAMMONS (Miss) C. B.Sc., B.Sc. (Hons.)	Rhodes University	Fungal ecology of pineapple plants with special reference to condition known as black spot. (Previous award: 1954.)
GORDON, (Miss) H. R. S. B.Sc.	University of the Witwatersrand	A study of the ecology and behaviour of the Uca species of Inhaca Island. (Previous award: 1954.)
GRAHAM, P. B.Sc.	Rhodes University	Some aspects of the arthropod fauna of certain soils in the Eastern Cape Province.
MYERS, N. J. B.Sc.	Rhodes University	A study of some aspects of ant activity in the Eastern Cape Province.
SCHUTTE, C. H. J.	Potchefstroomse Universiteit vir C.H.O.	Die anatomie van <i>Biomphalaria pfeifferi</i> , die Suid-Afrikaanse slakvektor van dermbilharziase.
<b>Electrical Engineering/ Elektriese Ingenieurswese</b> BRAVER, E. B.Sc.	University of the Witwatersrand	Investigation of the radio noise caused by spark and corona discharges.
<b>Civil Engineering Siviele Ingenieurswese</b> MACGREGOR, M. D.	University of Natal	An experimental investigation of stresses induced in cylindrical shell concrete roofs by unusual loading conditions and other structural features.
ROBERTS, A. C. P.	University of Natal	Theoretical and experimental investigation into the buckling of pre-stressed concrete columns.
SPARKS, A. D. W.	University of Natal	Concerning the reliability of using a hydraulic model as a means of rating the flow of its prototype.
<b>Geology/Geologie</b> GLATTHAAR, C. W. B.Sc.	Universiteit van Pretoria	Die ysterertsafsetting op Kromdraai No. 459, suid van Rust-der-Winter.
GORSKY, (Mrs.) E. Dipl. Phil. Faculty of the University Ljubljana, Yugoslavia	University of Natal	Microscopic and field study of the minerals from the Lebombo range.
LIEBENBERG, B. F. B.Sc., B.Sc. (Hons.)	Potchefstroomse Universiteit vir C.H.O.	Die petrologie van die dolorietplaat van Annasrust 4 in die distrik Vrededorp, en die geologie van die ongewing.
<b>Land Survey/Landmeetkunde</b> BARRET, M. B.Sc. (Survey), L.S.A.	University of Natal	Study of scope and accuracy of Marriott Thompson stereoplotter and other photogrammetric apparatus.
JONES, B. M. B.Sc. (Survey)	University of Natal	Investigation into accuracy and reliability of property boundaries in Central Durban.
<b>Mathematics/Wiskunde</b> VAN DER MARK, J. B.Sc., M.Sc. (Fisika), M.Sc. (Wiskunde)	Universiteit van Leiden, Nederland	Bepaling van die groepe-karakters, sowel vir eindige as vir oneindige groepe, en in besonder vir modulêre groepe.
<b>Hydrobiology L Hidrobiologie</b> CLAASSEN, (Mej.) M. I.	Universiteit van Pretoria	Hidrobiologie (plantkunde). (Vorige toekening: 1954.)
<b>Biology/Biologie</b> GEORGALA, D. L. B.Sc. (Agric.), Dipl. in Applied Microbiology	Torry Research Station, Scotland	Qualitative and Quantitative studies of the bacterial flora of North Sea cod and the effect on the flora of subsequent handling.

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
Agriculture/Landbou DE MEULENAERE, H. J. H.	University of Natal	Metabolism study on poultry semen.
Botany/Plantkunde JONG, K. B.Sc.	University of the Witwatersrand	Investigations of the genus scilla on the Rand.
MELAMED, M. D. B.Sc.	University of the Witwatersrand	Fluorine metabolism of gifblaar.
TAYLOR, (Miss) P. A. B.Sc.	University of Cape Town	Studies on the effects of veld-burning in the South-Western Cape.
WINCKLER, (Mej.) D. G. B.Sc. (cum laude)	Universiteit van Stellenbosch	Die morfologie, sitologie, en voortplanting van <i>Micropterum herrei</i> en <i>M. pinnatifidum</i> .

(iii) Directed Research Bursaries/Beurse vir Navorsing onder Leiding

DE RIDDER, J. C. B.A., B.A. (Hons.)	National Institute for Personnel Research, Johannesburg	Occupational and educational differences in test performance on a battery of adaptability tests designed for natives. (Previous awards: 1953, 1954.)
FREAN, (Miss) R. M. Final year B.Arch. student	National Building Research Institute, Pretoria	Aesthetic considerations underlying the grouping of housing units in the planning of native townships.
HARRINGTON, J. S. B.Sc., B.Sc. (Hons.) P.R.Ent. S.	London School of Hygiene and Tropical Medicine, London, England	A study of various aspects of the bio-chemistry of insect blood. (Previous awards: 1952, 1953, 1954.)
KAPLAN, Dr. M. F. B.A., B.Sc. (Eng.), Ph.D. (Eng.), A.M.I. Struct.E., A.M. (S.A.), I.C.E., M.Am.C.I., A.M. (S.A.), P.C.A.	Road Research Laboratory, Harmondsworth, England	Pre-stressed concrete. (Previous awards: 1951, 1953, 1954.)
LANGER, G. B.Sc. (Eng.), M.Sc. (Eng.), A.M.I.Mech. E., A.F.R. Ae.S.	Cambridge University, England	The thermodynamics of airflow with friction and heat transfer in a smooth tube. (Previous awards: 1953, 1954.)

ASSISTANTSHIPS — ASSISTENTSKAPPE (£450 - £650)

(a) Grants for the employment of skilled research assistants/Toekennings vir die indiensneming van geskoolde navorsings-assistente

AARTS, Dr. W. H. B.Sc., M.Sc., Ph.D., Senior Lecturer	University of the Witwatersrand	Investigation of resistivity changes in further alloy systems beginning with copper-nickel and brass.
BADENHUIZEN, Prof. N. P. D.Sc. (cum laude), Professor of Botany	University of the Witwatersrand	Biochemistry of starch metabolism. (Previous award: 1954.)
BOTHA, Prof. P. J. M.Sc. (onderskeiding), Ph.D. Professor in Plantfisiologie	Potchefstroomse Universiteit vir C.H.O.	Die fisiologie van parasitiese blomplante. (Vorige toekennings: 1946, 1947, 1949-1954.)
BOZZOLI, Prof. G. R. D.Sc. (Eng.), Professor of Electrical Engineering	University of the Witwatersrand	(a) Study of long sparks in the atmosphere. (b) Study of sparks in oil.



<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
CONNELL, Prof. P. H. B.Arch., M.I.S.A.A., A.R.I.B.A., Professor of Architecture	University of Natal	Investigation into the use of building materials in South Africa. (Previous awards: 1951-1954.)
DAY, Prof. J. H. Ph.D., F.R.S.S.A., Professor of Zoology	University of Cape Town	(a) A survey of S.A. estuaries. (b) The shallow-water fauna of False Bay. (Previous awards: 1950-1954.)
DE WIT, Prof. J. J. D. Dr. Phil. Nat. (cum laude) Professor in Dierkunde	Universiteit van die Oranje-Vrystaat	Studie van bittervoorn-, groot- en kurpervisse. (Vorige toekening: 1954.)
DU TOIT, Prof. C. A. M.Sc. (cum laude), Ph.D., MALAN, Dr. M. E. M.Sc. (cum laude), D.Sc. Onderskeidelik Professor en Senior lektrese in Dierkunde	Universiteit van Stellenbosch	(a) Kraniologie van die Anura. (b) Gastrulasie van die bergskilpad en skedelontwikkeling van die soogdiere.
GANE, Dr. P. G. B.Sc., M.Sc., Ph.D. A.Inst.P. Deputy Director of the Bernard Price Institute for Geophysical Research	University of the Witwatersrand	Seismic investigation of crustal structure in South Africa. (Previous awards: 1949-1954.)
GOULD, Prof. A. J. Ph.D., D.Sc., M.I.C.E., M.I.Mech.E., M.I.N.A. Professor of Mechanical Engineering	University of Natal	(a) The fatigue properties of a range of steels of S.A. manufacture. (b) A fundamental investigation of caustic cracking in boiler steels. (c) Fundamental investigations into corrosion-fatigue. (Previous award: 1954.)
HALES, Prof. A. L. B.Sc., B.A., M.Sc., M.A., Ph.D. Director, Bernard Price Institute of Geophysical Research	University of the Witwatersrand	Investigations relating to the structure of the crust of the earth and its history. (Previous award: 1954.)
HOLLIMAN, Prof. F. G. B.A., M.A., Ph.D. Professor of Organic Chemistry	University of Cape Town	An investigation of the pigments produced by various strains of <i>Pseudomonas aeruginosa</i> and the synthesis of the phenazine system in these organisms.
ISAAC, Prof. W. E. B.Sc., Ph.D. Harry Bolus Professor	University of Cape Town	Algal ecology and distribution patterns of genera and species on S.A. coasts. (Previous awards: 1952-1954.)
JAMES, Prof. R. W. B.A., M.A., B.Sc. Natural Sciences Tripos, F.R.S. (S.A.) Professor of Physics	University of Cape Town	The structure of crystals. (Previous award: 1954.)
KRUGSMAN, Dr. B. J. Ph.D. Senior Lecturer	University of Cape Town	Electrophysiology of the nerve-muscle sensory system of marine animals in relation to salinity. (Previous awards: 1953, 1954.)
TWYMAN, Prof. E. S. M.Sc., Ph.D.; and OMER-COOPER, Prof. J. M.A., M.Sc. Professors of Botany and Zoology respectively	Rhodes University	Biological survey of the standing waters of the Eastern Cape Province.

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
SMITH, Prof. J. L. B. B.A., M.Sc., Ph.D., F.R.S. (S.A.) Research Professor	Rhodes University	Fishes. (Previous award: 1954.)
STEYN, W. J. A. M.Sc. Lecturer in Soil Science	Rhodes University	The mineral status of plants and soils. (Previous award: 1954.)
TWYMAN, Prof. E. S. B.Sc., M.Sc., Ph.D. Professor of Botany	Rhodes University	(a) Nutritional survey of Eastern Province. (b) Water culture investigations on the functions of minor elements. (c) Grassland experiment at Bathurst. (d) The absorption of cations by plant tissues from culture solution. (Previous award: 1954.)
WARREN, Prof. F. L. A.R.C.S., B.Sc., Ph.D., D.Sc., F.R.I.C. Professor of Chemistry and Chemical Technology	University of Natal	The chemistry of natural products derived from South African plants. (Previous awards: 1951-1954.)

(b) Grants for the employment of unskilled research assistants/Toekennings vir die indiensneming van ongeskoolde navorsings-assistente (£350 - £450)

KOCH, Dr. C. D.Ph. Assistant Professional Officer	Transvaal Museum	Monograph of Southern Africa tenebrionidae including Pan-African and inter-continental phylogenetic studies.
LEISEGANG, Dr. E. C. B.Sc., M.Sc., Ph.D. Senior Lecturer	University of Natal	Infra-red spectroscopy. (Previous award: 1954.)
LUTJEHARMS, Prof. W. J. Nat.Phil.D., F.R.S. (S.A.) Professor in Plantkunde	Universiteit van die Oranje-Vrystaat	Mikrobiologiese ondersoekings i.v.m. die populasie en organiese stof in die grond.



**MEDICAL, DENTAL AND NUTRITIONAL RESEARCH/  
 MEDIESE, TANDHEELKUNDIGE EN VOEDINGSNAVORSING**

**BURSARIES — BEURSE**

**(i) Senior Bursaries/Senior Beurse (£200 - £1,000)**

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
HOFFENBERG, Dr. R. M.B., Ch.B., M.R.C.P. £800	University of Cape Town	A study of calcium and phosphorus metabolism with reference to the mode of action of parathyroid hormone, Vitamin D, etc.
MUSPRATT, J. B.A. (Hons.) Natural Sciences Tripos. £500	South African Institute for Medical Research	Arthropod-borne diseases of South Africa. (Previous awards: 1951-1954.)
PRETORIUS, Dr. H. P. J. M.B., Ch.B., M.Med. (Paed.) £800	Children's Medical Services, Bellevue Hospital, New York, V.S.A.	Ondersoek na die voorkoms van patogene organismes in die dikderm by kinders met gastroenteritis, veral die B. Coli neapolitanum groep.
SLOME, Dr. R. M.B., Ch.B., M.D. M.R.C.P. £800	University of Cape Town	Study of fate of orally administered protein and amino-acids in protein malnutrition by isotope-labelled techniques.

**(ii) Student Bursaries/Studentebeurse**

SALBER, Dr. E. J. M.B., Ch.B., D.P.H.	University of Cape Town	Weight growth of infants from birth to one year.
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**ASSISTANTSHIPS — ASSISTENTSKAPPE (£450 - £650)**

**(i) Grants for the employment of skilled research assistants/Toekennings vir die indiensneming van geskoolde navorsings-assistente**

DE JAGER, Prof. C. L. B.A., B.D.S. Professor/Tandarts	Universiteit van Pretoria	'n Opname van die patologiese letsels van die mondholte met spesiale aandag aan die karies-insidensie by die nie-blanke rasse van S.A.
FORMAN, Prof. F. M.D., F.R.C.P., Physician, Groote Schoor Hospital	University of Cape Town	Gout and uric metabolism. Renal lesion in gout. Hypopituitarism after Hypophysectomy Proteinurias. Cortisone, calcium and phosphorus studies. (Previous awards: 1953, 1954.)
GRIEVE, Dr. J. M. M.B., Ch.B., D.M.R.E. Head of Dept. of Radiotherapy, Groote Schoor Hospital and Cape Town University	University of Cape Town	The apparent sex, age and other distributions of the various types of malignant disease in different ethnic groups as reflected in reports of cases in the Groote Schoor Hospital between 1938 and 1945.
HEYNS, Prof. O. S. M.A., D.Sc., F.R.C.A.G. Professor of Obstetrics and Gynaecology	University of the Witwatersrand	An investigation into the nature of uterine contractility. (Previous awards: 1947, 1950-1954.)
KARK, Dr. A. E. B.Sc., M.B., B.Ch., F.R.C.S. (Eng.) Surgeon (Tutorial)	University of the Witwatersrand	(a) Cirrhosis of liver and portal hypertension. (b) Surgical shock. (c) Small intestine obstruction. (Previous awards: 1951-1954.)
KINNEAR, Dr. A. A. Ch.B., M.D., D.Sc., Senior Lektor	Universiteit van Pretoria.	Biochemie van melaatsheid.

<i>Name and Qualifications Naam en Kwalifikasies</i>	<i>Where tenable Waar geldig</i>	<i>Subject of Research Onderwerp van Navorsing</i>
(1) MULLER, Prof. (Mev.) T. M.B., Ch.B. (2) MEYER, Prof. B. J. B.Sc., M.Sc., D.Sc., M.B., Ch.B. (3) KOK, Dr. O. V. S. M.B., Ch.B. D.A. (Eng.), D.A. (Ireland) D.I.M. (Liverpool) (1) Professor in Anatomie (2) Professor in Fisiologie (3) Senior lektor (Narkose)	Universiteit van Pretoria	(a) Invloed van A.T.C.H. kortisoos, stilboëstrol estrogene, testosteroon en Vit. C op bindweefsel. (b) Verband tussen genoemde stowwe en wondgenesing. (c) Verband tussen verskillende hormone, vitamines en spermatogenese. (d) Verband tussen bynier en timus soos op proefdiere waargeneem. (Vorige toekenning: 1954.)
OETTLER, Dr. A. G. B.Sc., B.Sc. (Hons.), M.B., B.Ch. Cancer Research Fellow	South African Institute for Medical Research	(a) The obtaining of sitetype ratios for histologically diagnosed cancers in different racial groups in South Africa. (b) The development of a colony of multimammate mice, and subsequent experiments of factors affecting the spontaneous cancers appearing in these.
PIJPER, Prof. A. M.D. (Leiden), D.Sc. (Hon.c.) Pretoria, D.Sc. (Hon.c.) Kaap Emeritus Professor in Patologie	Universiteit van Pretoria	Beweging van bakteries en hul flagella. (Vorige toekennings: 1950-1954.)
SNYMAN, Prof. H. W. M.B., Ch.B., M.D. Hoof van Departement en Direkteur van Hartnavorsingseenheid	Universiteit van Pretoria	Miokardaandoenings by die Bantoe. (Vorige toekennings: 1950-1954.)
UNDERWOOD, Prof. W. E. M.A., Nat. Sci. Tripos M.R.C.S., L.R.C.P., F.R.C.S., M.B., B.Ch. Professor of Surgery	University of the Witwatersrand	The study of gastric and duodenal functions in the series of dogs now "in residence."

(ii) Grants for the employment of unskilled research assistants/Toekennings vir die indiensneming van ongeskoolde navorsings-assistente—(£350 - £450)

BARNARD, Dr. P. J. J. M.B., Ch.B., M.R.C.P., M.D. Senior lektor	Universiteit van Pretoria	Trombo-emboliese pulmonale arteriosklerose, die uitwerking van hipoksemie op die harte en longe van proefdiere. (Vorige toekennings: 1953, 1954.)
GOETZ, Prof. R. H. M.B., Ch.B., M.D. (Frankfurt), M.D. (Berne) Research Professor in Surgery	University of Cape Town	Anatomy and haemodynamics of the circulation through the head in the giraffe with special reference to changes in posture. Anatomy and physiology of the autonomic nervous system in general, and the carotid sinus in particular, in this animal. (Previous award: 1954.)
HEEREMA, Dr. (Miss) J. C. Oogarts (Utrecht) Ophthalmic Surgeon	University of Cape Town	Keratopasty of the cornea: I. Reaction of epithelium. (Previous awards: 1950, 1952, 1954.)
OETTLER, Dr. A. G. B.Sc., B.Sc. (Hons.), M.B., B.Ch. Cancer Research Fellow.	South African Institute for Medical Research	(a) The obtaining of site-type ratios for histologically diagnosed cancers in different racial groups in South Africa. (b) The development of a colony of multimammate mice, and subsequent experiments on factors affecting the spontaneous cancers appearing in these.



## Publications

## Publikasies

## A.—C.S.I.R. PUBLICATIONS/W.N.N.R. PUBLIKASIES

## Library and Information Division

*C.S.I.R. Information* (monthly library accessions list)  
*Abstracting and indexing journals.*  
*C.S.I.R. List of abbreviations of names of societies, organizations, etc.*  
*Books and pamphlets on air pollution*, Library Class list No. 8.  
*Books and pamphlets on soil mechanics*, Library Class List No. 3 (supplement).

## Biblioteek- en Inligtingsafdeling

*W.N.N.R. Inligting* (maandelikse biblioteekbyvoegingslys)

## National Institute for Personnel Research

*Journal of the N.I.P.R.* (thrice yearly).

## Nasionale Instituut vir Personeelnavorsing

## National Building Research Institute

*Information Sheets* (Series DIS)—bi-monthly selections of technical enquiries with replies.  
*Bulletin* (Series D.B)—twice yearly.  
*Research studies on the costs of urban Bantu Housing*, Series D.R. 10, 1954, Pretoria, Council for Scientific and Industrial Research (Price 30/-).

## Nasionale Bounavorsingsinstituut

## Telecommunications Research Laboratory

*Monthly basic radio propagation predictions for Southern Africa.*  
*Monthly bulletin of ionospheric characteristics observed at Johannesburg and Cape Town.*

## Telekommunikasie-navorsingslaboratorium

## Liaison Division

*Research Review*  
*Annual Report of the C.S.I.R.*  
*The South African Council for Scientific and Industrial Research*—pamphlet.  
*Library and Information Division*—pamphlet.  
*The National Building Research Institute*—pamphlet.  
*The National Physical Laboratory*—pamphlet.  
*The National Chemical Research Laboratory*—pamphlet.  
*The Telecommunications Research Laboratory*—pamphlet.  
*The National Institute for Personnel Research*—pamphlet.

## Skakelafdeling

*Navorsingsoorsig*  
*Jaarverslag van die W.N.N.R.*  
*Die Suid-Afrikaanse Wetenskaplike en Nywerheidsnavorsingsraad*—pamflet.  
*Biblioteek- en Inligtingsdiens*—pamflet.  
*Die Nasionale Bounavorsingsinstituut*—pamflet.  
*Die Nasionale Fisiese Laboratorium*—pamflet.  
*Die Nasionale Chemiese Navorsingslaboratorium*—pamflet.  
*Die Telekommunikasie-Navorsingslaboratorium*—pamflet.  
*Die Nasionale Instituut vir Personeelnavorsing*—pamflet.

MASSON, D. RYLE, *Directory of scientific Research Organizations in the Union of South Africa*, Pretoria, J. L. van Schaik Ltd. (Price 25/-).

B.—PAPERS IN SCIENTIFIC JOURNALS BY MEMBERS OF THE C.S.I.R. STAFF  
B.—ARTIKELS IN WETENSKAPLIKE TYDSKRIFTE DEUR LEDE VAN DIE W.N.N.R.-PERSONEEL

## National Building Research Institute/Nasionale Bounavorsingsinstituut

CALDERWOOD, D. M. Research on school furniture undertaken by the Architectural Division of the National Building Research Institute. *S. Afr. Arch. Record*, vol. 49, no. 6.

KAPLAN, M. F. Recent developments in non-destructive methods of testing concrete with particular reference to the ultrasonic pulse technique. *Trans. S. Afr. Inst. Civ. Eng.*, vol. 5, no. 8, August, 1955, pp. 243-252.

LAURIE, J. A. P. A design method for composite tile-concrete floors. *N.B.R.I. Bulletin*, Series DB 13, Mch. 1955, pp. 61-76.

STUTTERHEIM, N. Excessive shrinkage of aggregates as a cause of deterioration of concrete structures in South Africa. *J.S. Afr. Inst. Civ. Eng.*, vol. 4, no. 12, Dec. 1954, pp. 351-367.

VAN AARDT, J. H. P. The resistance of concrete and mortar to chemical attack—progress report on concrete corrosion studies. *N.B.R.I. Bulletin*, Series DB 13, Mch. 1955, pp. 44-60.

VAN DEN HEEVER, L. L. Temperature, moisture content and electrical potential measurements in the soil under a house at Leeuwhof, Vereeniging. *N.B.R.I. Bulletin*, Series DB 13, Mch. 1955, pp. 77-98.

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- ENSLIN, P. R. Bitter principles of the Cucurbitaceae. I. Observations of the chemistry of curcurbitacin A. *J. Sci. Food Agric.*, vol. 5, no. 9, Sept. 1954, pp. 410-416.
- HARRISON, A. D. A preliminary report of a hydrobiological survey of the Great Berg River, Western Cape Province. *Proc. Int. Ass. Limn.*, vol. 12, 1955, pp. 346-350.
- HAUL, R. A. W. The use of gas adsorption technique for the separation of substances. *S. Afr. Ind. Chem.*, vol. 9, no. 5.
- HOUGEN, F. W. and M. A. Real. The composition of the bases from an ISCOR coal tar. *J. S. Afr. Chem. Inst.*, vol. 7, no. 2, Sept. 1954, pp. 90-95.
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- JONES, J. K. N. and J. R. Nunn. The constitution of gum myrrh. Part II. *J. Chem. Soc.*, Sept. 1955, pp. 3001-3004.
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- STEIN, L. H. Uptake and degradation of labelled insecticides. III—Estimation of the more toxic degradation products of *Systox*. *J. S. Afr. Chem. Inst.*, vol. 7, no. 2, Sept. 1954, pp. 120-124.
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##### Amoebiasis Research Unit

King Edward VIII Hospital, Durban

##### Amoebiasenavorsingseenheid

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Universiteit van die Witwatersrand, Johannesburg

#### Human Biochemistry Research Unit

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Mediese Skool, Universiteit van die Witwatersrand

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BALANSSTAAT SOOS OP 31 MAART 1955.

	LASTE.			BATES.		
	£	s. d.	s. d.	£	s. d.	s. d.
Kapitaalfonds						
Geboue- en Reserve-kapitaalrekening	728,628	5 2	1,777,120	129,883	9 5	143,161 0 5
Saldo op 1 April 1954	617,388	17 8		12,862	6 10	
<i>Plus</i> —				250	17 1	
Parlamentêre toekening	100,000	0 0		164	7 1	
Rente deur Raad toeges wys tot 31 Maart 1955	11,239	7 6				
Toerustingkapitaalrekening						417,153 0 0
Saldo op 1 April 1954	904,680	16 8		405,913	18 6	
<i>Plus</i> —				11,239	7 6	
Parlamentêre toekening	128,270	0 0				
Skenkings	4,724	16 9				
Inkomste	10,816	10 3				
Vooruit ontvang vir ondersoeke en toetse			27,526			52,011 18 8
Vooruit ontvang vir bourse			10,031			61,651 16 4
Diverse krediteure			64,432			3,273 1 11
Lopende rekenings—						514 18 11
Bitumineuse Bindstofnavorsingsseenheid						73,196 10 10
Appropriasie-rekening						79,556 1 0
						710,367 12 1
						13,877 7 6
						54,854 14 0
						11,168 8 1
						427,894 8 9
						<u>£2,048,681 4 6</u>

S. M. NAUDÉ,  
*President.*

A. J. MILLER-SMIT,  
*Sekretaris/Treasurer.*

Pretoria, 26 September 1955.

Bostaand balansaats is ingevolge die bepaling van artikel 13 (1) van die Wet op die Wetenskaplike Navorsingsraad, Wet No. 33 van 1945 geouditeer en na my mening is dit opgestel om 'n ware en korrekte stand van die finansiële sake van die Wetenskaplike en Nywerheidsnavorsingsraad weer te gee.

Pretoria, 2 Desember 1955.

T. J. CANTY,  
*Kontroleur en Ouditeur-generaal.*

(A.O. R.46/1.)





KAPITAALFONDS.

STAAT No. 2.

STAAT VAN TRANSAKSIES VIR DIE JAAR GEËINDIG 31 MAART 1955.

Besonderhede.	UITGAWE.			ONTVANGSTE.			Totale op 31 Maart 1955.		
	1954-55.	£	s. d.	1954-55.	£	s. d.	1954-55.	£	s. d.
(A) <i>Gebou- en Reserwkapitaalrekening—</i>									
Grond en geboue	136,381	4	1	427,894	8	9	1,452,568	0	0
Belegging by Staatskuidkommissaris	(—)25,141	16	7	300,733	16	5	231,614	18	11
TOTALE .. .. .	£111,239	7	6	£728,628	5	2	69,028	5	2
(B) <i>Toerustingkapitaalrekening—</i>									
Voorrade voorhande	2,435	17	1	73,196	10	10	5,041	7	1
Meubels, toebehore en kantoor-toerusting	13,729	0	11	79,556	1	0	18,367	17	8
Laboratorium- en werkwinkeltoerusting	110,313	5	0	710,367	12	1			
Voertuie en fiets	1,738	7	6	13,877	7	6			
Boeke en tydskrifte	10,826	15	3	54,854	14	0			
Geboue (verpag)	—			11,168	8	1			
Koste van buite	139,095	5	9	943,020	13	6			
Onbestede saldo	4,716	1	3	105,471	10	2			
TOTALE .. .. .	£143,811	7	0	£1,048,492	3	8			
TOTALE VAN (A) EN (B)	£255,050	14	6	£1,777,120	8	10			

Besonderhede.	TOEWYINGS VAN ONBESTEDE SALDO.		
	£	s.	d.
(1) Vaste verpligings ten onsigte van kapitaalfonds (geskat)	63,052	0	0
(2) Gehou deur Universiteit vir die aankoop van kapitaaltoerusting	12,862	6	10
(3) Nie toegewys nie	29,557	3	4
TOTALE	£105,471	10	2

Pretoria, 26 September 1955.

S. M. NAUDÉ,  
President.

A. J. MILLER-SMIT,  
Sekretaris/Tesourier.

(A.O. R.46/1.)





REKENING VAN LOPENDE UITGAWES VIR DIE JAAR GEËINDIG 31 MAART 1955.

		1954-55.		1954-55.	
		£	s. d.	£	s. d.
Aan—					
Hoofkwartier en Administrasie, insluitende huur en algemene dienste aan laboratoriums	..	104,459	7 11	96,755	1 8
<i>M/n:</i> Vervoerkoste verhaal van laboratoriums	..	7,704	6 3		
Biblioteek en Inligtingsafdeling	..	12,821	7 6		
Londense Sending	..	9,693	6 6		
Washingtonse Sending	..	9,700	13 11		
Skakelafdeling	..	16,589	6 8		
Sentrale werkwinkel	..	43,639	9 2		
Nasionale Bounavorsingsinstituut	..	50,087	16 5		
Nasionale Fisiiese Laboratorium	..	120,382	15 3		
Telekommunikasie-navorsingslaboratorium	..	22,233	3 5		
Nasionale Chemiese Navorsingslaboratorium	..	124,499	15 7		
Nasionale Voedingnavorsingsinstituut	..	20,069	15 8		
Nasionale Instituut vir Personeelnavorsing	..	63,318	9 4		
Navorsingseenheid Werktuigkundige Ingenieurswese	..	45,616	16 7		
Verdedigingsnavorsing	..	14,984	10 11		
Administrasie van Mediese Navorsing	..	3,347	18 9		
Toekennings en Subsidies	..	152,233	13 2		
(a) Navorsingstoekennings aan Universiteite, Museums en andere	..	52,847	1 6		
(i) Algemene wetenskappe	..	43,458	14 10		
(ii) Mediese navorsing	..	9,388	6 8		
(b) Mediese navorsingseenhede en S.A.I.M.N.	..	48,658	1 8		
(c) Nywerheidsnavorsingsinstitute	..	50,728	10 0		
TOTALE BEDRYFSKOSTE	..	845,974	0 6		
<i>M/n:</i> Bedryfskoste gekapitaliseer in toerusting vervaardig	..	15,472	14 0		
Saldo, nl. bedrag waarmee inkomste uitgawe oorskry, oorgegedra na die Appropriasiereskening	..	830,501	6 6		
		162,562	7 4		
		<u>£993,063</u>	<u>13 10</u>		

		1954-55.	
		£	s. d.
Parlamentêre toekening	..	743,740	0 0
Inkomste uit ondersoek en toets	..	74,076	11 11
Verkope van Radio-aktiewe Isotope	..	7,047	14 1
Skenkings	..	518	5 0
Inkomste uit beurse en toekennings oorgebring van 1953-54	..	15,389	12 7
Ontvangbaar gedurende 1954-55	..	13,157	2 10
<i>M/n:</i> Oorgegedra na 1955-56	..	28,746	15 5
		10,031	19 6
Inkomste uit publikasies	..	1,068	16 4
Diverse Inkomste	..	738	0 8
Werkerskadeloosstellingsverhaal	..	706	17 9
Toewysing uit Appropriasiereskening ingevolge artikel 14 (4) van Wet No. 33 van 1945	..	146,452	12 2
		<u>£993,063</u>	<u>13 10</u>

OPMERKING: Onderstaande is die Raad se vaste verpligtinge—  
 (i) onder Bedryfskosterekening (Beskat) .. .. . £ 62,181 0 0  
 (ii) vir Navorsingstoekennings .. .. . 13,749 0 0  
£77,930 0 0

S. M. NAUDÉ,  
*President.*

A. J. MILLER-SMIT  
*Sekretaris/Treasourer*

(A.O. R.46/1.)

Pretoria, 26 September 1955.



STATEMENT No. 4.

APPROPRIATION ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1955.

	1954-55.		1954-55.	
	£	s. d.	£	s. d.
<b>To—</b>				
Appropriation by Council to—				
(a) Building and Reserve Capital Account .. ..	11,239	7 6	157,691	19 8
(b) Running Expenses Account .. ..	146,452	12 2		
			<u>157,691</u>	<u>19 8</u>
Balance for allocation by the Council in terms of Section 14 (4) of Act No. 33 of 1945 .. ..			162,562	7 4
			<u>£320,254</u>	<u>7 0</u>
<b>By—</b>				
Balance brought forward for allocation by Council in terms of Section 14 (4) of Act No. 33 of 1945 .. ..	146,452	12 2		
Interest on investment for allocation to Building and Reserve Capital Account .. ..	11,239	7 6		
	<u>157,691</u>	<u>19 8</u>		
Excess of Revenue over Expenditure transferred from Running Expenses Account .. ..	162,562	7 4		
			<u>£320,254</u>	<u>7 0</u>

Pretoria, 26th September, 1955.

S. M. NAUDÉ,  
*President.*

A. J. MILLER-SMIT,  
*Secretary/Treasurer.*

(A.O. R.46/1.)

STAAT No. 4.

APPROPRIASIEREKENING VIR DIE JAAR GEËINDIG 31 MAART 1955.

	1954-55.		1954-55.	
	£	s. d.	£	s. d.
<b>Aan—</b>				
Toewysings deur die Raad aan—				
(a) Geboue- en Reservekapitaalrekening .. ..	11,239	7 6	157,691	19 8
(b) Bedryfskosterekening .. ..	146,452	12 2		
			<u>157,691</u>	<u>19 8</u>
Saldo vir toewysing deur die Raad ingevolge artikel 14 (4) van Wet No. 33 van 1945 .. ..			162,562	7 4
			<u>£320,254</u>	<u>7 0</u>
<b>Per—</b>				
Saldo oorgedra vir toewysing deur die Raad ingevolge artikel 14 (4) van Wet No. 33 van 1945 .. ..	146,452	12 2		
Rente op beleggings vir toewysing van Geboue- en Reservekapitaalrekening .. ..	11,239	7 6		
	<u>157,691</u>	<u>19 8</u>		
Bedrag waarmee inkomste die uitgawe oorskry, oorgedra van die Bedryfskosterekening .. ..	162,562	7 4		
			<u>£320,254</u>	<u>7 0</u>

Pretoria, 26 September 1955.

S. M. NAUDÉ,  
*President.*

A. J. MILLER-SMIT,  
*Sekretaris/Tesourier.*





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