

SOUTH AFRICAN  
COUNCIL FOR SCIENTIFIC  
AND INDUSTRIAL RESEARCH

FIFTH  
ANNUAL REPORT

1949—1950



*National Research Laboratories . . . . . Visagie Street, Pretoria*

The C.S.I.R.'s National Physical Laboratory, National Chemical Research Laboratory, National Building Research Institute, Library and Information Division, Liaison Division, Central Workshops and Administrative Headquarters are temporarily accommodated in these buildings in Visagie Street, Pretoria.

The National Institute for Personnel Research, Telecommunications Research Laboratory and Water Treatment Research Division are accommodated at the University of the Witwatersrand; there are smaller research units at Defence Headquarters (personnel research), the Bernard Price Institute of Geophysical Research (applied geophysics), the South African Institute for Medical Research (nutrition research) and the University of Cape Town (fats and proteins).

Plans are being prepared for permanent buildings on an excellent site, seven miles east of Pretoria, donated by the University of Pretoria.

Medical research units are supported by the C.S.I.R. at the following institutions: Department of Health — amoebiasis, social medicine and tuberculosis (all at Durban), South African Institute for Medical Research — applied physiology (also supported by Rand Mines Ltd.), and bilharzia; University of Cape Town — social medicine and virus diseases; University of the Witwatersrand — cardio-pulmonary diseases and nutrition.

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P.O. Box 395, Pretoria  
1st November, 1950

Sir,

I have the honour to present to you herewith the Fifth Annual Report of the Council for Scientific and Industrial Research for the year ended October 4th, 1950.

In accordance with the requirements of the Scientific Research Council Act, I present also a balance sheet and statement of income and expenditure certified by the Controller and Auditor-General for the financial year ended 31st March, 1950.

I have the honour to be,

Sir,

Your obedient Servant,

B. F. J. SCHONLAND

President: Council for Scientific and Industrial Research

Dr. the Hon. D. F. Malan,  
Prime Minister of the Union of South Africa,  
Prime Minister's Office,  
Union Buildings,  
PRETORIA

## Membership and Meetings of the Council

The membership of the Council during the year was:

Dr. B. F. J. Schonland (President)  
Dr. P. J. du Toit (Deputy-President)  
Dr. F. J. de Villiers  
Mr. F. J. du Toit  
Dr. M. S. Louw  
Prof. S. F. Oosthuizen  
Mr. P. E. Rousseau  
Mr. T. P. Stratten  
Dr. E. Taberner  
Dr. H. J. van Eck  
Dr. R. W. Wilcocks  
Mr. J. E. Worsdale

Mr. J. E. Worsdale and Professor S. F. Oosthuizen were reappointed by the Governor General as Members of the Council for three years from 5th October 1949, but Prof. Oosthuizen resigned as from 1st July 1950, in order to assume duty at the Council's request as part-time Secretary for Medical Research. Dr. M. S. Louw and Mr. P. E. Rousseau were appointed as new members of the Council for three years from 5th October 1949, to fill the vacancies created by the Scientific Research

Council Amendment Act of 1949, which increased the number of members on the Council from nine to eleven.

The Council met three times during the year, one meeting being held in Cape Town, and two in Pretoria. In the course of its meeting in Cape Town, the Council received representatives of the National Association of Worsted Textile Manufacturers to discuss the development of the Wool Textile Research Institute, and visited the laboratories of the Fishing Industry Research Institute at Portwood Road and discussed the Institute's activities with the Board of Control. The Council also had the opportunity of seeing research activities in various science departments of the University of Cape Town and the Medical School, the University of Stellenbosch and the Western Province Fruit Research Station. Science departments and the Medical School of the University of Pretoria were visited by the Council during the course of its September meeting in Pretoria.

The Executive Committee met five times during the year. Members of this Committee were:

Dr. B. F. J. Schonland  
Dr. P. J. du Toit (alternate Mr. T. P. Stratten)  
Dr. F. J. de Villiers (alternate Mr. J. E. Worsdale)



The Council for Scientific and Industrial Research — October 1949 to September 1950; standing (left to right) — E. Taberner, F. J. de Villiers, P. E. Rousseau, F. J. du Toit and S. F. Oosthuizen; sitting (left to right) — J. E. Worsdale, R. W. Wilcocks, P. J. du Toit, B. F. J. Schonland, H. J. van Eck and T. P. Stratten; inset M. S. Louw.

## General Survey of the Activities of the Council

### Permanent buildings

During the year an important step was taken by the Council towards providing a permanent home for its headquarters and national institutes. Permission was obtained from the Government to utilize the money previously voted by Parliament and held by the Council for this purpose. Although the sum available will be sufficient for only a portion of the total building scheme, it was decided to make a start as soon as possible.

The Council was extremely fortunate in obtaining from the University of Pretoria, as a free gift, an excellent building site on the University Farm, comprising an area of over 200 acres. The directors of laboratories were instructed to draw up schedules of their probable requirements for the next 25 years. Sketch plans were then prepared for the proposed buildings and committees were appointed to scrutinize these plans, until finally the Council was satisfied that the plans represented a satisfactory basis for architects to work on. It is hoped that within a very short time this next stage of the work will be started.

The Council's intention is that the National Building Research Institute should be the first institute to be moved to the new site. In addition, provision will have to be made immediately for a gas generating plant, an electricity distribution station, a sewerage plant, a reservoir, a caretaker's house, etc., also for certain sports amenities for the staff. Furthermore, roads and fencing must be provided and the general lay-out of the site decided on. It is hoped that in a year's time it will be possible to report considerable progress in the building programme, the completion of which will take several years.

### National laboratories and services

The Council is able to report further progress in the development of its national research laboratories, its medical research units and other services. These activities, which are reviewed individually in later sections of this report, reflect the initiative and enthusiasm of the entire staff, and particularly of the directors of the laboratories, of the Secretary/Treasurer and administrative staff and of the officers responsible for services such as library and information, workshops, industrial liaison and scientific liaison overseas. The Council is confident that the growing experience of its staff in many fields of research provides an essential background to the country's industrial effort, and constitutes an invaluable foundation on which to build for the future.

The policy of appointing South African men and women to the staff, except in specialized fields for which there are no facilities for training in this country, has been notably successful. Many of them have been sent overseas for further training and to gain experience of the latest techniques and of their applications. Much time has been devoted to the design, construction, installation and calibration of equipment but it has, nevertheless, been possible to initiate many research projects and to deal with practical problems submitted by industrial and other sponsors. The list of publications in Appendix II gives some indication of the nature and quality of this work, apart from industrial contract investigations.

### Industrial research contracts and fellowships

The total cost of 158 applied research projects investigated under contract for industrial and other sponsors has this year amounted to £65,067 11s. 8d. Of these, 133 were new projects, while 25 were carried over from the previous year. A list of sponsors and a list of the problems investigated is given in Appendix I.

Appointments were made to the two research fellowships established by the *South African Wool Board* for fundamental chemical research on wool and its by-products. One of these men is at the University of Leeds for advanced training under Prof. Speakman, while the other has taken up duty at Pretoria. The research fellowship established by the *Association of*

*The National Physical Laboratory's goniometer-spectrometer, with which small angles are measured to an accuracy of 1/10th of a second, i.e., 1/36000th of a degree, in determining refractive indices of optical glass and in calibrating angle-gauge blocks, etc.*

### General Survey of the Activities of the Council

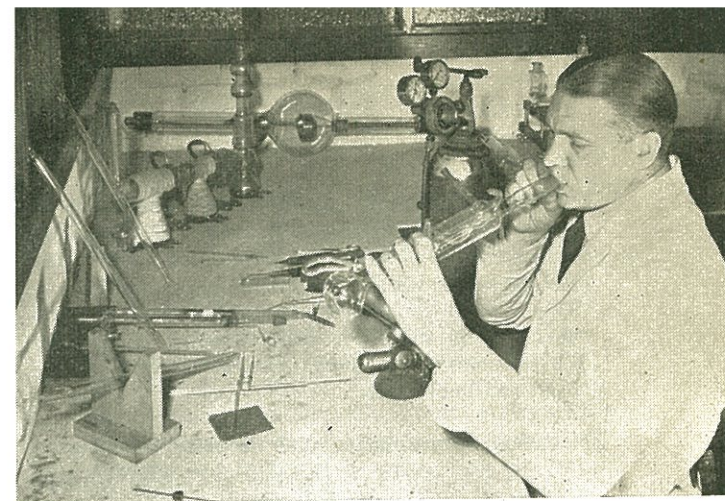
*Blue Lime Manufacturers* for research into materials produced from dolomite and high magnesia limestones has been continued, as also has the fellowship for research on lightning protection, provided by *African Explosives and Chemical Industries*. These "industrial research fellowships" are provided for research in specific fields of direct practical interest to the sponsors, but are of a longer term nature than the *ad hoc* investigations undertaken under contract. The sponsors provide the salaries and expenses of the "fellows", while the C.S.I.R. provides laboratory facilities and expert supervision.

### Industrial research associations

The *Wool Textile Research Institute*, originally established in co-operation with the South African Wool Board, has been further strengthened by the agreement of the National Textile Manufacturers Association and the National Association of Worsted Textile Manufacturers to become contributing members. An Action Committee has been set up with administrative services provided by the C.S.I.R., pending registration of the research institute as a non-profit company under the Company's Act. Two junior members of staff have been appointed and sent to the University of Leeds for advanced training in textile technology. The post of director has been advertised in this country and overseas, and an appointment will be made shortly.

A *Bituminous Binder Research Unit* has been established to investigate the use of locally produced bituminous materials in road and aerodrome construction. This is a co-operative research unit, the running expenses being provided by annual contributions from the Department of Transport, the Provincial Administrations, industrial subscribers and the C.S.I.R. It will not, however, be operated for the present as a non-profit company under the C.S.I.R. Research Association Scheme, but will be controlled by the C.S.I.R. with the assistance of a Steering Committee. The C.S.I.R. will provide laboratory accommodation, including a mobile laboratory, while assistance in the laying of experimental strips, etc., will be given by the Department of Transport and the Provincial authorities. The post of director was widely advertised in South Africa and overseas, and Dr. P. J. Rigden, one of the senior research staff of the Roads Research Laboratory, Harmondsworth, England, has been appointed as director and will assume duty in December, 1950.

The older research associations — the *Leather Industries Research Institute*, the *Fishing Industry Research Institute*, the *Paint Industries Research Institute* and the *Sugar Milling Research Institute*, are all nearing the end of the first five year period for which the contributions of industrial subscribers were guaranteed. These research institutes are proving of great value to the industries which they serve and it is probable that, in all cases, the industrial subscribers will increase their contributions



*A glass-blower at work.*

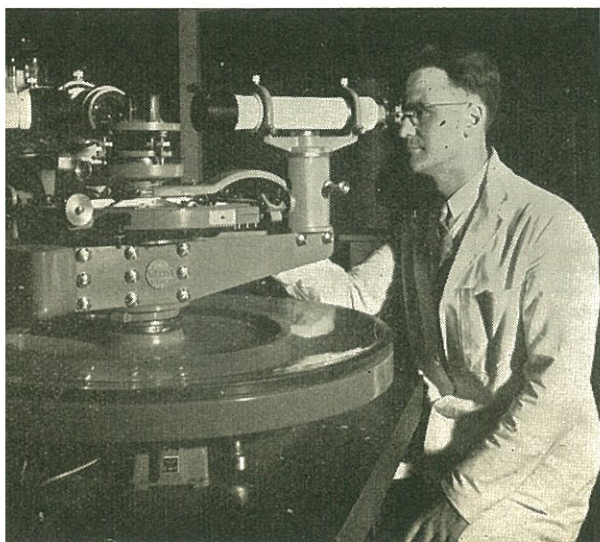
for the next five years. These early indications of the success of this scheme, under which industrial groups finance and manage their own research on a co-operative basis, have encouraged the Council in its belief that these industrial research institutes fully merit its confidence and continued financial support in the form of *pro rata* subsidies on guaranteed contributions.

### Certification of research expenditure for the remission of income tax

The Council's functions in regard to the certification of research expenditure, in terms of Sections 7 (l) (f) (j) bis (ii) and 7 (l) (f) (i) ter of the Income Tax Act of 1946, are becoming better known. Thirty-six applications were dealt with during the year, many of which involved members of the Council's staff in visits to the factories concerned. The Council is convinced that this concession is a valuable means of encouraging private firms to develop their own research activities.

### Research in the universities

Under the scheme for Consolidated University Research Grants introduced by the Council, applications for the support of post-graduate research are screened by research committees of the Universities concerned before submission to the Council. Before being finally dealt with by the Council they are sent to referees, selected for their specialized knowledge of the subjects concerned. Each university then receives a consolidated grant, representing the total value of all approved applications submitted by it, and is responsible for administering the individual awards. This scheme, which has been developed during the past five years, is working smoothly and the Council understands that it has done much to stimulate the post-graduate training of research workers who are urgently needed by the Government, by industry and by the universities and other research organizations throughout the country. The Council is glad to have this opportunity of thanking the referees who have assisted it in these matters and particularly the universities, on whose co-operation it is dependent for the successful working of the scheme.



During the year the Council provided a total sum of £60,378 for assistance to post-graduate research workers in the universities and to medical research units, of which £39,460 was for research in clinical medicine and surgery. This support took the form of 17 senior research bursaries, 38 student research bursaries, 32 research assistantships and 96 special grants for expenses, equipment and publication.

### General co-ordinating and advisory functions

The good spirit of co-operation which exists between the C.S.I.R. staff and the controlling bodies and staffs of other research organizations is a source of much pleasure to the Council. The Council attaches great importance to this, as it is well aware that the country cannot afford to waste its resources of scientific manpower and equipment through overlapping and duplication of effort.

This co-operation and co-ordination is achieved in many ways. For example, members of the Council serve on bodies like the Standards Council, the National Council for Social Research and on the controlling bodies of organizations such as the Fuel Research Institute, the South African Institute for Medical Research, the Government Metallurgical Laboratory, and industrial research institutes established under the Council's research association scheme. In addition, the directors or members of staff of these organizations and of Government agencies, such as the Geological Survey and the research divisions of the Department of Agriculture, are invited by the Council to serve on the national advisory committees and project sub-committees which advise it on the research programmes of its laboratories. These committees and their sub-committees also provide a means of securing the invaluable advice of industrialists, particularly on the technical and economic implications of research projects.

The Council is convinced that this growing spirit of co-operation cannot fail to ensure that the country's scientific resources are most effectively applied to the

solution of the scientific and technical problems most closely affecting the present and future development of the country.

### African Regional Scientific Conference

In the Fourth Annual Report mention was made of the very successful conference which was held in Johannesburg, in October 1949, under the auspices of the C.S.I.R., and at which a resolution was passed inviting the Governments concerned to set up a Scientific Council for Africa south of the Sahara. This proposal was discussed at subsequent meetings at which the Governments of Belgium, France, Portugal, Southern Rhodesia, the United Kingdom and the Union of South Africa were represented. First of all, at the inaugural meeting of the Commission for Technical Co-operation in Africa (C.T.C.A.) in Paris in January 1950, the proposal for the establishment of a Scientific Council for Africa (C.S.A.) received unanimous support. Thereupon a special meeting was convened in London in May 1950, to work out the details of the organisation of C.S.A. The meeting was held in South Africa House, under the chairmanship of Dr. P. J. du Toit; South Africa acting as host country. It was decided that the headquarters of the Council would be in the Belgian Congo, probably at Costermansville. The Council would consist of a chairman and twelve members, selected in such a manner that the major scientific disciplines would be represented as well as the main regions in Africa south of the Sahara and the National Governments which are responsible for the development of these regions. The services of an eminent scientist as Secretary-General, in the person of Dr. E. B. Worthington, of Kenya, were secured. Many other details of the organization were also agreed upon. The report of this meeting was thereafter considered by the second session of C.T.C.A. in Brussels in June, 1950 and was accepted.

The final step in the establishment of the Scientific Council for Africa will be taken in November 1950, when the first meeting will be held in Nairobi, Kenya. The hope may be expressed that this new body will contribute substantially to the development of science in Southern and Central Africa and to the progress of every territory in this part of the continent.

### Acknowledgments

The Council thanks the chairmen and members of its many advisory committees for the time and energy they have devoted to assisting it in reviewing the progress of research in its laboratories, and in drawing up their research programmes. It is particularly grateful to the Research Committee of the Federated Chamber of Industries for its helpful advice on matters affecting industrial research.

A 100 ton universal testing machine in the National Building Research Institute.

The University of Cape Town and the University of the Witwatersrand have continued to assist the Council in the provision of accommodation and services for decentralized units of its laboratories, and the Council once again gratefully acknowledges this assistance. The Council also wishes to thank the University of Natal for its assistance in the accommodation of the Sugar Milling Research Institute and the Paint Industries Research Institute.

The help of the State Information Office in designing some of the Council's publications, is gratefully acknowledged.

The following grants are acknowledged with thanks:

The Administration of South West Africa . . . . .	£1,000
The South African Broadcasting Corporation (radio research)	£1,000
Fire Insurance Association of the Transvaal (lightning protection) . . . . .	£1,000
Mr. Charles Lamb* . . . . .	Gouch Microtome
Mrs. M. M. Turnbull-Smith* . . . . .	£10 10 0
Mrs. Franklin* . . . . .	£2 2 0

\*For the Tuberculosis Research Unit, Durban.

The Council wishes to thank the following for donations to the Library:

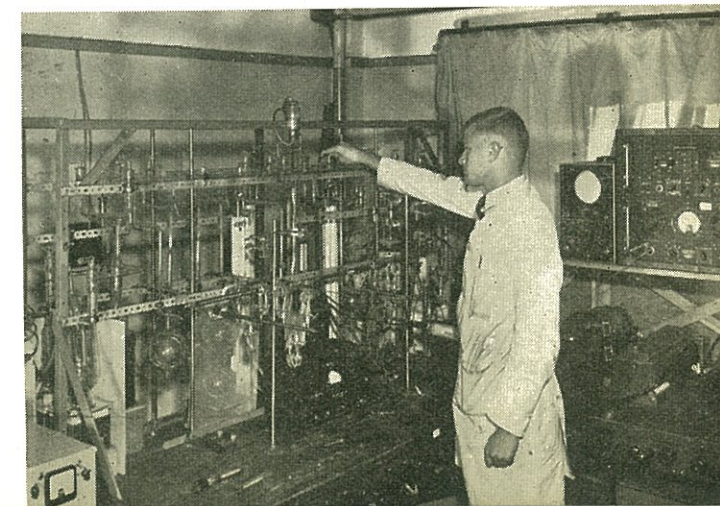
African Explosives and Chemical Industries Limited, Dr. S. Biesheuvel, Dr. O. Brune, Mr. J. V. Cutler, Dr. F. J. de Villiers, Miss A. S. du Toit, Dr. P. J. du Toit, High Commissioner for Canada, Mr. J. E. Jennings, Johannesburg Public Library, Dr. E. Jokl, Mr. B. Kantey, Mr. D. G. Kingwill, Massachusetts Institute of Technology, Miss Hazel Mews, Dr. S. M. Naudé, Radcliffe Observatory, Dr. W. S. Rapson, Dr. B. F. J. Schonland, Mr. N. Stutterheim, Transvaal Chamber of Mines, Transvaal Museum, United Kingdom Information Office, United States Information Service, University of Natal Library, Western Electric Company (N.E.), Johannesburg.

The Council also thanks the following organizations overseas with whom it has arrangements for the exchange of publications. In many cases the Council has received much more than it has been able to give in exchange but hopes that, as its activities develop, it will be able to reciprocate on a more equitable basis:

Alabama Polytechnic Institute, U.S.A.; Australian National Research Council, Australia; Batelle Memorial Institute, Ohio, U.S.A.; Board of Scientific and Industrial Research, Jerusalem; British Columbia Research Council, Canada; The British Council, England; Building Research Station,

Equipment in the National Physical Laboratory for evacuating and filling Geiger-Müller counters used in accurate measurements on radio-isotopes.

England; Bygglitteratur, Sweden; The Cawthron Institute, New Zealand; Centraal Instituut voor Materiaal Onderzoek, Holland; Centre National de la Recherche Scientifique, Paris; Chalmers University of Technology, Sweden; Commission Internationale des Industries Agricoles, France; Commonwealth Scientific and Industrial Research Organization, Australia; Commonwealth Experimental Station, Australia; Department of Scientific and Industrial Research, London; Department of Scientific and Industrial Research, New Zealand; Division of Applied Biology, Canada; Division of Fish and Game, California, U.S.A.; Division of Natural Sciences, UNESCO, France; Division of Research Reports and Statistics, Public Roads Administration, Washington, U.S.A.; "Endeavour", London; Facts for Industry, England; Ingeniörsvetenskapsakademien, Sweden; l'Institut Scientifique de Madagascar; Instituut voor Warmte-Economie, Holland; Institute of Tropical Medicine, Lisbon; Journal of Scientific and Industrial Research, India; Der Kongelige Danske Videnskaberne Selskab; Metallurgical Research and Development Div., Ohio, U.S.A.; Midwest Research Institute, Missouri, U.S.A.; Ministry of Agriculture, Sudan; Ministry of Agriculture (Div. of Research), Tel Aviv; Ministry of Works Library, London; National Academy of Sciences and National Research Council, Washington, D.C.; National Coal Board, England; National Central Library, London; National Research Council, Canada; New Zealand Journal of Science and Technology; Office of Scientific Research and Development, Washington, U.S.A.; Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Holland; Organization for Scientific Research, Indonesia; Research Association of British Rubber Manufacturers, England; Rothamsted Experimental Station, England; Royal Institute of Technology, Sweden; Science Co-operation Office, Middle East, Egypt; The Science Museum, London; Southwest Research Institute, U.S.A.; Zinc Development Association, England



# National Physical Laboratory

## Advisory committees

The Laboratory had six separate committees to advise on its activities in the following fields:

Electrotechnology and Electronics

Acoustics

Heat

General Physics including optics, mass spectrometry, spectrochemistry, X-rays and electron microscopy

Biophysics

Applied Geophysics.

These committees dealt with the various aspects of the work done by the laboratory. They met during the year and provided valuable advice on the development of the work of the various sections.

## Acknowledgments

It is a pleasure to acknowledge the assistance received in various ways from the National Physical Laboratory, Teddington, the National Bureau of Standards, Washington, the Physics Section of the National Research

Council of Canada, the Physical Laboratory of the Commonwealth Scientific and Industrial Research Organization in Australia, the Atomic Energy Research Establishment at Harwell, the Medical Research Council, London, the Division of Civil Aviation of the Department of Transport, and the South African Bureau of Standards, Pretoria. The Nobel Institute for Nuclear Research at Stockholm, the Physics Laboratory of the Johns Hopkins University at Baltimore, the Electrical Engineering department of the University of Manchester, the Electrical Division of the National Physical Laboratory, Teddington, and the Electrical Engineering Laboratory of the Massachusetts Institute of Technology have helped the Laboratory greatly by extending hospitality to five of its staff who studied Nuclear Physics and cyclotron construction, spectrochemistry, servomechanisms and electrical standardization, and electronics respectively. The National Bureau of Standards at Washington has again assisted the Laboratory by standardizing several important pieces of equipment free of charge.

## Division of Electrotechnology and Acoustics

### Electrical Standards Section

The reference standards which are being maintained now consist of 17 standard cells and 6 standard 1 Ohm resistors. Regular intercomparison of the units in these groups with each other and with similar units received from standardizing laboratories overseas has shown them to be of high stability. They have been used for calibrating standard cells and standard resistors for a number of outside organizations including the South African Bureau of Standards. Considerable work on instrument calibration has also been done and has covered potentiometers, current transformers, and pointer instruments of various types.

### Electronics Section

Activities have included further developments, adjustments and refinements to borehole logging apparatus for measuring temperature and radio-activity in boreholes. A convenient and satisfactory method has been developed for measuring the velocity of artificial hailstones, projected from the top of a tower, and is being used by the National Building Research Institute for testing hail resistance of roofing materials. The development and construction of an instrument for recording the rate of blood circulation by detecting the arrival at the ear of a dye, injected in a vein in the arm, has almost been completed for a medical research worker at the University of the Witwatersrand. A seed-counting apparatus, using an electric eye, was successfully developed for the Potchefstroom Agricultural College for counting seeds with diameters between 0.3 mm. and 2 mm., at a rate of 500 seeds per minute with an accuracy of 1 per cent.

*Radioactivity and temperature in boreholes 2" in diameter, at depths down to 6,000 feet, are automatically recorded at the surface as electrical impulses are received up the single strand of wire used for lowering a special instrument developed for South African conditions.*

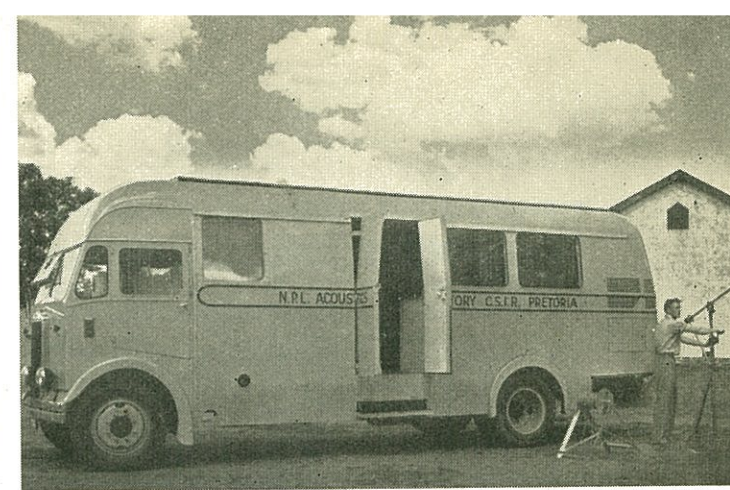


*A mobile acoustics laboratory for field work on problems such as the acoustics of studios, halls, cinemas, etc., transmission of noise in buildings and the reduction of industrial noise. Tests are made with electronic equipment in the mobile laboratory, which is connected by cable to microphones, loudspeakers and other apparatus set up in the building under test.*

### Acoustics Section

Equipment for the measurement, recording and analysis of sound and vibrations is reasonably complete, and a mobile laboratory is being fitted out for work on building acoustics and industrial noise and vibration reduction. The body was built by an outside firm to the laboratory's design and fitted to a 5-ton bus chassis.

Sound-intensity standards, comprising Rayleigh-disc tubes, an electrostatic actuator and equipment for free field reciprocity calibration of microphones, have been constructed and tested. Sound-intensity sub-standards, comprising condenser microphones, moving coil microphones and moving coil probe-microphones have been calibrated, and are available for carrying out tests and



calibrations for other organizations. Artificial ears and couplers are being constructed and calibrated and used in the testing of earphones for bodies such as the South African Bureau of Standards and the General Post Office.

A quartz crystal ultrasonic generator has been used for observing the effects of ultrasonic vibrations on emulsions and suspensions. Other miscellaneous activities have included the development of an acoustic cavity oscillator for temperature measurement in a confined space and at remote distances; the design of an electrical micro-manometer and the construction of recording equipment for the intra-venous measurement of bloodpressure.

## Division of Physics of Matter

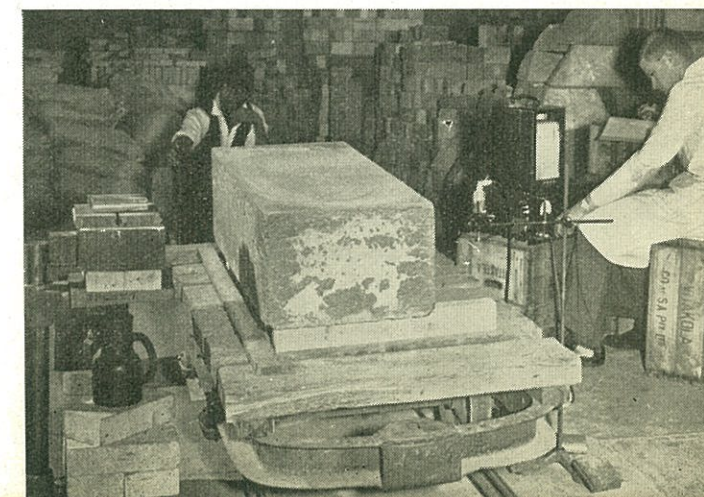
### Mechanical Standards Section

Work has been mainly concerned with the development of standards of mass. A 500 gm. balance and a 20 gm. microbalance have been received. It has been possible to modify the former so that weighings of 100 gms. can be made to an accuracy of 10 micrograms. A total of 220 assay weights have been calibrated and five boxes of analytical weights have been tested.

### Nuclear Physics Section

The development of an Alpha Scintillation Counter and the Kevatron, mentioned in the Fourth Annual Report, has continued. The design and production of Geiger-Müller counters for special purposes has continued and counters and counting apparatus have been built and modified to the specifications of outside organizations.

*Radio-isotopes imported from overseas being applied to the solution of an industrial problem — investigating the use of the gamma-rays of radio-active cobalt for locating cavities in large refractory blocks.*



such a way that the weak parts are less subjected to corrosion.

A member of staff is obtaining experience in Sweden, England and the U.S.A. to enable the Council to proceed with the construction of a 42-in. cyclotron on his return in 1951. In September the head of this Section, Dr. S. J. du Toit, returned from Stockholm, after studying at Nobel Institutet för Fysik.

### Biophysics Section

Work has been done on protection against overdoses being received by workers with X-rays and radioactive substances. For this purpose badges containing sensitive film are supplied with the request that the badges should be worn in an exposed position. The films are returned to the laboratory and developed. From the density of fogging of the film an estimate of the dosage received can be made, and if it indicates an over dosage, the head of the department concerned can be warned. This film badge service is now being used throughout the Union. During the past year 346 badges have been used for standards and the protection of National Physical Laboratory staff, while 2,355 have been issued to the staffs of 36 radiological departments, to whom reports have been issued each week of dosages received by staff members. Many departments have noticeably improved their protection since making use of the film badge service.

A new scheme for the importation of radio-isotopes in the wing tips of aeroplanes came into operation in February, 1950. This method renders the use of lead screening for gamma rays unnecessary and has made it possible to import quantities of radio-isotopes which could not have been obtained by conventional air transport. As a result, the cost of radio-isotopes in South Africa has been greatly reduced, and the demand by medical users for radio-iodine for diagnostic and therapeutic purposes has grown very considerably and is still increasing. One hundred and thirty-five doses were made up and standardized for medical users. In order to maintain the calibration of counting and ionization apparatus, four standard solutions of Iodine

131 were obtained from the Atomic Energy Commission, United States of America, and eight from the Atomic Energy Research Establishment, Britain.

The use of radio-iodine as a diagnostic aid and as a form of therapy, involves measurements of uptake and excretion by patients and, to avoid this, research has been done into methods of making *in vivo* measurements. Sixty-five patients have been measured for diagnostic purposes, and measurements made on seventy cases treated therapeutically. The bulk of the work has been done since the "wing tip" scheme came into operation. In three cases further diagnostic aid was rendered by making autoradiographs of biopsy material from thyroid carcinomata.

Phosphorus 32 has been used therapeutically and diagnostically. Twenty-seven therapeutic doses have been standardized by a new method developed in this section. Tissues from eight patients (biopsy material) have been examined as part of a research programme undertaken by a radio-therapist who is comparing the uptake of phosphorus by normal and neoplastic tissues.

Radio-iodine was used as a tracer to investigate certain aspects of the Heat Section's rain-making project (silver iodide smoke).

Research by the Division of Entomology into the effectiveness of the new insecticide, Pestox, against the aphid infestation of peanut plants was assisted by the use of Pestox labelled with radio-phosphorus. The course taken by Pestox in peanut plants was followed in field experiments as well as in pot plants by measuring the radio-phosphorus content of different parts of the plants.

Radio-phosphorus has been synthesized into radioactive superphosphate and some preliminary work has been done in co-operation with the Tobacco Research Station, Rustenburg, on the uptake of phosphate fertilizer by tobacco plants.

Work on the standardization of radio-iron has led to the discovery that manganese 54 is produced in the pile irradiation of iron in a reaction not hitherto noted. This adds manganese 54 to the small list of radio-isotopes which can be produced "carrier-free" in the chain-reacting pile.

Work on "radiocardiography", a method for investigating heart diseases by the use of radio-sodium, has been started in collaboration with the Department of Medicine of the Medical School of the University of the Witwatersrand.

Work on the use of radio-sodium in the investigation of peripheral vascular disease has been started in collaboration with the Department of Medicine, Pretoria University.

*Radio-active sodium being used in the measurement of blood circulation.*

Radiobiological research has been greatly assisted by the acquisition of an X-ray therapy machine which is capable of delivering a high dose-rate, and of a curie of Cobalt 60. A new method has been developed for assaying small quantities of hydrogen peroxide in the amounts formed by irradiating water with doses of about 1,000 roentgens. This method has been of assistance in acquiring further data on the "dilution" effect caused when substances in dilute solution are irradiated and in distinguishing between that part which is due to formation of hydrogen peroxide and that which is due, presumably, to the action of H and OH radicals. Results so far obtained should add to existing knowledge of the indirect effect of radiations on living cells.

### Heat Section

Work has continued on the establishment and maintenance of the International Temperature Scale, comprising the following:

Resistance Thermometer Range (−180 to 600° C.)  
Platinum-rhodium Thermocouple Range (660 to 1063°C.)

Optical Pyrometer Range (above 1063°C.)

The demand for tests and calibration of temperature measuring instruments has increased considerably. The following instruments have been tested for the C.S.I.R. and industrial firms:

146 Thermometers  
106 Thermocouples  
1 Optical pyrometer  
1 Indicating potentiometer

Other activities have included measurements of the thermal constants of materials in board or slab form for various industrial firms, investigation of heat flow in the earth and the artificial stimulation of rain.

### Radiation Division

#### X-ray and Electron Microscopy Section

The internal structure of single crystals formed the basis of the fundamental research undertaken in this Section. The structure of para-dinitro benzene has been determined completely. The structure of the complex crystal  $K Cr(C_2O_4)_2 (H_2O)_2 \cdot 3H_2O$  has been fully determined and two papers on this work have been submitted for publication. At present, other chromium complexes are being investigated in the form of a number of isomorphous compounds.

A Geiger counter X-ray spectrometer has been modified to deal with a number of important projects requiring quantitative investigations. The quantitative analysis of tri- and di-calcium silicate in commercial cement clinker has been successfully carried out. The quantitative analysis of reject limes for a firm manufacturing fire-bricks and the free quartz content in samples of mine and factory dusts are two further examples of industrial research projects that were successfully investigated and completed during the past year with this instrument.

Considerable work has been done on metals and metallic compounds. Many synthetic spinels have been investigated, with the object of determining the dimensions of the unit cell edges and the structure of these compounds. Several samples of tungsten carbide from a manufacturing firm were studied for grain size, orientation and texture as related to physical properties.

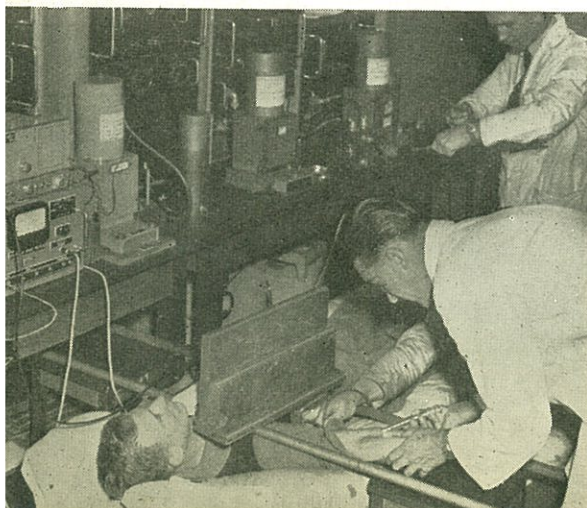
Research projects on the decomposition of dolomite under known external conditions and the determination of the cell edges of long-chain hydrocarbons have recently been undertaken successfully by X-ray methods.

Identification by X-ray analysis formed an important part of the Section's work, and many samples of minerals, clays, dusts, etc., were successfully identified. Methods for determining particle size by X-ray methods were devised and applied to the studies of particle size distribution in carbon blacks, in mine dust, and in samples of magnesium oxide. These results will be correlated with direct measurements when the electron microscope becomes available.

The Philips electron microscope, which arrived at the end of July, is now being installed and tested. Much preliminary work, such as fine adjustments, proper alignment of the magnetic and mechanical axes of the electron lenses, magnification, calibration, etc., will have to be done before the instrument can be used in research investigations. Once the preliminary work has been completed, the microscope will form a powerful tool in the study of a large variety of industrial, medical and biological problems.

#### Optics and Mass Spectrometry Section

In addition to work on photometry, refractometry, radiometry and spectroradiometry and interferometry, optical instruments have been designed and constructed. These include a galvanometer amplifier for the amplification of thermopile e.m.f.'s, an optical precision pyrometer, a chromatographic photometer, an internal focussing anallatic telescope for the Trigonometrical Survey, aplanatic lenses and eyepieces. The optics workshop has made many test surfaces, lens combinations and simple lenses, as well as prisms, optical flats and quartz windows.



### Applied Mathematics Section

Work in collaboration with members of staff of other sections of the National Physical Laboratory and other laboratories of the C.S.I.R. has included the following projects:

*Low Reflectance Coatings:* the ability of thin coatings on glass to reduce the reflection of heterochromatic light at the glass surface was investigated theoretically.

*The Influence of Convection on Measured Borehole Temperatures:* boreholes sunk in South Africa for mining purposes are invariably water-filled to within a short distance from the top. The downward temperature gradients are high enough to excite convection currents. Theoretical considerations show that the average temperature over any borehole cross-section is nevertheless that of the surroundings at the same depth and that thermometers of sufficient diameter will measure this average temperature.

*Measurement of the "Warmth" of Flooring Materials:* recommendations, based on theoretical calculations, were made in connexion with the improvement of an instrument for measuring the "warmth index" of flooring materials.

*Conduction of Heat* (temperature variation of the inner surface of a wall).

*Damping of the Rayleigh disc for oscillations in a uniform magnetic field.*

*Ventilation calculations on the rate of air change in rooms.*

### Director's Laboratory

Work on the perturbations in the molecular spectra of the diatomic molecules of phosphorus and sulphur was completed and the results are in the course of publication.

The Raman effect of the isomers of benzene hexachloride was investigated, and a method developed for the quantitative determination of the isomers which may be of practical value.

A vacuum arc was designed and constructed in the C.S.I.R. workshops. With the help of this instrument it has been possible to obtain the molecular spectra of the following elements in inert gas atmospheres: Beryllium, Bismuth, Antimony and Silicon. These spectra have not been obtained before in emission.

*A steinheil spectrograph and vacuum arc used in studying the molecular emission-spectra of beryllium, bismuth, antimony and silicon.*

## National Chemical Research Laboratory

### National Advisory Committee for Chemical Research

The Council is again indebted to the National Advisory Committee for Chemical Research and the members of its various sub-committees, for their assistance in the formulation of research projects. The work of the Liaison Division, in opening up new fields of work by providing reviews of raw materials and industries for the consideration of advisory committees,

### Physical and Analytical Chemistry Division

#### Sorption of gases

There has been a considerable advance in all research programmes related to this field.

*Reactivity of coals:* a comprehensive study has been made of low temperature adsorption of argon on a wide range of South African coals, in order to determine internal surface and pore structure. Adsorption and desorption cycles were completed over the whole range of relative vapour pressures. This programme is being continued in the forthcoming year on a broadened basis.

*Calcination of dolomites and of magnesite:* work has been commenced on surface properties of magnesia produced by calcination of dolomite and of magnesite at various temperatures.

*Fundamental studies:* fundamental work on surface diffusion of adsorbed gases has progressed rapidly.

The work on pore structure of coals has shown a need for more fundamental knowledge of capillary condensation and hysteresis, and a programme of work has been initiated in this connexion.

*Surface of fine particles:* adsorption and permeability measurements on some glass microspheres showed good agreement with microscopic measurements.

#### Decomposition of dolomites

This work has been initiated as a fundamental study in connexion with a more technical programme on dolomitic limes. Studies are being made of the thermal

*The density of coal is measured with this vacuum apparatus. Difficulties due to the porous structure of the coal samples are overcome by measuring the displacement of helium gas.*

The mass spectrometer has been equipped with a device for automatic scanning of mass spectra and is being used for isotope ratio determinations. An instrument is being made with a range of up to 400 mass units, and will be suitable for lead-isotope abundance measurements in the determination of the ages of rocks and for analyses of hydrocarbon gas mixtures.

### Spectrochemistry Section

Spectrochemical work has included the analysis of various samples, which could not be analysed conveniently by chemical means, for several individuals and laboratories. Much of this work has been concerned with the determination of trace elements in metals, soils and plant materials.

Research work has been mainly concerned with the development of methods of analysis for special purposes on behalf of industrial firms and research organizations, such as the determination of magnesium in iron castings and the methods of analysis of copper alloys and of minerals used in the manufacture of welding electrodes. Methods were worked out for the determination of alkali elements by making use of a flame source, and semi-quantitative methods developed for the analysis of non-conductive samples such as clays, soils, plant materials and silica compounds.

### Applied Geophysics Section

The gravity survey of South Africa was completed and the results prepared for publication. Other work has been mainly concerned with seismic investigations in collaboration with the Bernard Price Institute for Geophysics, including a study of the seismic waves resulting from the detonation of 10 tons of explosives near Thabazimbi and investigation of the practicability of short range seismic work for determining sub-surface structure.

has proved of considerable assistance in the specific formulation of research projects.

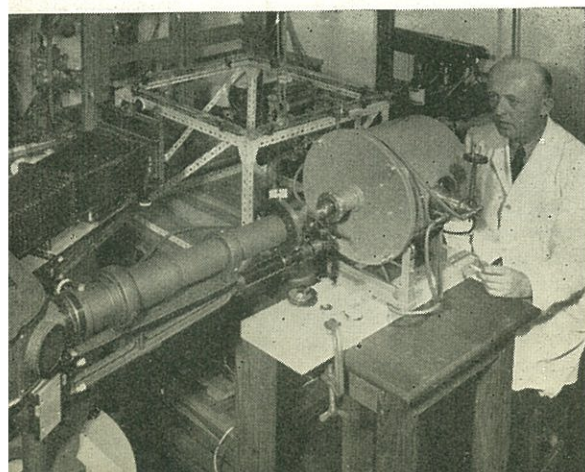
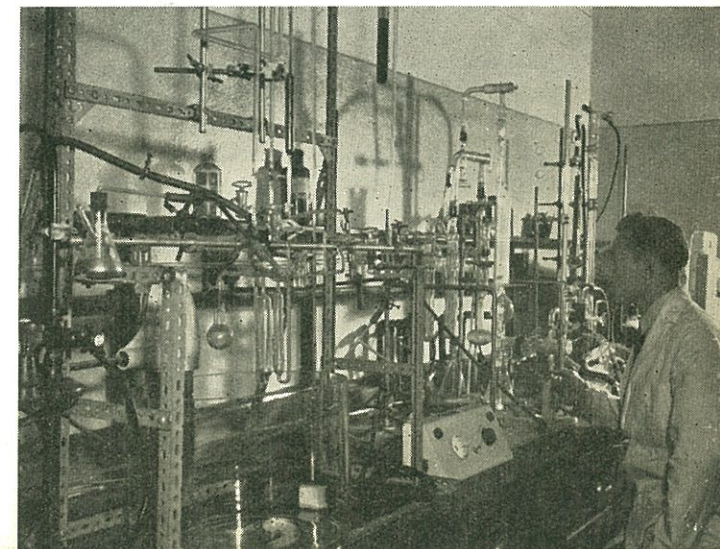
### Research fellowships

Appointments have been made to the research fellowships made available by the South African Wool Board for fundamental work on wool and its by-products. The work of these Fellows has been further reinforced by the assignment of an experienced officer from the Department of Agriculture to this project.

decomposition of dolomite at various constant temperatures and pressures. Rate of loss of weight, X-ray changes in single crystals, and interchange of CO<sub>2</sub> containing C<sup>13</sup> with decomposing dolomite are the main techniques thus far employed.

### Studies of clays and related materials

During the past year, a South African deposit consisting primarily of montmorillonite has been identified, and a visit to it by an officer of the Geological Survey indicates that it is probably extensive. It cannot be called a bentonite, as it occurs as a white, fairly hard rock which shows swelling properties only when finely ground. There is some indication of hydrothermal origin, which would seem to be unique for a montmorillonite. During the course of this work many samples of clays collected in the Cape area and elsewhere have been examined for montmorillonitic types.





Examination of colloid fractions of a large number of South African soil types has been successfully undertaken. Using X-ray diffraction and differential thermal analysis, it has been clearly shown that laterites and lateritic soils contain large amounts of goethite, with kaolinite and/or gibbsite; subtropical black clay soils contain montmorillonite as dominant mineral, etc. A more detailed survey covering a larger number of samples has been begun.

#### Metallic corrosion

With the help of the Liaison Division, contacts have been made with industries and municipalities and with Government departments. Enquiries coming from these sources have been answered and investigations undertaken in connexion with them.

#### High polymer studies

The officer sent overseas for special study in this field has returned and has been engaged in the setting up of special equipment. In addition to carrying out studies of starches, gums and stand-oil constituents for the Organic Chemistry Division, a beginning has been made on a detailed study of sunflower seed protein.

#### Chromium chemistry

This has been confined to the chemistry of chromite. Dissolution and electro-winning studies have been transferred to the Process Development Division but some work has been done on the behaviour of chromite on reduction and on oxidation. A study has been made of the possibility of identifying and estimating gangue minerals in natural chromite, using differential thermal analysis. This has proved very satisfactory where talc and serpentine are the gangue minerals, but has no application to Transvaal chromite, in which pyroxenite is the associated mineral.

#### Process Development Division

Considerable assistance has been given to other divisions of the laboratory in the design and supply of special equipment.

#### Processing of chrome ore

Preliminary work on the production of chromium by the electrolysis of chromous salt solutions prepared from low grade Transvaal chromite was continued, and important contributions have been made to knowledge of this process from the theoretical and economic points of view. Other methods for the processing of chromite are under investigation, and pilot plant work, except for the operation of a semi-scale electrolysis cell, has been postponed until the relative merits of the processes have been investigated more fully.

Many samples of Transvaal chromite have been obtained from both Eastern and Western belts. A survey of variations of composition in the gangue-free spinel is being carried out, with special attention to the ratio of ferrous to ferric iron.

#### Radio-chemistry

An officer has been appointed to assist in research investigations requiring the use of both radioactive and stable isotopes, particularly in conjunction with the Biophysics Section of the National Physical Laboratory. Assistance has been given in projects requiring (i) rapid determination of sodium in a chromium electro-winning cell, (ii) exchange of  $\text{CO}_2$  containing  $\text{C}^{13}$  in dolomite dissociation, (iii) study of the behaviour of certain insecticides and of phosphate fertilizers in their application to various plants, (iv) solution of metals in drying oils, (v) separation and identification of  $\text{Mn}^{54}$  in iron slugs irradiated in piles at Harwell and at Oak Ridge.

#### Analytical Laboratory

This laboratory has been primarily committed to providing service to other sections. The most important change in the last year has been a re-organization in which the Microanalytical Laboratory was transferred from the Organic Chemistry Division to become part of the Analytical Laboratory. Two assistants are now occupied full time in the microanalytical section carrying out analyses arising within the Laboratory. It is hoped in the next year to enlarge staff further and to be able to undertake analyses for outside laboratories.

#### Wool Research Fellowship

The Fellow appointed for work on protein fibres is now with Professor J. B. Speakman at Leeds University where he will spend two years gaining general experience of wool research, and in the study of a specific research problem.

#### Manganese ores

The utilization of domestic manganese ores has been reviewed and a programme of work decided upon. One immediate objective is the production of a manganese dioxide suitable for dry cell manufacture. Longer range studies will be concerned with the ferruginous manganese ores of the western belt of the Postmasburg deposits and in particular with the utilization of manganese salt solutions derived from the application of leaching processes to these ores. As a preliminary to these latter studies, the Government Metallurgical Laboratory is investigating the mineralogy of the ores with particular reference to the possible application of ore-dressing methods for their beneficiation.

#### Citric acid and itaconic acid

Work has continued on the production of citric acid from cane molasses and of itaconic acid from sugar. Delay in obtaining equipment has greatly retarded progress on this project.

#### Fluidized bed techniques

Pilot-plant-scale equipment for studying fluidized bed techniques with particular reference to the carbonization of South African coals has been built, and work is now in progress.

#### Chitin from crawfish offal

Large-scale laboratory experiments have been carried out on a process for the production of chitin from crawfish waste, and preliminary estimates of the cost of production of chitin prepared in order to aid industrial firms in making a market survey of this material.

#### Processing of whales

In order to obtain samples of material for evaluation for nutritional purposes, so-called "glue waters", which constitute a hitherto unutilized product from the processing of whales, have been subjected to spray-drying. These samples have been passed to the Organic Chemistry Division for further study.

#### Treatment of wine distillery residues

As a sequel to the investigations of the Water Treatment Research Division, a preliminary design for a pilot plant for the study of these residues by an improved anaerobic digestion process has been made.

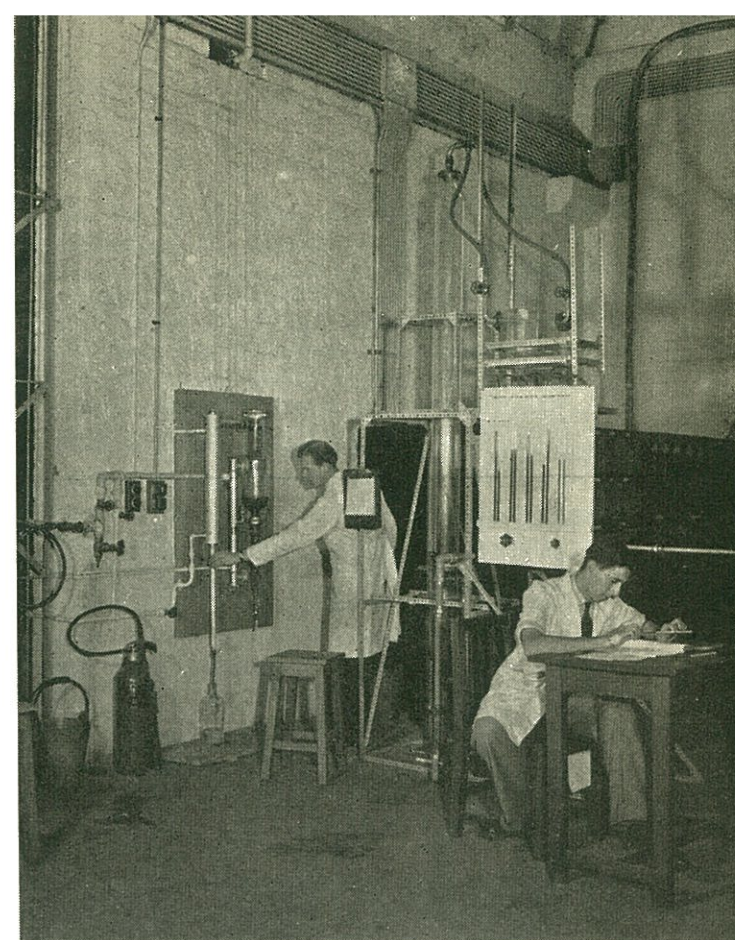
#### Organic Chemistry Division

##### Wool Wax

*Unsaponifiable fraction:* by column chromatography, a glycol fraction has been separated from the unsaponifiable fraction of wool wax. Preliminary experiments suggest that this material is a mixture of aliphatic 1:2-glycols in which one of the hydroxyl groups is located on a terminal carbon atom. Its examination is proceeding.

During the above studies, considerable quantities of the triterpene constituents have been separated and a study of complex formation between them and oxalic acid is in progress.

It has been found that urea forms molecular complexes with two series of compounds present in the unsaponifiable fraction — one series is identical with the 1:2-glycol fraction isolated by column chromatography as above, and the other is a mixture of monohydric alcohols. The application of this technique of separation constitutes an important advance in the methods of studying these materials and is being actively pursued.



*Equipment under test for investigating the use of fluidization techniques in the gasification of South African coals.*

*Acid fraction:* methods for the synthesis of the ante-iso and iso acids of wool wax have been studied and five ante-iso and two iso acids have been prepared. This investigation will shortly be concluded, however, owing to the activity of other workers in this field.

*Technological studies:* The saponification of wool wax with lime has been investigated. Optimum conditions of time, temperature, etc., are being sought for the reaction and it is expected that the data will shortly be available to pass on to the Process Development Division for the planning of larger scale trials.

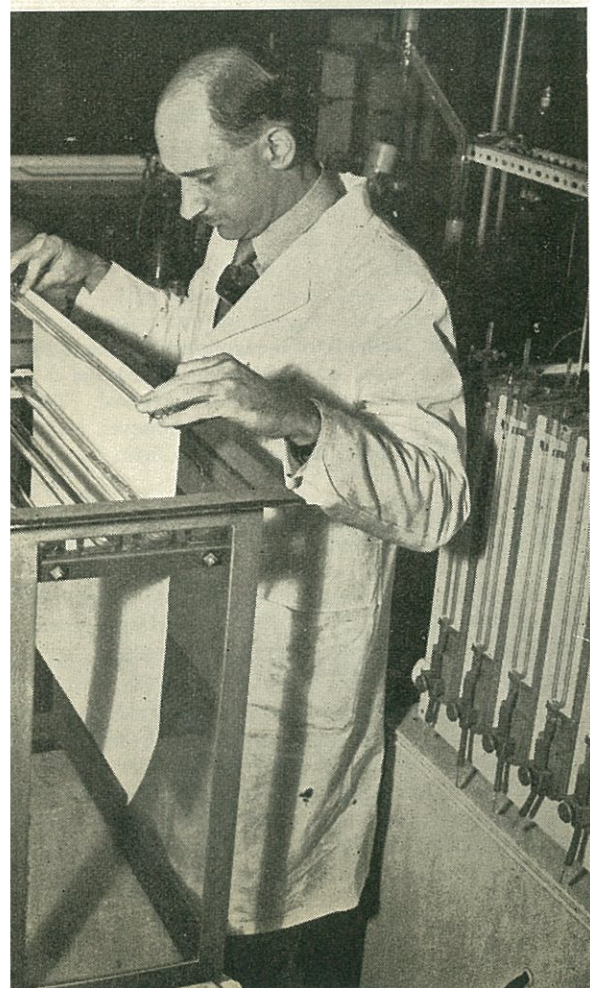
In consultation with the Process Development Division, an experimental wool scouring train has been designed for the investigation of the scouring of lox and Native wools with synthetic detergents. In this connexion the Division has collaborated with an industrial undertaking in a comparative study of different scouring techniques on a factory scale.

### Itaconic acid

The incorporation of itaconic acid into surface coatings (alkyd resins) has been studied. Alkyd resins which were satisfactory with respect to their viscosity, drying properties and film hardness were prepared by a partial replacement of the phthalic acid component with itaconic acid. These experiments are proceeding on a laboratory scale with a view to finding suitable formulations, cooking times, etc., before planning larger scale trials.

### Marine oils

*Constitution:* a difficulty encountered in the study of the constitution of the highly unsaturated acids of marine oils is the risk of isomerisation during their preparation from the oils by saponification. With a view to avoiding this difficulty, the direct preparation of the alcohols corresponding to the constituent acids is being explored via reduction with lithium aluminium hydride. As a preliminary to further work on the separation of the unsaturated alcohol mixtures so obtained, a number of pure long unsaturated alcohols have been prepared and characterized.



*Utilization:* studies of the mechanism of stand-oil formation from marine oils have been begun. A low viscosity stand-oil prepared by mild thermal treatment of pilchard oil has been submitted to short path distillation and the residual polymeric material saponified, and the resulting mixture of acids esterified and separated into mono- and dimeric ester fractions in a short-path still. The investigation of the materials segregated in this way is proceeding. Molecular weight measurements for this project are being carried out by the high polymer section of the Physical and Analytical Chemistry Division.

### Plant products

Investigations of a number of plant products have been completed or are in progress.

*Ximenia spp.* (Suurpruim): kernel oils of a number of *Ximenia* species have been shown to contain a new conjugated enyne acid (Ximenyinic acid), the structure of which has been fully determined. Other components of the oils and the kernels are being investigated, including two unusual long chain unsaturated acids (lumeniqueic and ximenic acids).

*Pittosporum undulatum:* a number of interesting components of the fruits of this species have been separated in a preliminary study.

*Sclerocarya caffra* (maroola): an examination of the fruit coat fat of this species has established it to be of a normal type.

*Euryops floribundis* (harpuisbos): this shrub has assumed the character of a noxious weed in certain parts of the Eastern Cape. It yields a high proportion of a resinous material on extraction, from which a large variety of substances have been separated. Amongst these may be mentioned anisic acid, isobutyric acid, tiglic and angelic acids, a hydrocarbon (ca. C<sub>30</sub>), lignoceryl alcohol, a ketol C<sub>18</sub>H<sub>30</sub>O<sub>3</sub>, two liquid neutral substances as yet uncharacterized, a solid neutral substance (possibly C<sub>23</sub>H<sub>46</sub>O<sub>2</sub>), and several phenolic substances.

*Acacia mollissima* (black wattle): as a result of the production of wattle tannin, very large quantities of wattle wood are available for commercial use. In view of this, and in order to assist the Wattle Research Institute in its biological investigations, a study of the chemistry of *Acacia mollissima* has been begun. Extractives from the wood have been shown to include a tannin-like material (not identical with the tannin of the bark), d-pinitol, and a crystalline substance which is probably a diterpene alcohol. These are being further

*Starting a run in paper chromatography, a method of analysis by which it is possible to separate and identify minute quantities of closely related organic compounds with chemically similar properties, such as the constituents of protein extracts from whales.*

examined and, in addition, studies of the cellulosic and lignin fractions of the wood have been planned. Wattle gum has been shown to contain as major constituent a polysaccharide of molecular weight ca. 90,000, which yields L-arabinose, D-galactose, L-rhamnose and an aldobionic acid on hydrolysis. The relative proportions of these sugars have been determined by chromatographic and other means. By arrangement, wattle seeds are under examination at the University of the Witwatersrand.

*Passiflora edulis* (granadilla): arising from an investigation for a commercial firm, a starch fraction has been separated from the fruit pulp of the granadilla. This has proved on investigation to be an almost pure amylopectin. It has been characterized by molecular weight determinations on its acetate, by end group assay and by other measurements. The tendency of the juice to thicken rapidly on concentration is apparently associated with its content of amylopectin starch.

## Microbiological Chemistry Division

Although staffing difficulties have delayed work on some projects, progress can be reported in the following investigations.

### Citric acid fermentation

As indicated above, the production of citric acid from cane molasses on a large laboratory scale (300 lbs. medium) has been in progress. At the same time a number of strains of *Aspergillus niger* have been tested for their ability to produce citric acid under conditions of submerged culture, and promising strains are under study at present under varied conditions.

### Itaconic acid

Nutritional and cultural conditions for the production of itaconic acid from sucrose have been investigated. It has been shown that unrefined cane sugar is an excellent carbon source for itaconic acid formation from *Aspergillus terreus*. Cane molasses, however, is not a suitable substrate for this fermentation although it has been demonstrated that it is the traces of molasses in unrefined cane sugar which make it preferable to pure sucrose as a substrate. It is probable that trace elements are involved here, since molasses ash additions to pure sucrose are equally beneficial.

### Reaction of proteins and derived products with sugars

This reaction is of importance because it leads to so-called "browning" effects in food processing. Through the courtesy of the Department of Scientific and Industrial Research of Great Britain, facilities have been made available for a research officer to study this problem in collaboration with a research team at the Low Temperature Research Station, Cambridge. The reaction between glucose and the free amino groups of casein is being investigated, one of the objects being to determine the relative rates of reaction of the sugar with free  $\alpha$ -amino (chain terminal) groups and with free  $\epsilon$ -amino groups (originating from lysine residues). At the same time, attempts are being made to identify the amino acids responsible for the free amino groups in casein, and it has been shown that these include lysine, aspartic acid and glutamic acid.

### Nutritional factors

With reference to studies of whale solubles, fish and whale liver extracts, fish solubles, and metabolic products of bacteria, it has been necessary to develop techniques for the estimation of essential amino acids and other nutritional factors. For the estimation of the former, an attempt is being made to develop the technique of paper partition chromatography on a quantitative basis and good progress has been made in this connexion. Of the latter, the factor that has come in for most attention has been vitamin B<sub>12</sub>.

### The role of sulphate reducing bacteria in corrosion processes

A beginning has been made with the isolation of a number of strains of sulphate-reducing bacteria with a view to the study of their action in anaerobic corrosion processes.

### Synthesis of heterocyclic quinones

Methods for the synthesis of heterocyclic quinones containing 5 membered rings have been worked out and a number of members of this class of compound are available for testing for anti-bacterial properties.

## Water Treatment Research Division

### Anaerobic digestion of fermentation effluents

The laboratory investigations of this method of purification of effluents from fermentation industries have been completed and the results submitted for publication. Effluents from the alcoholic fermentation of cane molasses, from the manufacture of bakers' yeast and from the distillation of wine have been studied. As a result of this very extensive investigation, important information has become available concerning the influence of the solid phase, and of sulphates. Of greatest significance, however, has been the demonstration that the increase in the concentration of volatile acid salts, which usually precedes breakdown of the digestion process and which has in the past been taken as an index of the overloading of the digesters, is caused by a depletion or unbalancing of the microbiological population of the digester under high rates of feed. This has led to the development of a new principle in the application of the method, in which the digesters are continuously inoculated with sludge suitably conditioned for the process. Under these conditions, rates of feed to digesters have been increased far beyond what was possible using accepted procedures. Since this implies a considerable decrease in the capital costs of installations for treating effluents by this method, it is planned to carry the investigations on to a pilot plant scale.

### Sewage disposal

The Division collaborated in a survey of sewage disposal on the South Coast of Natal for the Natal Provincial Administration, and a report was submitted to this body. Arising from the survey, preliminary work on the chlorination of sewage and sewage effluents has been carried out with a view to facilitating disposal in this area.

### Effluent from wood processing plant

The treatment and disposal of the effluent from a wood processing factory was investigated under contract. As a result, the details of a treatment process were worked out and recommendations made concerning the installation of a treatment plant.

### Sterilization of sewage sludge

Existing routine methods for testing the pathogenicity of sewage sludge have been modified and adapted for the special purpose of determining the viability and infectivity of parasitic ova and cysts, and a survey of the occurrence of such ova and cysts in sewage sludges is in progress. At the same time, an active investigation has centred on attempts to evolve an effective and applicable method for the destruction of parasitic ova and cysts. It has been demonstrated that heating of sewage sludges to 50–55°C. for two hours leads to complete destruction of such ova and cysts. Since such treatment could be practised readily by most municipal organizations, it appears that a practical solution to this problem has been found, and trials on a larger scale are planned. At one stage it appeared as if the operation of sludge digesters in the thermophilic range would provide adequate sterilization, but comparative tests of filterability on mesophilic and thermophilic sludges have demonstrated that the former type of digestion process, followed by heat treatment, is preferable.

Other factors in the destruction of parasitic ova and cysts, such as the effects of moulds, are being studied and the fate of other pathogens in the heat treatment process will be explored.

### Stream surveys

Few data are available as to the biological and chemical conditions which prevail in South African rivers, or of the effects on these of industrial development. Such data are considered essential for the development of proper standards for industrial and other effluents. During the past year, a stream survey programme has been formulated and work has begun in the Cape area and with special reference to the Berg River. The

*Industries concerned with wine distillation, molasses fermentations, fruit and vegetable canning, cereal processing, etc. have difficulty in disposing of residual wastes. A solution to this problem has been successfully demonstrated with this experimental unit in which the organic matter in these industrial effluents is digested by anaerobic microorganisms.*

Department of Irrigation, the Inland Fisheries Organization of the Cape Provincial Administration, and the University of Cape Town are collaborating in these surveys, and in this connexion the Council is especially indebted to Professor J. H. Day and to Dr. Hey for their individual co-operation, and to the University of Cape Town for providing facilities for the work.

In addition to these long term investigations, other short term studies of rivers in Natal and the Eastern Transvaal are being planned.

## Nutrition Unit

The officer-in-charge of the Unit has visited Great Britain and certain continental countries to study recent developments in the field of nutrition.

Studies on the absorption of cereal fat by humans, following those recently reported, have been continued. The results obtained indicate that, contrary to opinion expressed overseas, such fat is as well digested as animal fat in the everyday diet of Europeans and most Bantu. Since the fat intake of the latter is derived mainly from cereals, this finding is of some importance in the practical nutrition of the Bantu. Further studies on the digestibility of nutrients in cereals, legumes, etc., are in progress.

The Bantu frequently prepare their food in iron utensils and, in consequence, ingest an unusually large amount of iron. Bearing in mind other evidence on the subject, it has been suggested that with the particular type of malnutrition affecting these people, the high

## Water supplies on the West Coast of the Union and in South West Africa

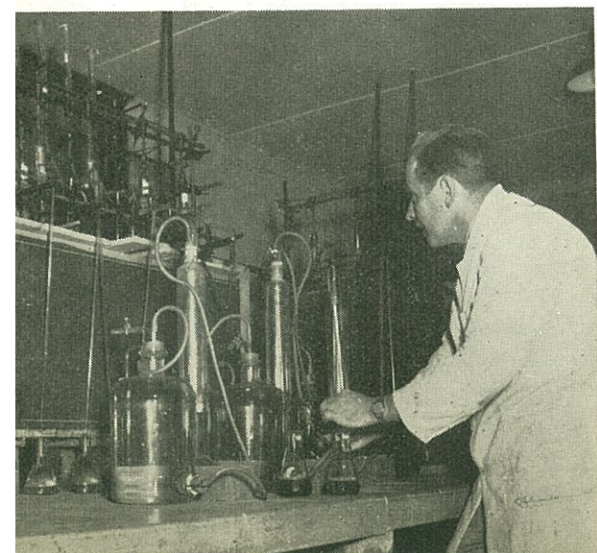
A visit was made to these areas by an officer of the Liaison Division and a report on water supplies and water supply problems has been drawn up. Arising from this, a request has been received from the South West African Administration for an investigation into the removal of fluorine from certain water supplies. This work is now in progress.

iron intake may be a causative factor in the haemochromatosis that is so common amongst them.

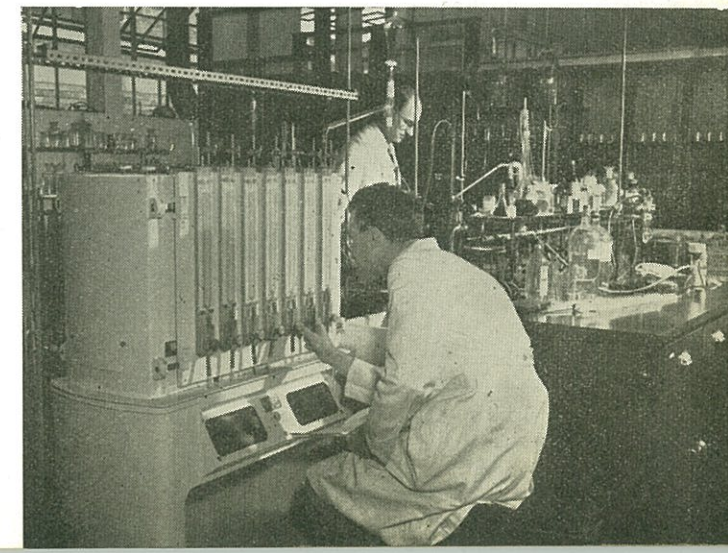
Examination of relevant experimental and field evidence has thrown serious doubt on the validity of the currently held theory that the phytic acid of cereals is rachitogenic to man. To throw more light on this problem of the calcium metabolism of the Bantu, radiological, balance, and other studies have been planned in collaboration with paediatricians in local non-European hospitals.

Observations on the diets consumed, the state of bowel motility, and the incidence of appendicitis among the Bantu, have led to detailed consideration of the still unsettled aetiology of appendicitis. From the available data and evidence, it seems established that both diet and bowel motility are factors which any hypothesis on the causation of the disease must take into account.

A start has been made to determine the nutritional value of some of the lesser known Bantu foodstuffs, such as wild leaves, roots, etc.



*The respiratory processes of yeasts are examined to determine factors affecting the growth of microorganisms — an essential step in the study of industrial fermentation processes.*



# National Building Research Institute

Emphasis has again been placed on the four major national problems which occupy the greater part of the work of the Institute. These four problems relate to the provision of housing for the Native peoples; the study of periodic heat flow in buildings under conditions of high diurnal temperature range and high intensity of solar radiation; the heaving of buildings on desiccated clay soils; and, finally, the problems of high magnesia contents in building materials manufactured from magnesia limestones. Progress can be recorded in all these fields.

There is ample evidence to indicate that the Institute is accepted by the Building Industry and has gained its confidence. This has been repeatedly confirmed by the number of urgent and unsolved problems which are referred to the Institute. The number of publications has appreciably increased, and a token of Industry's further acceptance of the Institute's work is the growing subscription list for its publications.

## Building Research Advisory Committee

This committee has rendered another year of sterling service to building research in South Africa. The following changes in membership are recorded:

*Mr. T. H. Louw*, with *Mr. A. A. Björkman* as alternate, to represent the Chapter of South African Quantity Surveyors

*Mr. D. P. Marriot*, as alternate to *Mr. A. H. Roberts*, to represent the South African Federation of Civil Engineering Contractors

*Mr. L. E. Kent*, with *Dr. D. J. L. Visser* as alternate, to represent the Geological Society of South Africa

*Mr. E. F. Allen*, as alternate to *Mr. J. M. Thompson*, to represent the National Federation of Building Trade Employers

*Dr. M. D. A. Baldocchi*, with *Mr. W. van Beijma* as alternate, to represent the National Housing and Planning Commission (Department of Health)

*Mr. J. M. Southey* in the place of *Mr. A. F. Bruyns Haylett*, to represent the South African Railways and Harbours

## Overseas visits

During the year, three officers have been overseas for study visits: *Mr. C. A. Rigby*, Head of the Engineering Division, has been to the United Kingdom and the Continent to study building methods; *Mr. T. L. Webb* of the Materials Division to the National Bureau of Standards, Washington, to study magnesia lime problems in the Building Industry; and *Dr. W. M. H. Rennhackkamp*, of the Functional Efficiency Division, to the United Kingdom, to study lighting in buildings. The Institute is particularly grateful for the ready assistance offered by the various organizations which received these officers.

## Soil Mechanics Division

Considerable effort has again been devoted to the problem of heaving foundations, and two theories have been put forward to explain the moisture movements which give rise to this rather unexpected behaviour. The first theory suggests that a thermo-osmotic transfer of moisture is taking place towards the centre of the building, this phenomenon occurring throughout a considerable depth of the soil: the other considers that a redistribution of moisture occurs in the soil due to the interference with evaporation by the erection of the building.

In association with the National Housing and Planning Commission, a large-scale experiment has been started at Vereeniging to test these theories, and it is proposed to measure temperatures and changes of moisture content in the soil under a specially constructed house. Under twelve other houses, the depth to which the heaving movements persist, and the effect of reinforcing the brick walls as a substitute to grade beams, will be tested. Other anchor-pile loading tests have also been started, and on all the buildings very careful observations of vertical movements are being made.

*Calibrating a soil-pressure cell of the magnetic-inductance type, used for measuring pressure in soil under buildings, against dam walls, and inside earth banks.*

In the laboratory, studies have been started both on thermo-osmotic transfer of moisture in soil, and on the relationship between the soil moisture suction and soil moisture content of soils encountered at Vereeniging and Odendaalsrus.

Three solutions to the difficulties have already been proposed: the first suggests flexible buildings, as for example dry wall block construction; the second proposes reinforcing, to make the walls of the building act as deep slender beams and thus tolerate the movements; the third makes use of piles to anchor the building down to the zone at which no movement takes place — at present believed to be the water table zone. Many of the new buildings for erection in expansive soil areas have been designed during the last year on one or other of these principles.

Other projects on which this Division is engaged are:

Foundation analysis for the Umbilo-Umhlatzana

Canal Bridges — Durban (contract)

Silt pressures in reservoirs

Study of residual pressures in soils.

## Engineering Division

During the year Pretoria experienced a very serious hailstorm with jagged stones, up to 5 inches overall dimension, causing severe damage to buildings in the city. This local experience gave considerable impetus to the project concerned with the hail resistance of roofing materials and a new installation was constructed for firing artificial hailstones cut from clear ice. Using roofing materials which were just damaged in the Pretoria storm, the average severe impact was reproduced on a laboratory scale and a range of new roofing materials has been tested under these conditions. This work has disclosed much information which is of practical value and the majority of the findings have been verified by practical experience in the storm. The next task of developing a suitable laboratory acceptance test for hail-resistant materials is now being undertaken.

Other projects in progress in this Division are:

The development of a new concrete vibrator

The development of a new soil pressure cell

Strain measurements in buildings on heaving soil foundations

Experimental structural designs for foundations on heavy soils.

## Functional Efficiency Division

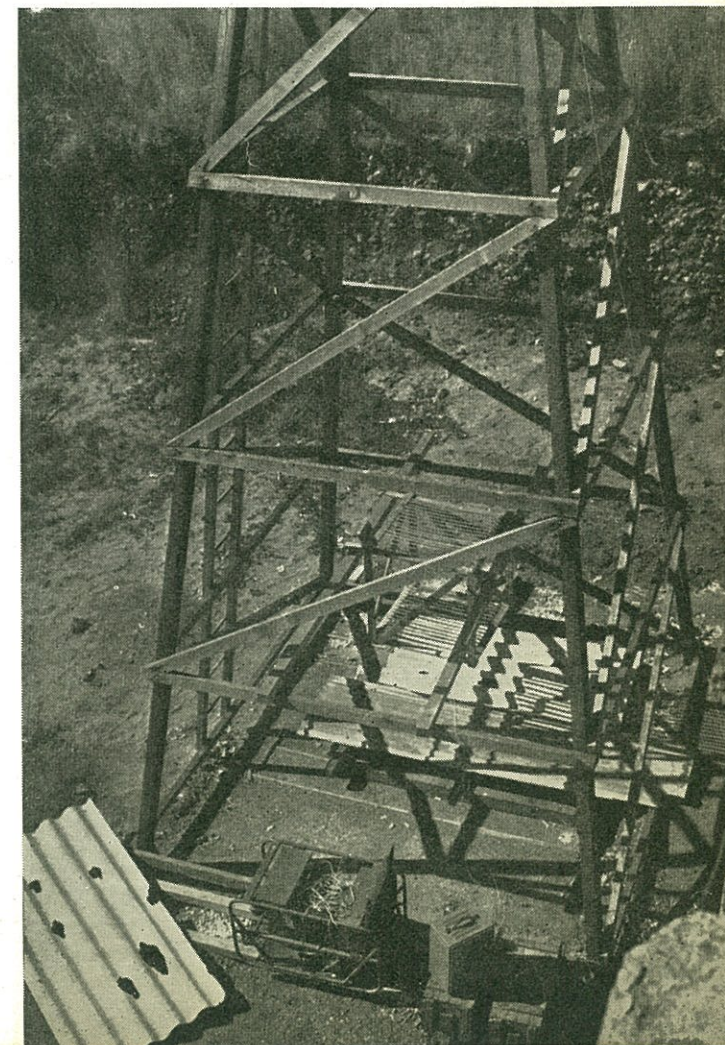
The attention of this Division has been devoted mainly to the study of heat exchange in buildings under conditions of high diurnal temperature range and high solar radiation intensity. This work has centred mainly round the experimental observations on a large-scale test room designed and built to measure actual heat transfer under conditions of outdoor exposure in Pretoria. Two research reports, dealing with the heat exchange under periodic heat-flow con-

ditions at the inner face of a wall and through the wall itself, have been produced, and excellent correlation has been found with the observations on the heat transmission test room. Further reports dealing with the heat exchange at the outer surface of a wall and through the roof-ceiling combination are in preparation.

These studies have emphasized the previous conclusion that, in dry semi-tropical countries, the theories of heat flow in the steady state must be replaced by periodic heat-flow procedures. They have also indicated that the film-coefficient plays a very important role in actual heat exchange, and that much more study must be devoted to this subject.

Practical field tests have been carried out on the heat exchange and ventilation conditions in houses, and it is clear that this work must be considerably extended.

*Hail-resistance of different roofing materials is compared by firing artificial hailstones, cut from clear ice, from the top of a tower.*



### Materials Division

The principal emphasis in this Division has been on the solution of building problems associated with the use of the high magnesia limestones which are used for making building materials in South Africa. Falling within this field are the problems concerning the use of high magnesia limes for masonry and plaster mortars.

Progress can be reported in these matters. In particular, studies of the burning of limes have produced results which will be of considerable industrial significance.

Work on a South African standard sand for cement and lime testing has been completed and handed to the Bureau of Standards for practical exploitation.

The report of the Committee on Termites, Wood-borers and Fungi in Building Timbers has been produced, and has been very well received by the Industry.

Other projects on which this Division is engaged are:

- The rain resistance of thin wall constructions
- Development of a floor tile with a warm bituminous finish
- The uses and failures of paints.

### Architectural Division

Work in this Division has been principally devoted to researches following on the studies of the Committee on Minimum Standards of Accommodation. Study has been devoted to the problem of increasing the density of development in Native townships, in order to produce more satisfactory environments and also to reduce the ratio of the cost of services to the cost of buildings. A section of the Witbank Native Township has been re-designed to increase the density by one dwelling per acre, and this process will probably be followed in other town planning experiments over the next few years. A steering committee, composed of leaders in this field, has been set up to provide advice on this work.

A sample survey has been made of the furniture requirements in Orlando Native Township, and has shown interesting and very significant results, which have an important bearing on the design of Native houses. Smaller utility furniture is at present being designed, and the furniture manufacturers are being asked to assist.

Working in co-operation with the Housing Commission, the minimum standards of accommodation previously recommended have been thoroughly reconsidered, and have been placed before the Commission for adoption as standards for the country.

- Other projects include investigation into:
  - The attitude of occupants in low-cost housing
  - Methods of analysing minimum house plans.

*Experimental studies of the penetration of moisture through walls constructed of different materials.*

## National Institute for Personnel Research

During the first few years of its existence, the Institute concentrated on field activities, because follow-up data would not be available for some time, and because the value of personnel research had to be clearly demonstrated. A stage has now been reached where the intake of new research projects, and the collection of new material, must be balanced with the Institute's capacity to deal with the research data produced by this volume of field work. Most projects involve follow-up studies which extend over a number of years. This follow-up material has been accumulating for some time and is now coming in at an accelerated rate. Some limitation of field research activities is therefore necessary, if this essential stage in personnel studies is not to be neglected, and very little new work has been undertaken.

Field research has consolidated itself in the three major fields of Defence, Gold Mining, and the Iron and Steel Industry.

### Mines Research Section

The lengthy research project undertaken on behalf of the Gold Producers' Committee of the Transvaal Chamber of Mines was completed during this year, with satisfactory results. It was demonstrated that the screening tests constructed for the classification of native labour, together with the boss boy selection tests, constitute an advance on current selection methods.

### Industrial Research Team at Iscor

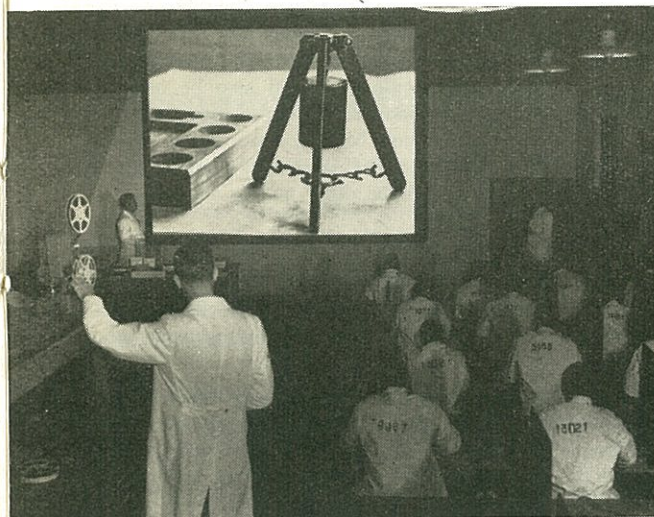
This team has successfully completed its two major projects in the course of this year, namely: the development of selection procedures for administrative trainees, and research into the nature and incidence of absenteeism and labour turnover.

### Industrial and General Testing Team, Johannesburg

This team has undertaken no major assignments during this year, its testing activities being chiefly concerned with a number of minor and routine projects.

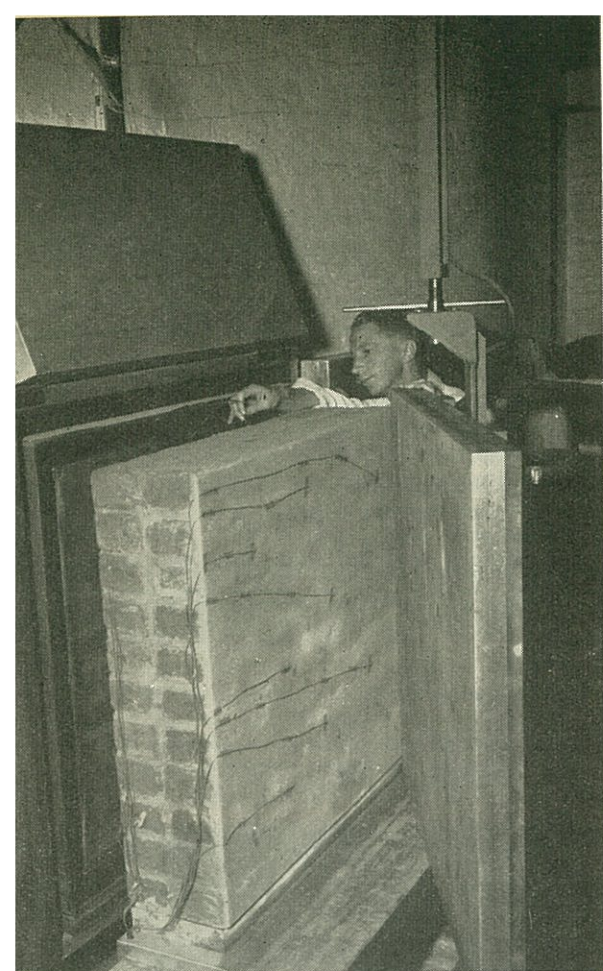
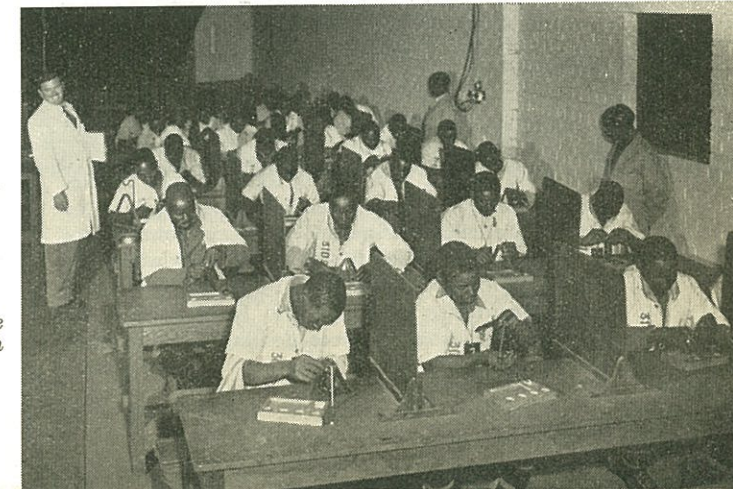
Another batch of applicants for articles in the accounting profession was tested, for follow-up research. With the co-operation of the Professor of Accountancy at the University of the Witwatersrand, further studies are being undertaken on the validity of the Accountancy Selection Test for the prediction of success in B.Com. studies.

The team has been responsible for most of the artisan selection on the mines, and also assisted in the testing



*In the classification of Mine Natives by aptitude testing, tests are administered by silent ciné film, which eliminates verbal and written instructions. Here a "tripod test", one of the tests of general adaptability, is shown on the screen.*

*After film demonstration, candidates do the test, which is assembly of the tripod from parts distributed in the box.*



*Measuring the thermal conductivity of wall sections.*

Other projects on which this Division is engaged are:

- Standards of comfort in buildings in South Africa
- Climatological data for heat exchange design in buildings
- Rain resistance properties of building materials
- Acoustics in buildings
- Lighting in buildings



### Laboratory Research Section

#### Psychophysiological Team

This team has proceeded with its programme of research into the significance of the electrophysiological phenomena of the brain for the study of human behaviour. A wide variety of clinical material is dealt with, including senile and psychotic patients, various types of epilepsies, patients with brain lesions and other suspected neurological abnormalities, psychoneurotic cases and patients undergoing such treatments as insulin and hypnotic therapy. This work is done in close collaboration with medical practitioners.

The main interest is in the study of the relationship between aspects of the E.E.G. (electroencephalograph) and the basic determinants of temperament. Normal subjects are obtained as volunteers, students and members of staff being most frequently used. Most of these subjects do a flicker-fusion and psychogalvanic adaption test in addition to the E.E.G. These psychophysiological and sensory measurements are being related to a variety of temperament qualities.

Further apparatus such as a frequency analyser will shortly be available to refine and amplify the techniques now in use. An oscillograph will also be used for studies of basic reaction time. A plethysmograph has been designed and is now being constructed, to provide further information on the emotional components in records obtained from the other testing devices.

#### Clinical Research Team

This team has completed its field investigations at Tara Neuropsychiatric Hospital on the effect on test performance of various kinds of psychoneurotic conditions.

The team will devote all its time to the South African standardization of the Wechsler-Bellevue test. This test, which originated in America, is extensively used for the measurement of adult intelligence and for the diagnosis of specific emotional maladjustments. Its contents are not suitable as they stand, for use in South Africa, and no Afrikaans version is available. While carrying out the standardization, the team will also investigate to what extent the test is valid as a diagnostic tool, as distinct from its function as an intelligence test.

As representative population samples have to be tested, including people of all ages and in all walks of life, this project is not expected to be completed for some time.

#### Statistical Section

Most of the time of the Statistical Section has been devoted to the statistical analysis of data supplied by field research teams. In the course of this work, much fundamental research was carried out on statistical

procedures applicable to personnel research problems. This led to some findings of importance with regard to the statistics of absentee and accident proneness.

Further work has also been done on operating characteristics and on quality control techniques. This work constitutes an advance in the technique of personnel selection.

The amount of time which could be devoted to theoretical statistics was limited, but work has continued on the study of maximum likelihood estimators.

An important piece of research was completed on

behalf of the Chamber of Mines involving the comparison of different techniques of dust sampling.

### Departmental Workshop

The workshop has completed further apparatus for the study of mechanical aptitude and manual dexterity. A study of these concepts will eventually be undertaken by the Laboratory Research Section. Apparatus was also built to measure aptitudes for winch and loco driving, among mine natives. A new type of tachistoscope was built for the psychophysiological section to investigate individual differences in imagery.

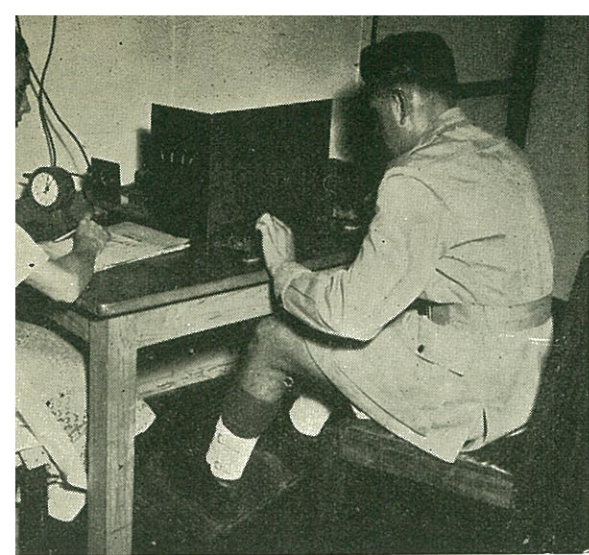
## Telecommunications Research Laboratory

Studies of the factors affecting radio wave propagation have again been the main objective of the Laboratory. Other work has included the further development of a crystal-controlled all-wave communications receiver and lightning research.

### The ionosphere

Regular measurements of the height vs. frequency characteristics of the ionosphere have been made at Johannesburg and Cape Town and have been published monthly. Predictions of high frequency radio propagation conditions for Southern Africa have been prepared monthly and issued in the form of a bulletin with graphs of "optimum frequency vs. time of day" for various transmission distances and latitudes. The daily broadcast by the South African Air Force Station ZRB, giving a statement of ionospheric conditions as observed in the Laboratory at 8 a.m., has continued.

A third automatic ionosphere recorder has been built in the Laboratory. This will be installed in Nairobi with the assistance of the East Africa Meteorological Department. Data from this station should be of great value for radio communication with the northern hemisphere.



A multiple reaction-time test, in which four lights are controlled by two hand and two foot switches. The "learning-time score" is obtained from the number of switching reactions made by the candidate, in learning by trial and error the correct switch for each light.

In the second part of the test the lights come on in a varied sequence, and the candidate is given a set time in which to switch off as many lights as possible. "Multiple-choice-reaction time" is calculated from the number of correct and incorrect responses, recorded on electric counters.

of European officials on the mines. Follow-up results with assessments obtained from an Officials' Training Centre are good.

### Defence and Public Service Research Section

#### Defence

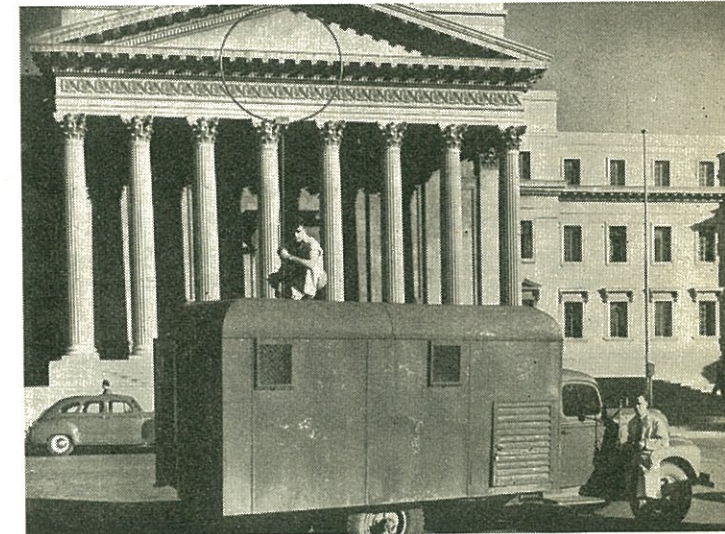
The work of the Defence Research Team continued to be hampered throughout the year by the volume of routine testing which had to be undertaken for the Union Defence Forces.

Despite the heavy testing programme, a number of follow-up studies were carried out, the most important of which concerned the selection procedure for officer cadets.

#### Public Service

The team has done further work on the selection of artisan apprentices for the General Post Office.

A good deal of attention is being devoted to pre-apprenticeship training, for which purpose pupils at the Pretoria Technical College and the Queenstown School of Industries are being tested. This study will be of value both to the Union Defence Forces and to Government departments, and may also be of use for the vocational guidance of those desiring to enter trade schools.



Measurements are being made over the whole of the Union to enable radio-frequency propagation characteristics of the ground to be determined. This information is required for estimating the performance of low and medium frequency radio systems and, particularly, of long-range radio-aids to air navigation.

Special studies are being made of the behaviour of the ionospheric layers around sunrise, and of the recovery of the layers following "sudden ionospheric disturbances".

### Radio noise levels

The regular measurement of radio noise levels at 100 kc/s at Palmietfontein Airport has continued throughout the year. An automatic noise recorder has been installed at Nairobi with the assistance of the East African Department of Posts and Telegraphs. Noise level measurements in this part of Africa are of particular interest to aviation authorities operating in this region, and funds for this purpose have been made available by the Southern Africa Air Transport Council.

An intensive study of the effect of radio noise on a commercial radio navigator system was made by the Laboratory during the trials sponsored by the Division of Civil Aviation, the South African Air Force and the South African Railways and Harbours. With the noise records already obtained by the Laboratory it was possible in a few months to predict the performance of the system over the whole year. The Laboratory also assisted in other aspects of the trials, in particular in the study of errors at night due to sky-wave interference and the effect of mountainous terrain.

Considerable progress has been made in the development of automatic equipment for the recording of atmospheric noise over the range 0–30 Mc/s. A detailed study of the nature of atmospheric noise and its effect on various systems of radio communications is being made.

### Ionospheric absorption

Equipment for the study of ionospheric absorption is under development.

### Ground constants

The equipment necessary for the ground constants survey was completed by December 1949, and measure-

ments in the field have continued since then. During the radio navigator system trials, it was possible to make measurements on frequencies not normally available in South Africa.

### Underground communication

Early in the year, at the request of the Chamber of Mines, a demonstration of the underground radio communication equipment developed earlier by the Laboratory, was given to members of the Committee of Management of the Rescue Training Station. The demonstration showed that communication through rock up to a range of about 1,500 feet can be obtained in the Witwatersrand mines, using specially designed portable equipment.

### Lightning Research Fellowship

The holder of this Fellowship, established by Messrs. African Explosives & Chemical Industries, is on the staff of the Laboratory but is accommodated at the Bernard Price Institute.

A new lightning alarm has been built and installed at the Modderfontein Dynamite Factory. It has been used in conjunction with radar weather observations over that area.

The operation of three B.P.I. electrostatic fluxmeters located at outstations on the Bernard Price Institute radio telemeter network has continued.

Investigations have been carried out on the effect of lightning on electric detonators, both at the surface of the earth and underground.

Work on the ceraunometer (lightning counter) and the study of lightning protection with particular reference to earthing techniques has continued.

### Standard of radio frequency

The standard of radio frequency has been maintained during the year.

### Library and information service

Information on radio developments in various overseas laboratories and organizations is held in the laboratory's library.

The services of this library are available to other organizations through the medium of the main C.S.I.R. Library and Information Division.

*The Laboratory's standard of frequency, which consists of one 100 Kc/s crystal oscillator and two auxiliary oscillators. It provides for recording radio time-signals and time-signals derived from the 100 Kc/s oscillator. The resolution of the recorder is better than 5 milliseconds and is particularly suited to recording weak signals in the presence of radio interference. Facilities are also provided for instantaneous inter-comparison of the frequencies of the three crystal oscillators and for continuous recording of the difference in frequency between pairs of oscillators.*

## Central Workshops

A considerable volume of work has been placed with outside firms throughout the year, and this practice is to be continued as it relieves both the woodwork and metalwork sections of the less specialized work.

Equipment to the value of £8,995, in direct costs, was built in the workshops and, having proved satisfactory, was taken on permanent charge. The following is a list of the major items of equipment produced during the year.

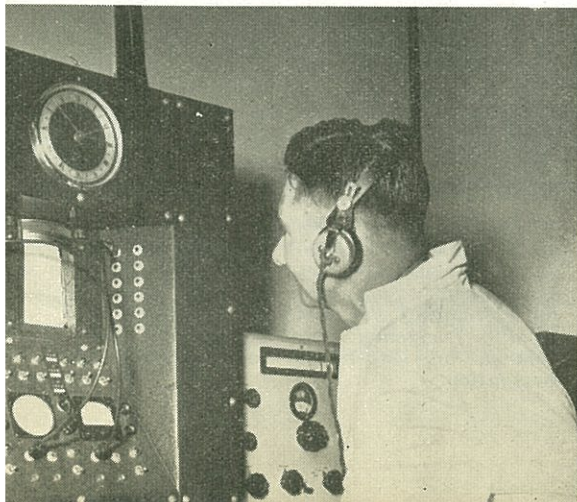
### National Physical Laboratory

Electrolyte bath	for investigations of heat flow in the earth
Ten thermometer tubes	for temperature measurements in deep boreholes
Standard optical pyrometer (under construction)	for accurate temperature measurements above 1,000°C.
Adjustable binocular stand	used in the accurate reading of thermometers
Two lead castles	for the assay of radio-activity in liquids
Four micro-pipettes	for measurements of very small quantities of radio-active liquids
Two photographic six channel intermediate frequency oscillographs	for acceleration measurements, etc.
Probe microphone	used as part of the British type of artificial ear for testing earphones
Artificial head	used for experiments on binaural listening
Pre-amplifier	used for testing earphones in conjunction with American type couplers
Standard footsteps machine (under construction)	for impact transmission testing of floor sections and floors
Free field apparatus (under construction)	for the free field reciprocity calibration of microphones
Vacuum arc apparatus	for the study of special molecular spectra which cannot be produced under normal conditions
Galvanometer amplifier	for the measurement (amplification) of small thermo E.M.F.'s
Integrating sphere (nearing completion)	for use in the standardization of lamps by comparisons of total light output with that of standard lamps

Four logarithmic function scales	for use with the Applied Research Laboratories' Calculating board, which is used in the calculation process in spectrochemical analyses
Interrupter switch	for the accurate charge and discharge of a condenser bank used in a high intensity light source unit (this unit excites the halogen spectra)
Photo-tube attachment	for the direct recording of the alkali spectra
Wilson chamber	for use in the study of emission from treated metal surfaces
Electro-magnet for mass spectrometer (under construction)	to extend the range of the existing mass spectrometer
Seed counter	a mechanical device for accelerating and separating seeds for feeding into an electronic counter
Rotary switch	a mechanical switch for displaying the characteristic curves of vacuum tubes on an oscillograph

### National Building Research Institute

Octagonal wind tunnel (nearing completion)	for calibration of wind speed instruments and for the determination of film coefficients under forced convection conditions
Conductivity of bricks apparatus	for the determination of thermal conductivity of bricks at various mean temperatures
Sixteen miniature Stevenson screens	to measure accurately the outdoor air temperatures near the wall surfaces of the "heat transmission test room"
Six globe thermometers	for experiments in the determination of thermal comfort conditions
Adjustable screen	for continuously shielding the illumination instrument from direct sunlight



mass produced for use in native houses

Hailstone apparatus an aiming device for controlling the firing of artificial hailstones used in testing roofing materials

#### National Chemical Research Laboratory

Ten slow-metering devices a battery of ten mechanical devices for the micro-feeding of reagents in the investigation of water treatment

Four chromatography tanks for chromatography work

Pressure digester for use in the study of the dissolution of chrome ores by sulphuric acid under pressure

Tensiometer and spring balance for use in the study of the electrodeposition of chromium from chromous salt solutions (obtained from the dissolution of chrome ores in sulphuric acid)

Cyclone separator and perspex column for preliminary studies in the fluidization of S.A. coals prior to studying carburization of these coals

Drum mixer (under construction) for use in chemical engineering studies on the fundamental principles of solid-solid mixing

Four furnaces for differential thermal analysis of minerals (including potentiometer and auxiliary apparatus for controlling furnaces)

Biological filter for investigation of the treatment of industrial effluents

#### National Institute for Personnel Research

Two additional two-hand co-ordinators for use in a test battery for selection of apprentices and pupil pilots

Two pursuit meters for study of co-ordination

Pupil pilot test apparatus for use in selection of potential air force pilots

Design of modified "hand-foot" co-ordinator (in progress) for the selection of garment workers

## Library and Information Division

The work of the Division has grown steadily with the work of the laboratories and the growing knowledge of its services amongst technologists and industrialists in South Africa. During the year ended 31st August, 1950, the Division lent on the average forty-four publications a day, the total number being 13,372. Most of these were borrowed by members of the Council's research staff, but during the year 2,035 were borrowed by readers outside C.S.I.R., i.e., South African industrialists, government departments, research institutions, etc. Industrialists borrowed almost twice as many books and pamphlets as they did during last year. Most of these loans were sent out by post.

#### Bookstock

The total number of bound volumes in the Library at 31st August, 1950, was 11,002 and the estimated number of pamphlets was about 90,000.

#### Photographic copies

Two hundred and twenty-eight microfilms and other types of single photographic copies of articles in scientific journals were obtained during the year. Of these, 105 were obtained in South Africa, 75 in Great Britain, and 48 in the United States.

#### Periodicals

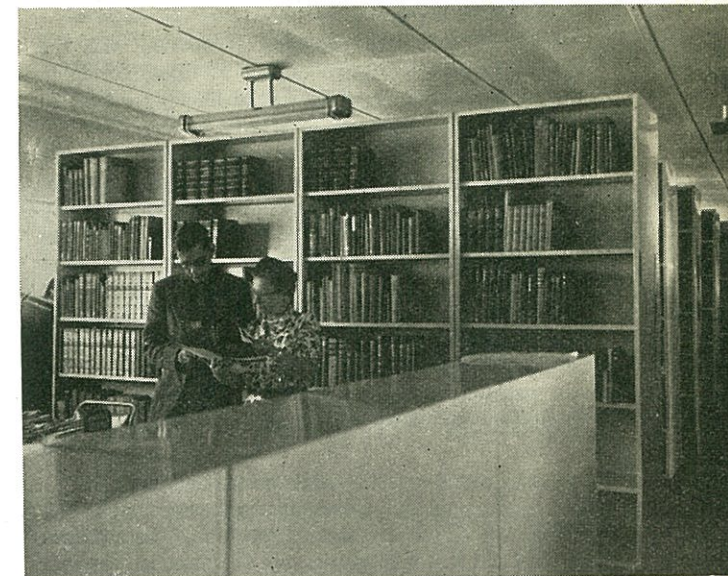
In April, 1950, the Division issued a catalogue of its holdings of periodicals, including all current and back sets of journals in the Library at that date. Seven hundred and sixty-five scientific and technical periodicals were listed.

#### Translated contents lists of Russian periodicals

By courtesy of the British Department of Scientific and Industrial Research, the Division receives regularly copies of their monthly *Translated Contents Lists of Russian Periodicals*, and these are available for consultation in the Library. It should perhaps be pointed out that these lists are not translations of the entire contents of Russian journals, but only of the titles of the various articles.

#### African Regional Scientific Conference

The head of the Division acted as a recorder at the African Regional Scientific Conference in Johannesburg in October, 1949, and presented a paper on *Scientific*



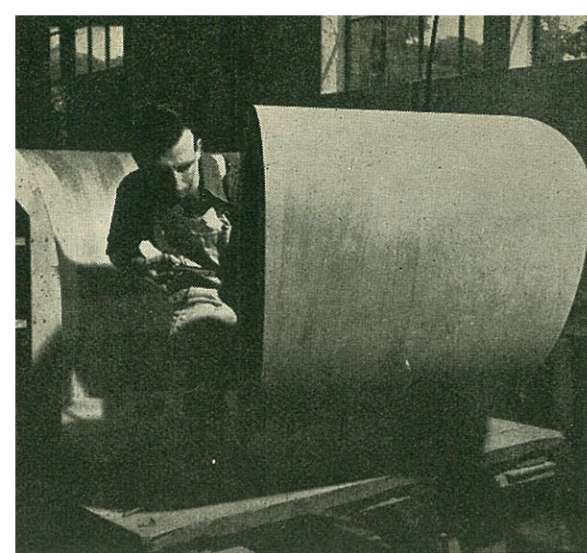
The Head of the Library and Information Division discusses a pamphlet with one of the liaison officers.

and Technical Library and Information Services in the Union of South Africa, together with the Chief Government Service Librarian.

#### Publications

In time for the African Regional Scientific Conference, the Division produced a *Directory of Scientific, Technical and Medical Libraries in the Union of South Africa* (edited in collaboration with the Librarian of the Witwatersrand Medical Library) and gave copies to all visiting delegates. Since that time there has been a steady demand for this directory from many overseas countries, ranging from Sweden to Java, and Israel to Czechoslovakia.

The Division also issued stencilled lists of *Scientific and Technical societies and industrial associations in the Union of South Africa* and of *South African scientific and technical periodicals*. For the convenience of editors and contributors to journals in this country, it reproduced the Royal Society's *Guide for the Preparation of*



Constructing the intake of a two-foot octagonal wind-tunnel for calibrating air-flow instruments used by the National Building Research Institute in studying the ventilation of buildings.

Soil trimming lathe for preparing soil samples for "Triaxial" and "Consolidation" tests

Shear-box driven by variable reduction gearbox for slow-shear tests of soils

Six experimental pressure cells for use in investigating theories on pressure distribution in the soil

Soil dispersion apparatus for grading analysis of soils

Four triaxial machines (under construction.) for "Triaxial" tests on soils

Solenoid switch for use in conjunction with limit switches to apply automatically a D.C. bias to a recording millivoltmeter, to enable the instrument to record peaks of an amplitude greater than the chart width (it is considered that this device effects a considerable saving in man hours by automatically performing the duties of an operator)

Steam hydration apparatus to study dimensional changes in potentially expansive building materials under pressure (this device affords the additional advantage of enabling a continuous record of volume changes to be made)

Two additional four-gang moulds for use in the preparation of test bars of cement materials

Experimental chair a sample of utility, inexpensive furniture to be



*Synopses* and sent copies to all scientific journals published here. A list of books on preparing scientific articles for publication, proof reading, etc., etc., was also produced under the title *Helps for the Scientist as Author*, and was made freely available to enquirers.

#### School for special librarians

In May, 1950, the Division co-operated with the University of Cape Town School of Librarianship in providing a short course in special library methods in Cape Town.

## Liaison Division, Pretoria

The role of this Division in relation to the activities of the C.S.I.R.'s laboratories and to industrial research is gradually becoming more clearly defined. Its main activities have been concerned with co-operative industrial research, research intelligence, enquiries for scientific and technical advice concerning practical problems, and publicity.

#### Co-operative industrial research

The head of the Division has represented the C.S.I.R., as alternate to the president, on the boards of control of the Paint Industries Research Institute and the Sugar Milling Research Institute, and has kept in touch with the pattern of development of research associations in South Africa, as manifested in the growing activities of the two older research associations — the Leather Industries Research Institute and the Fishing Industry Research Institute. The Division also played an active part in the formation of two new research associations — the Wool Textile Research Institute and the Bituminous Binder Research Unit.

#### Research intelligence

Activities in this field are concerned with surveys of the need and scope for research in specific fields. Surveys were made of problems connected with mechanical engineering; water supplies along the West Coast and in South West Africa; utilization of chromium, titanium and manganese ores; pectin production; utilization of seaweed and exploitation of the water soluble constituents of fish livers.

For the first time, the Division was asked to take a student from the Cape Town School of Librarianship for his officially recognised period of practical work.

#### Science abstracting committee

At the request of the Union Education Department, the C.S.I.R. called a committee to discuss problems connected with science abstracting in South Africa. Representatives of bodies interested in these problems duly met on 24th August, 1950, but decided that their needs were sufficiently well served by existing services.

The surveys of raw materials are conducted by liaison officers attached to the National Chemical Research Laboratory for that purpose, while other surveys are usually made by members of the research staff of the laboratories with the assistance of liaison officers.

#### Enquiries

Enquiries from industrial firms in connexion with scientific and technical problems which can be answered simply by references to publications are referred to the Library and Information Division. Those which require specialized advice are referred to the C.S.I.R.'s laboratories. Enquiries which cannot be dealt with in either of these ways, are handled by the liaison officers. The number of such enquiries has increased considerably, an average of twenty five being received each month.

Claims for the remission of income tax on research expenditure were also investigated by officers of the Division.

#### Publicity

Foundations have been laid for providing a service in this field. An illustrated brochure on the C.S.I.R.'s *National Laboratories and Services* has been prepared, and a *Directory of Research Organisations in the Union of South Africa*. Other activities have included editing, designing and publishing the Council's Annual Report and the compilation of material, on request, for publication in the Press, trade journals, directories, etc.

## South African Scientific Liaison Office, London

Africa House, Kingsway, W.C.2

During the year, many enquiries for scientific information were undertaken for the Council's laboratories and for other research organizations. An increase in the number of enquiries has been noted.

Officers of the Council on duty in the United Kingdom and on the Continent have been assisted with their itineraries, travel arrangements and with general assistance and advice. These facilities are being used more and more by visitors from other research organizations.

Assistance in the recruitment of staff included services such as giving information to prospective applicants, interviewing applicants and arranging their transport to South Africa.

Single photostat or microfilm copies of special publications which are not available in the Union were obtained for the Library and Information Division. The volume of these requests has grown to nearly double the number for previous years.

Eight reports prepared by officers of the Council on the results of their investigations during overseas visits, were issued and circulated to the other Commonwealth countries, where they were greatly appreciated.

The Office, as a member of the British Commonwealth Scientific Offices, has become well known to research organizations in the United Kingdom and has established itself as a source of information there on scientific and industrial research in South Africa. In many instances, it has been able to establish contact between research workers in the United Kingdom, and other Commonwealth countries, and their counterparts in South Africa. It has also derived much benefit from its close relations with the other Commonwealth Scientific Liaison Offices and from its good relations with the various departments of the Union High Commissioner's Office.

The Scientific Liaison Officer has continued to represent South Africa on a number of committees and conferences.

## South African Scientific Liaison Office, Washington

1800 K. Street, N.W.

With the recognition in December 1949, by the United States Government, of the Scientific Liaison Officer as Scientific Attaché to the South African Embassy in Washington, the Office has assumed a new status which is of considerable assistance in contacts with United States Government institutions. This has also led to the forging of a closer link with the Embassy which has been of great mutual benefit. The Liaison Officer is frequently called in to assist the Ambassador on scientific matters, and receives the fullest support from the Embassy Staff.

A steady stream of technical literature has continued to flow through the Office resulting in the despatch to the C.S.I.R. Library of 3,803 documents. A further 680 documents were sent to the Industrial Adviser, Department of Commerce and Industries, and a number of industrial catalogues were sent to both. Fifty-six microfilms or photostats of articles in journals which are not available in the Union have been supplied to the C.S.I.R. Library and Information Division. The

technical pamphlet library of scientific reports and reprints of South African origin has increased to over one thousand items, and current runs of 51 South African Scientific periodicals have been kept up to date for the benefit of American scientists. Monthly accessions lists have been distributed to some 40 individuals and institutions in the United States.

The Scientific Liaison Officer attended three conferences. He was the South African delegate to the United Nations Scientific Conference on the Conservation and Utilization of Natural Resources held during August and September 1949, at United Nations Headquarters, Lake Success, New York. On behalf of the National Building Research Institute he attended the two-day conference on Scientific Research and the Building Industry, organized in Washington by the Building Research Advisory Board of the National Research Council, and he attended the meetings of Study Group 6 of the International Scientific Radio Union held in Washington during April 1950.

# Medical and Dental Research

## Advisory committees

The Medical and Dental Research Committee has continued to give the Council much valuable help in developing its activities in this field.

In July, Prof. S. F. Oosthuizen, at the request of the C.S.I.R., undertook the duties of Hon. Secretary for Medical Research and Prof. G. A. Elliott kindly acted as Chairman of the Committee until Dr. T. B. Davie was permanently appointed to this position.

In May, the C.S.I.R. accepted, with regret, the resignation of Mr. H. F. Pentz from the Medical and Dental Research Committee.

Dr. Charles H. Best, Professor of Physiology of the University of Toronto and Director of the Banting and Best Department of Medical Research, visited the Union in November 1949, under the auspices of the Nuffield Foundation. During the course of his visit, he discussed medical research problems with the Medical and Dental Research Committee.

The C.S.I.R., acting on the recommendation of the Medical and Dental Research Committee, has invited Dr. C. H. Barlow, a malacologist (snail expert) of international standing, to visit the Union towards the end of 1950. With the assistance of the Department of Health of the Union Government, arrangements have been made for Dr. Barlow to make a survey of problems connected with Bilharzia snails in the Union, and to give advice on methods of control.

The Council and the Medical and Dental Research Committee continued to be assisted in their work by many advisory sub-committees and panels, whose help on many specialized problems is gratefully acknowledged.

Dr. Graham Bull, Hon. Medical Liaison Officer in the United Kingdom, and Dr. R. M. Kark, Hon. Medical Liaison Officer in the United States of America, have continued to render valuable assistance to medical and dental research workers in South Africa by reporting to the C.S.I.R. on general developments in the field of medical and dental research in Great Britain and America, and in answering specific enquiries addressed to them through the Council's Scientific Liaison Officers in London and Washington.

## Administration

Approximately £52,500 was allocated to Medical and Dental Research during the financial year 1950/51, some £10,000 being allocated to the support of Medical Research in the Universities, £7,500 to the South African Institute for Medical Research and approximately £35,000 to Medical Research Units. A small proportion of the amount covers the costs of administration, involved in the full-time services of one administrative officer, typing, travelling, etc.

## South African Institute for Medical Research

The C.S.I.R. has continued to support the research activities of the Institute through an annual grant of £7,500, by the provision of a laboratory assistant for the Bilharzia Research Unit, which is accommodated there, and in placing one of the Council's Staff, Dr. A. R. P. Walker, at the Institute for research in nutrition. The Council has two representatives on the Board of Control of the Institute, Prof. J. F. Brock (alternate Prof. G. A. Elliott) and Prof. S. F. Oosthuizen (alternate Dr. P. J. du Toit).

## Medical research units

The C.S.I.R. has continued to promote the development of these Units, the establishment of which was announced in the Council's Fourth Annual Report. The assistance of Governmental and Provincial authorities, and individuals, who have co-operated in this work, is gratefully acknowledged.

### Amoebiasis Research Unit — Durban

Honorary Head of Unit — Dr. R. Elsdon-Dew

The work of the Amoebiasis Research Unit in Durban has been largely preparatory, though reports on the tests of various drugs have been published. Survey work has been commenced and the director of the unit had the opportunity of comparing conditions in Lourenco Marques and Durban in respect of amoebiasis. It was a remarkable feature that, by comparison, Lourenco Marques had to all intents and purposes no amoebic dysentery. The main points of this difference formed the basis of a letter to the Editor of the *South African Medical Journal*.

On the laboratory side, investigations are being made into the bionomics of the amoebae with special reference to the concomitant organisms. A fruitful source of material for this work has been provided by the cases under treatment with antibiotic drugs, for the removal of the amoebae is associated with the change of bacterial flora, and investigations are proceeding to see whether this change in bacterial flora is responsible for the death of the parasite.

In the course of the survey work, certain other parasites have been discovered and a report is in the press on the hitherto unsuspected high incidence of *Isospora Hominis* in this area.

### Applied Physiology Unit — Johannesburg

Head of Unit — Dr. C. H. Wyndham (South African Institute for Medical Research)

The C.S.I.R.'s contribution to the expenses of the Unit provides for the employment of a physicist, the

## Medical and Dental Research

purchase of capital equipment, and also travelling and general expenses; the contribution of the S.A.I.M.R. includes the salary and temporary accommodation of the head of the Unit. In April, 1950, Rand Mines Ltd. undertook to provide, for one year, facilities for the experiments on the physiological problems associated with heat and humidity, and financial support for staff and apparatus.

Arrangements for the first series of pilot experiments in the City Deep Gold Mine were completed early in July, and actual work began on July 10th. One month was spent in training 14 African experimental subjects to a particular routine of work.

The City Deep Gold Mine has built according to specification an experimental room at the 26th level of No. 5 shaft. This room is now being calibrated and it is hoped to be able to vary the wind-velocity from still air to 500 ft./min.; wet bulb temperature from 82 to 96°F.; and dry bulb temperature over a slightly wider range.

The aim of these pilot experiments is:

To examine any difference in response to heat of Tropical and South African natives

To determine the point on an Environmental Stress Scale, in terms of Effective Temperature or Sweat-Rate, at which physiological strain becomes gross and at which physical efficiency becomes impaired

To compare the accuracy of the various methods of combining environmental determinants, such as the Effective Temperature Scale, the Sweat-Rate Index and the Kete-Thermometer, in predicting physiological strain in Africans

To examine the relative improvement which occurs in an environment due to increasing wind-velocity, compared with that resulting from reducing wet-bulb temperature by refrigeration.

### Bilharzia Natural History Unit — Johannesburg

Head of Unit — Dr. B. de Meillon (South African Institute for Medical Research)

The unit was established in May, 1949 when a technical assistant was appointed by the C.S.I.R. This assistant resigned at the end of April, 1950, and is being replaced. When the head of the Unit was away in South West Africa from February until July, 1950, Dr. James Gear supervised the work of the Unit and was helped by technicians at the S.A.I.M.R., who attended to the snail colonies.

The work of the Unit has, up to the present, consisted of making a snail collection for subsequent study. The object of this is to attempt to clear up the confusion which exists in snail systematics.

Methods of breeding snails in captivity have been investigated with some success. The object here is to determine which snails are vectors of Bilharzia in South Africa, and what their distribution is. It is known that presumed vectors occur in areas where no human

Bilharzia is known. It is not known whether this is because the disease has not spread so far, or because the snails are not capable of acting as vectors.

Laboratory animals have been exposed to fork-tailed cercariae from natural snails. Adult worms subsequently recovered from such animals were sent overseas for identification. It is obvious that much confusion exists in the systematics of adult *Schistosomes*, since our specimens which contained typical *haemotobium* eggs *in utero*, were wrongly identified as *bovis*.

Some small scale experiments on molluscides were carried out. It was shown that the gamma isomer of Benzene hexachloride will kill snails in a dilution of 7 parts per million in a balanced aquarium after a lapse of 16, but not after 20 days.

Dr. C. H. Barlow has been invited to visit the Union towards the end of 1950, and arrangements have been made for him to survey problems connected with Bilharzia snails in the Union.

A bibliography of all aspects of Bilharziasis in Southern Africa has been compiled.

### Cardio Pulmonary Research Unit — Johannesburg

Head of Unit — Prof. G. A. Elliott (University of the Witwatersrand)

The following projects were completed during the year July, 1949, to July, 1950.

*Some Effects of Digitalis on the Circulation in Patients with Congestive Cardiac Failures* (B. van Lingen, J. H. Gear, Joanna Whidborne, J. C. Gilroy and V. Wilson)

Intracardiac pressures were measured by cardiac catheterisation, and cardiac output by ballistocardiography, in 15 patients with congestive cardiac failure from various causes.

*The Ballistocardiogram in Aortic Stenosis Coarctation and Thrombosis of the Aorta* (B. van Lingen, J. H. Gear, Joanna Whidborne. Manuscript in preparation)

Previous publications by other workers, that the "K" wave of the ballistocardiogram in coarctation and thrombosis of the aorta is absent or small and deformed, have been confirmed. In addition, similar changes in aortic stenosis have been found. This has not been reported before and should prove valuable in the diagnosis of this heart lesion, which is frequently missed in clinical medicine.

*A Comparison on the Blood Cholesterol Levels in the European and Bantu Races of South Africa* (B. van Lingen, J. H. Gear and Joanna Whidborne)

*A Teleroentgenographic Study of the Transverse Diameter of the Heart in 1048 Normal Adult Males* (B. van Lingen, J. H. Gear and H. Kerrich)

The heart size was measured in 1048 normal adult male miners. The best of existing prediction formulae or heart size (based on height and weight) are to be compared with a regression equation calculated from his data.

Work started in the period July, 1949, to July, 1950, but not yet completed includes:

A study of 100 male and 35 female ballistocardiograms (Dr. J. H. Gear *et al.*)

The ballistocardiogram in coronary heart disease (B. van Lingen *et al.*)

The genesis of the electrocardiographic deflections in  $V_1$  (M. McGregor)

The blood cholesterol levels in the European and Bantu races of South Africa (Joanna Whidborne *et al.*)

The cardiovascular dynamics in congenital heart disease (various members of the Cardio-Pulmonary Unit)

#### General

Essential cardio-respiratory research equipment has recently arrived from abroad. More will become available shortly. This has increased the scope of the Unit's projected work.

Accommodation has been improved over and above the existing laboratory in the Department of Medicine, Witwatersrand Medical School. Two rooms in the Out Patient Department, Johannesburg General Hospital, have been made available for clinical research. A large room in the above hospital is at present being converted into a screening (X-ray) room for clinical investigation, cardiac catheterisation, angiocardiology and animal experimentation.

#### Nutrition Research Unit — Johannesburg

*Head of Unit* — Prof. J. Gillman (University of the Witwatersrand)

The activities of the Unit fall under the following headings:

- Human Nutrition
- Experimental Nutrition
- Study of Macromolecular Syndromes
- Endocrine and Reproductive Physiology

Since new animal rooms and laboratories, in the Department of Anatomy of the University, became available for occupation in August, 1949, increased activity has been possible.

#### HUMAN NUTRITION

An analysis of the life-track of chronically malnourished Africans, studied from clinical and pathological points of view, is being published in the form of a book, entitled *Perspectives in Human Nutrition*.

For studies of liver diseases of the Bantu, 4,000 specimens of liver from non-European and Europeans

autopsied at the Medico-Legal Laboratory, Johannesburg, have been collected in addition to material from Mozambique, Mexico and the United States. This collection of livers, as well as biopsy specimens of liver removed from 400 Bantu patients (including patients with pellagra, with clinically recognisable hepatic cirrhosis and with primary hepato-cellular carcinoma) has provided the basis for studies on hepatic pathology.

In addition to the above investigations on the liver of the Africans, a study has been made, in collaboration with the late Dr. A. Altmann of Baragwanath Hospital, on the reactions of the livers of African infants, as assessed by liver biopsies performed during, and many months after, an acute attack of infantile pellagra or nutritional oedema.

In order to determine in greater detail the pathological reactions attributable to malnutrition in the Bantu, material has been gathered from some 400 infants and children who died during an acute malnutritional episode as well as from other causes. Particular attention has been devoted to the incidence and nature of bone disease in the Bantu child, as well as to the manifestations of malnutrition in organs other than the liver.

In addition to its own investigations, the Nutrition Research Unit has provided advice and assistance to others in studies of rickets in the Bantu and in studies of haemochromatosis in the European.

#### EXPERIMENTAL NUTRITION

*Supplement to the Bantu diet:* Data have been accumulated concerning the effects of feeding rats on a predominantly maize meal diet, supplemented with varied concentrates of the following: brewer's yeast, food yeast, dried skimmed-milk powder, soya beans, vegetables, meat and mineral salt mixtures.

*Experimental Liver Diseases:* A diet has been devised for producing, with great consistency (98%), extensive hepatic necrosis, making it possible to assess with considerable precision the importance of various nutrients in the aetiology, prevention and therapy of this lesion.

In view of the frequency with which carcinoma in the Bantu occurs primarily in the liver, and since this form of cancer is usually associated with a high incidence of nutritional hepatic damage and cytosiderosis, a series of experiments has been designed in an attempt to investigate the relationship between hepato-cellular carcinoma, nutrition and pigment metabolism.

#### REPRODUCTIVE AND ENDOCRINE PHYSIOLOGY

A technique has been developed for maintaining, handling and breeding the Chacma baboon, which is an ideal Primate for experimental work, its peculiar anatomy and physiology making it particularly valuable for the study of reproductive and endocrine physiology. As one of its main tasks, the Unit has undertaken to standardize this animal in order to provide base lines for future experimental work.

#### Medical and Dental Research

##### MACROMOLECULAR SYNDROME

Following the hypothesis, elaborated on the basis of certain evidence derived from the analysis of nutritional disease in the Bantu, the significance of macromolecules in the aetiology of disease has been investigated during the past three years.

##### CONGENITAL ANOMALIES AND DISEASES

A high percentage of malformation is encountered in the offspring of female rats treated with trypan blue before and during pregnancy. Details of these congenital anomalies have been fully described and published.

#### Social Medicine Research Unit — Cape Town

*Head of Unit* — Prof. J. F. Brock (University of Cape Town)

The general programme of the Unit continues to be a comparative study of health and disease in Cape Coloured and European residents of the Cape Peninsula area, with special reference to whether the considerable and, in some cases, startling differences in life expectation, mortality and morbidity already recorded, derive mainly from differences in heredity or differences in environmental factors.

A general review of existing information has been published (Brock and Rollo, *S. Af. Med. Jnl.* 1949, v. 23, p. 1000). A pilot survey of Cape Coloured morbidity in relation to socio-economic status has been completed in collaboration with the Department of Social Science.

At present pilot surveys are being undertaken into: the incidence of malignant malnutrition in the Cape area, in co-operation with the Department of Paediatrics; and the alleged heavy incidence of eclampsia and pre-eclamptic toxæmia in the Cape Coloured people, in co-operation with the Department of Obstetrics and Gynaecology.

A survey of the racial incidence of cirrhosis of the liver in the Cape area has been completed.

Intensive laboratory studies are in progress into renal haemodynamics with special reference to pregnancy toxæmia.

#### Social Medicine Research Unit — Durban

*Head of Unit* — Dr. S. L. Kark (Department of Health)

The Social Medicine Research Unit at the Training Scheme for Health Personnel began to function on May 1st, 1950. Two projects were approved. The first is concerned with studies of development in girls, with particular reference to puberty, and the other with the birth weight of infants and their subsequent growth during the first year of life. Each is concerned with a comparative study of the various race groups in this country, namely, European, Coloured, Indian and Native.

##### STUDY OF DEVELOPMENT IN GIRLS

*Menarche Study:* An assessment is being made of menarche age in Durban girls of the four main ethnic groups, by which it is hoped to determine the relationship of menarche age and social class, including the influence of race, occupational group of parents, birth place and birth rank. The girls being investigated live in the various neighbourhoods served by the Health Centres of the Training Scheme for Health Personnel.

*Clinical Study:* This aspect of the project is at present confined to a Native group, living in Lamontville, Durban. It includes somatometric study as well as an assessment of secondary sex characteristics in relation to menarche age. An assessment of the state of health of the girls is also carried out by means of a full clinical examination with special reference to the state of nutrition.

##### STUDY OF BIRTH WEIGHT AND GROWTH OF INFANTS

*Birth Weight:* A comparative birth weight study of the four racial groups is being undertaken on data gathered from various hospitals in South Africa. Influence of sex, economic status, birth rank of infant, age of mother and season of birth, of approximately 3,000 European babies, is being analysed.

*Weight Growth in Neonatal Period:* This includes European and Native infants during the first 7 to 10 days of life as well as a specific experiment which has been set up at a hospital to determine the effect of different feeding schedules on neonatal growth.

*Weight Growth in First Year of Life:* Data of weights of babies attending various clinics in different parts of South Africa are being gathered and analysed.

The Unit is working under the direction of the medical Officer-in-Charge of the Training Scheme for Health Personnel, and is staffed by two full-time Senior Bursars, Dr. Emily Kark and Dr. E. J. Salber, with two full-time Assistant Research Officers.

#### Tuberculosis Research Unit — Durban

*Head of Unit* — Dr. B. A. Dormer (Department of Health)

This Unit will move into its own premises at the close of this year, having previously occupied part of the pathological laboratory at King George V Hospital.

Work has gone ahead in:

Tuberculin testing and histoplasmin testing  
Mass X-ray of population groups and angiocardiological study of pulmonary circulation  
The study of the comparative anatomy of the bronchial tree by means of plastic casts

The study of diseased lungs by stereoscopic radiographs of plastic casts opaque to X-rays (this work will shortly be reported in the *British Journal of Radiology*).

The typing of tubercle bacilli and sensitivity procedures for antibiotics and chemotherapeutic substances

The use of antibiotics, etc., in various types of tuberculosis (a series of papers on this and other matters will shortly appear in the South African Medical Journal)

The search for antibiotics from soil

The production of thin sections of whole organs by modification of the technique of Gough, a study which is proving very profitable.

### Virus Research Unit — Cape Town

*Head of Unit* — Prof. M. van den Ende (University of Cape Town)

The general programme of the Virus Research Unit is the study of the structure and multiplication of viruses.

#### Bacteriophages

A systematic study of a group of *P. pyocyanea* phages is under way. A publication now in the press describes the isolation of the phages and important features of the bacterial host strains.

Filtration and electron microscope studies of these phages was undertaken by M. van den Ende at the National Institute for Medical Research in London during the latter half of 1949. The results will shortly be published in collaboration with workers at the N.I.M.R.

Studies on the growth rate of these phages, their

serological relationships and the antigenic structure of the bacterial hosts are also being undertaken.

The effect of bacteriophage on the respiration of susceptible bacteria is being studied with *coli B* and the *T. Phages*. This work will later be extended to the lysogenic pseudomonas strains.

#### Poliomyelitis

A few strains of polio virus have been isolated from human cases of the disease. Attempts are being made to adapt the Lansing strain of polio virus to egg embryos.

#### Lumpy Skin Disease

Purification procedures are being studied with the aim of producing suitable antigens for *in vitro* serological tests with this virus, and as a preliminary to the development of purification methods applicable to other disease-producing viruses.

The laboratories which have been specially equipped for the research unit to give facilities for specialized biochemical and physical procedures, await for their completion only certain major items of equipment. A start has however already been made on the production of bacteriophages in bulk and on methods of purification.

Those participating in the activities of the Research Unit are:

Professor M. van den Ende	Dr. Enid E. Mitchell
Professor F. G. Holliman	Dr. C. Macpherson
Dr. T. H. Mead	Dr. C. Kaplan
Dr. Phyllis A. Don	Mr. G. S. Turner
Dr. Golda Selzer	Mr. J. H. Maytham

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## Sponsored Investigations, including work done free for Government and other organizations

Work was done on 158 investigations under contract to industrial and other sponsors, 133 being initiated during this report period. The total sum paid by

sponsors towards the cost of these projects was £53,067 11s. 8d.

### A. LIST OF SPONSORS OF INVESTIGATIONS UNDERTAKEN UNDER CONTRACT

African Explosives and Chemical Industries	Masonite (Africa) Ltd.
Agricura Laboratoria	McDonald Adams & Co. Ltd.
Anglo-American Corporation Ltd.	McLachlan & Lazar
Associated Engineers Co. Ltd.	M.T.S. Dessels (Pty) Ltd.
Atlantic Ocean Industries Ltd.	Newton, M.
Babcock and Wilcox (Africa) Ltd.	Ocean Products (Pty) Ltd.
Batteries and Lead Products (Pty.) Ltd.	Ort Oze Co. Ltd.
Bell's Asbestos and Engineering (Africa) Ltd.	Power Electric
Berliner, Dr. H. N.	Pretoria City Council
Bezuidenhout, F. W.	Pretoria Glass Works
Bird, Dr. R.	Pretoria Metal Industries Ltd.
Bonafide Fisheries	Pretoria North Church Council
Bos Motors	Pretoria General Hospital
Butler & Herbert Engineering (Pty.) Ltd.	Pretoria Portland Cement Co.
Central Mining & Investment Corporation	Quix Products Ltd.
Chemico (Pty.) Ltd.	Rand Leases (Vogelstruisfontein) Gold Mining Co. Ltd.
Cohen, Dr. S.	Rand Mines Ltd. and Central Mining and Investment Corporation Ltd.
Concrete Development Corporation (Pty.) Ltd.	Rennie Bros. (Pty.) Ltd.
Connell Instrument Co.	Rhodes, Harrison & Bull
Consolidated Glass Works, Ltd.	Rhodes University College
Denyssen, Dr. J. A. F.	St. Helena Bay Fishing Industries
Department of Defence	South African Bureau of Standards
Devers, A. F. H.	South African Iron & Steel Industrial Corporation Ltd.
Direct Construction Co. Ltd.	South African Sea Products Ltd.
Durban Roodepoort Deep Ltd.	South African Railways & Harbours
E.R.P.M., Ltd.	Sterling Metal Co.
Electricity Supply Commission	Strathmore Exploration & Management Ltd.
Fuel Research Institute of South Africa	Transvaal Association of Blue Lime Manufacturers
Geological Survey	Transvaal Chamber of Mines
George Mann	Transvaal Clothing Manufacturers' Association
Grootvlei Proprietary Mines Ltd.	University of Cape Town
Hawkins, Jeffares and Green	University of Natal
Holdcraft, Mrs. M. E.	Vereeniging Brick and Tile Co.
Huddy Hard Metals (Pty.) Ltd.	Verhoef, Smit and Viljoen
Hume Pipe Co. (S.A.) Ltd. and Superconcrete Pipes (S.A.) Ltd.	Virginia Orange Free State Gold Mining Co. Ltd.
Lamberts Bay Canning Co. Ltd.	Welkom Gold Mining Co. Ltd.
J. Mackay & Son Ltd.	Wilbur Ellis & Co.
L. H. Marinus Ltd.	
Marine Oils refiners of Africa Ltd.	

**B. SUMMARY OF NEW PROJECTS UNDERTAKEN UNDER CONTRACT**

**National Building Research Institute**

Hail resistance of cement tiles  
Impact and bending tests on precast reinforced concrete buntons  
Loading test on a portion of the structural frame of a building in Salisbury  
Measurement of temperature, humidity and air movement in a workshop

**National Physical Laboratory**

Testing samples of electric sheet steel for power-loss and magnetizing current  
Spectrographic analyses of lead, white metal samples  
Testing sound and vibration at a power station and advising on remedial measures  
Sound testing of Pretoria City Hall and Pretorius Hall  
Measuring sound reflection of proprietary material  
Calibration of standard cells  
Investigation of acoustics of a church  
Goldplating of quartz wire of electrometer  
Testing and adjusting of Coleman spectrometer  
Standardizing and issuing certificates for weights  
Semi-quantitative spectrographic analyses of manganese, bronze, copper, aluminium, and brass samples  
Testing and issuing reports on clinical thermometers  
Calibration and testing of analytical weights  
Investigation and development of device for measuring borehole inclination  
Measurement of absorption co-efficient of acoustic tiles  
Calibration and etching of thermometers  
X-ray analysis of powder, metal and flux samples  
Calibration and testing of electrical instruments  
Calibration of thermocouples  
X-ray investigation to determine the amount of CaO in reject lime samples  
Measurement of thermal conductivity of proprietary board  
Investigation of drying of sodium thiosulphate by infra-red lamps  
Repairs to Chatlock-Fry tilting gauge  
Calibration of disappearing filament optical pyrometer  
Resistivity measurements on samples of copper strip and alloy tubing  
Constructing electrometers  
X-ray analysis of samples of Tungsten Carbide  
Making Geiger counters  
Reflection determinations of pigment and paint samples  
Film Badge Service, including supplying of badges and developing of films after use  
Supplying of radio-active phosphorus and iodine to

hospitals and doctors, and measuring patients treated with radio-active phosphorus or iodine  
Gamma-ray detection of blow-holes in refractory locks

**National Chemical Research Laboratory**

Determination of Vitamin "A" content in samples of fish liver oil  
Investigation into the treatment and disposal of effluents  
Investigation of chrome ore samples  
Salt spray test of rust-preventative oils  
Advice on procedure for locating source of trouble in refrigerating units

**National Institute for Personnel Research**

*For a Mining Company*  
Supervising the establishment of a testing unit and assisting with the initiation of a testing programme  
Acting as consultants and doing follow-up work  
*For the Iron and Steel Industry*  
Investigation of job-evaluation, research into absenteeism, labour-turnover, and accidents, and the development of new techniques for the evaluation of these phenomena; validation of test-procedures for the selection and classification of administrative personnel  
*For the Department of Defence*  
Aptitude testing of candidates to undergo specialist technical training  
Research on classification and consultations on demobilization cases  
Research on occupation standards  
*Union Defence Forces*  
Officer selection  
Construction of screening tests for sea and land forces  
Development of instructor's selection procedure  
Aptitude testing of photographer trainees  
Classification procedure for artisans  
Aptitude testing of clerks  
Quality control on tests  
*Active Citizen Force*  
Development of aircrew selection procedure  
*South African Air Force*  
Aptitude testing  
Selection of technical ground staff  
*Permanent Force Training Centre*  
Aptitude testing  
Selection of officers and other ranks  
*General*  
Aptitude testing and vocational guidance  
Selection of apprentices  
Working drawings of aptitude tests  
Construction of tests

**C. EXAMPLES OF PROJECTS UNDERTAKEN FREE FOR GOVERNMENT DEPARTMENTS AND OTHER ORGANISATIONS (estimated value (£12,031))**

**National Housing and Planning Commission**

Experimental designs of reinforced brick houses at Welkom  
Experimental designs of houses and of under-reamed piles, and measurements of temperatures and moisture contents in the soil under houses at Leeuhof, Vereeniging  
Inspections and tests of foundation soils at North-downs, Port Elizabeth  
Inspections and records of building movements in Bloemfontein, Pretoria and Johannesburg  
Roof painting tests in Johannesburg  
Inspections and reports on paint failures in Port Elizabeth  
Rain penetration tests of thin wall constructions  
Heatflow in thin walled buildings  
Inspections and reports on building lime failures  
Studies of furniture requirements in Native housing  
Studies of space requirements in Native housing  
Study of Witbank Native township layout and re-design to increase densities

**South African Bureau of Standards**

Study of the possibility of producing a South African standard sand for cement testing  
Miscellaneous consultations and small tests

**Various Mining Groups in the Orange Free State**

Studies of foundation movements

**South African Railways and Harbours**

Research on extensions of the Umbilo-Umhalatazana Canal Bridge foundations

**National Transport Commission**

Studies of moisture changes under a road at Vereeniging

**Natal Housing Board**

Various opinions and tests on foundations, concrete and other building materials

**Geological Survey**

Maintenance, checking and calibration of equipment and analyses of samples

**Department of Agriculture**

*Division of Entomology*

Work on radio-active Pestox, under trial as an insecticide for peanut plants. Measurements of freezing temperature of potatoes

*Tobacco Research Station*

Co-operative research on the uptake of phosphate fertilizers. Radio-active superphosphate has been prepared and the uptake of some young tobacco plants has been measured

*Division of Chemical Services*

Quantitative analysis of lucerne samples for boron, calcium and iron

*Division of Veterinary Services*

Analysis of soil samples for cobalt, molybdenum, etc.  
Repairing of 47 filters  
Erection and testing of "Coleman" spectrophotometer  
Construction of speedmeters and glass apparatus  
Development and testing of chromatographic photometer

**Weather Bureau**

Calibration of thermocouple and thermometers

**South African Railways**

Repairs to strain gauge amplifiers  
Searching for steel reinforcement in strong room  
Construction and development of wheel speed indicator

**Union Tender Board**

Investigation of B. B. Krauss microscope at Onderstepoort

**Division of Trigonometrical Survey**

Designing of an internal focussing microscope

**Government Metallurgical Laboratory**

The determination of structural and unit cell dimensions of a number of synthetically prepared spinels  
Attempting to identify the composition of samples by X-ray diffraction methods  
Analysis of samples by X-ray for structure and spacing; X-ray investigations of vanadium spinels



**Division of Civil Aviation, South African Air Force and South African Railways and Harbours**

Assessment of a commercial navigator system under South African conditions. Full responsibility for the determination of the performance of the system in high noise levels and part responsibility for the determination of field strengths established by the trials system and for the determination of errors due to sky-wave

**Division of Civil Aviation, South African Air Force, South African Naval Force, General Post Office, South African Railways and Harbours, South African Police and South African Broadcasting Corporation**

Frequency prediction service

**General Post Office**

Selection of apprentices

**Public Works Department**

Vocational guidance

**South African Mint**

Selection of apprentices

**Chartered Accountants**

Selection of articled clerks

**Publications—Publikasies**

**A. — C.S.I.R. LABORATORIES — W.N.N.R. LABORATORIUMS**

**Library and Information Division — Biblioteek en Inligtingsafdeling**

PERIODICAL PUBLICATIONS/GEREELDE PUBLIKASIES

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NAUDÉ, S. M., and H. Verleger. Über die Störungen im bandenspektrum des schwefelmoleküls. *Zeits. für Physik*, vol. 128. Aug., 1950. p. 173.

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STRASHEIM, A. An improved electrode holder and cutter. *Spectrochimica Acta*, vol. 4. 1950. p. 2.

VAN DER MERWE, J. H. Misfitting monolayers and

oriented overgrowth (containing an extensive survey of experimental observations), *Discussions of the Faraday Society*, no. 5. 1949. *Crystal growth*.

VAN DER MERWE, J. H. On the stresses and energies associated with intercrystalline boundaries. *Proc. Phys. Soc. A.*, vol. 63. 1950. p. 616.

VAN NIEKERK, J. N., and F. R. L. Schoening. The structure of trans-potassium dioxalato-diaquochromate, K Cr (C<sub>2</sub>O<sub>4</sub>)<sub>2</sub>(H<sub>2</sub>O)<sub>2</sub> 3H<sub>2</sub>O. *Nature*, vol. 166. July, 1950. p. 108.

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HOGG, D. The measurement of atmospheric radio noise in South Africa in the low frequency band. *Journal of the S.A. Institute of Electrical Engineers*, vol. 41, part VII. July, 1950.

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FEJER, J. A. Measurement of ground-wave propagation characteristics over mountainous terrain (Cape decca trials — 1950). Pretoria, C.S.I.R./W.N.N.R. 1950. ETR—9.

FEJER, J. A. Measurements of the propagation of low frequency radio waves by the ionosphere using airborne equipment (Cape decca trials — 1950). Pretoria, C.S.I.R./W.N.N.R. 1950. ETR—10.

HEWITT, F. J., J. A. Fejer and D. Hogg. The performance of the decca receiver in high atmospheric noise levels. Pretoria, C.S.I.R./W.N.N.R. 1950. ETR—6.

HOGG, D. General description of 100 kc/s atmospheric noise measuring equipment. Pretoria, C.S.I.R./W.N.N.R. 1950. ETR—5.

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JENNINGS, J. E. The geologist and soil mechanics in South Africa. *Ibid.*

JENNINGS, J. E. Pull-over tests for wind loading on electric transmission poles. *Ibid.*

VICE, R. W. Determination of ground-wave propagation characteristics by field strength measurements (Witwatersrand decca-trials — 1950). Pretoria, C.S.I.R./W.N.N.R. 1950. ETR—7.

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BARNARD, V. The effect of lightning on electric detonators. *Report on progress* — October, 1949 — March, 1950. Pretoria, C.S.I.R./W.N.N.R. 1950. ETI—7.

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FEJER, J. A. The effect of night sky-wave on the decca navigator system in South Africa. Pretoria, C.S.I.R./W.N.N.R. 1950. ETM—6.

HOGG, D. Installation of telecommunications research laboratory noise recorder in Nairobi. Pretoria, C.S.I.R./W.N.N.R. 1950. ETM—4.

VICE, R. W. Notes on field strength measurements in the Cape decca trials. Pretoria, C.S.I.R./W.N.N.R. 1950. ETM—5.

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KANTEY, B. The application of the Dutch deep sounding apparatus in South Africa. *Ibid.*

KANTEY, B. Field tests to correlate laboratory analysis on bridge foundations in the Durban bayhead. *Ibid.*

KANTEY, B., and S. A. Kleyn. Residual stresses in soils. *Ibid.*

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national conference on soil mechanics and its impact on South African practice. *S.A. Institution of Civil Engineers, Minutes of Proceedings, Session 1950. Third Meeting.*

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STEYN, A. K. Pressure cells. *Ibid.*

WEBB, T. L. An electronic temperature regulator for muffle furnaces. *South African Industrial Chemist*, vol. 3, no. 10. October, 1949.

WEBB, T. L. Some aspects of research on certain South African dolomitic limes. *Proceedings 32nd annual convention of the national lime association*. Presented at the 48th annual meeting of the national lime association, Hot Springs, Virginia. May 13, 1950.

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Interim Reports/Tussentydse Verslae

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Sub-Committee to survey the attitudes of occupants to housing. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 2.

Sub-committee on house planning and design. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 3.

Sub-committee on estate planning. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 4.

Sub-committee on heating, cooling and ventilation. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 5.

Sub-committee on natural and artificial lighting. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 6.

Sub-committee on noise. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 7.

Sub-committee on legislation. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 8.

Interim report on the main committee/Tussentydse verslag van die hoofkomitee. Pretoria, C.S.I.R./W.N.N.R. 1949. DS 9.

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*Bulletin No. 4.* Pretoria C.S.I.R./W.N.N.R. May/Mei, 1950. DB 4.

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GARSTANG, A. The use of electric resistance strain gauges.

JENNINGS, J. E. Termite-proofing of buildings.

KANTEY, B., and H. Marr. The distribution of stresses in soil masses under load.

RENNHACKKAMP, W. M. H. Wenke vir die kunstmatige verligting van 'n woonhuis.

*Bulletin No. 5.* Pretoria, C.S.I.R./W.N.N.R. September, 1950. DB 5.

BRINK, A. B. A. Foundations on expansive clays. Report on the stratigraphic profile of a test-pit at St. Helena gold mine, O.F.S.

CALDERWOOD, D. M. Limiting factors in high-density, single storey estate layouts.

LE ROUX, L. W. The protection and painting of galvanised iron.

RIGBY, C. A. The Italian building industry.

STEYN, KEEVE. Reinforcement in brick walls as a means of preventing excessive cracking of buildings.

Appendix II (Continued)

B. — PUBLICATIONS RECEIVED DURING 1950 FROM HOLDERS OF C.S.I.R. RESEARCH AWARDS

B. — PUBLIKASIES ONTVANG GEDURENDE 1950 VAN HOUERS VAN W.N.N.R. NAVORSINGSTOEKENINGS

General Research — Algemene Navorsing

ARNOLD, R., and J. Th. OVERBEEK (non-bursar). The dissociation and specific viscosity of polymethacrylic acid. *Recueil des travaux chimiques des Pays-bas*. Vol 69. No. 2. February, 1950.

BENNET, R. N. E., and F. L. Warren. The Euphorbia resins. Part III. The epimerization and dehydration of Euphol. *J. Chem. Soc.* Febr., 1950. pp. 697-699.

BROOM, R., J. T. Robinson and G. W. H. Schepers. Sterkfontein Ape-man — Plesianthropus. *Transvaal Museum Memoir*. No. 4.

BURSELL, E., and D. W. Ewer. On the reactions to humidity of *Peripatopsis Moseleyi* (Wood Mason). *J. Exp. Biol.*, vol. 26. Febr., 1950. No. 4. pp. 335-352.

COETZEE, W. H. K. A histological method for the biological estimation of Vitamin A. *Biochemical J.*, vol. 45, No. 5. 1949. pp. 628-637.

COHEN, C. A first report on Mycorrhiza, associated with some Transvaal plants. *J.S.A. Bot.* July, 1948.

EARLE, P. A. Stroming van vloeibare en gasvormige swaeldioksied deur 'n mondstuk, en mengsels van lug met swaeldioksied deur 'n pyp. M.Sc. proefskrif — Universiteit van Stellenbosch.

ENGLAND, W. B., and H. A. E. Mackenzie. The kinetics of the uncatalysed dehydration of oxalic acid in acetic acid-acetic anhydride mixtures. *J. S.A. Chem. Inst.* (new series), vol. 11, no. 3. Dec., 1949. pp. 147-160.

ENGLAND, W. B. Dehydration in the solvo-system acetic acid-acetic anhydride oxalic acid. M.Sc. Thesis — University of Natal.

FOCKEMA, R. A. P. An occurrence of alkaline and acid lavas and volcanic breccias on the farm Kruidfontein 147, Rustenburg district. *Transactions and Proceedings of the Geological Society of South Africa*. Vol. LII. January-December, 1949.

FRANK, F. C., and J. H. van der Merwe. One-dimensional dislocations IV. Dynamics. *Proceedings of the Royal Society A*. Vol. 201. 1950.

FRANKEL, J. J. Notes on further occurrences of younger Olivine Basaltic Dolerities. *Transactions and Proceedings of the Geological Society of South Africa*. Vol. LII. January-December, 1949.

GLEDHILL, J. A., and M. E. Szendrei. Theory of the production of an ionised layer in a non-isothermal

atmosphere neglecting the earth's curvature, and its application to experimental results. *Proceedings of the Physical Society B*. Vol. LXIII. 1950. p. 427.

GROENEVELD, D. The geology of the area north-west of the confluence of the Crocodile and Pienaars Rivers. M.Sc. Thesis — University of Pretoria.

HAINES, D. W., and F. L. Warren. The Euphorbia resins — Part IV — A comparative study of Euphol and Tirucalol. *J. Chem. Soc.* June, 1950. pp. 1562-1565.

HEFER, S. V. Die ontkiemingsfisiologie van *Striga Lutea Lour.* M.Sc. tesis — Universiteit van Suid-Afrika.

HEY, D. New therapeutic agents of the Quinoline series. Part VII. 2-, 3-, and 4-Pyridylquinolines, 4-Pyridylquinaldines, and 2-Pyridyl-lepidines. *J. Chem. Soc.* 1950. pp. 1678-1683.

KROPMAN, M., F. L. Warren, R. Adams, T. R. Govindachari and J. H. Looker. The identity of β — Longilobine with Retrorsine. *J. Am. Chem. Soc.* Vol. 72. 1950. p. 1421.

KROPMAN, M., and F. L. Warren. The Senecio Alkaloids Part VI. The isomerisation of senecic acid to trans-senecic (integerrinecic) acid, and the general structure of the "necic" acids. *J. Chem. Soc.* Febr., 1950. pp. 700-702.

LEVYNS, M. R. B. (Mrs.). The relations of the Cape and Karroo Floras near Ladysmith, Cape. *Transactions of the Royal Society of South Africa*. Vol. XXXII. Part III.

LEISEGANG, E. C. (non-bursar), and F. L. Warren. The senecio alkaloids Part VII. The structure of retrorsine and isatidine: the Ester groupings. *J. Chem. Soc.* Febr., 1950. pp. 702-703.

LOMBAARD, B. V. Die geologie van die Bosveld-kompleks langs Bloedrivier. *Transactions and proceedings of the Geological Society of South Africa*. Vol. LII. 1949.

MALHERBE, P. N. The separation of the isotopes of oxygen by the rectification of water. M.Sc. Thesis — University of Natal.

MALHERBE, P. N., E. C. Leisegang and H. A. E. Mackenzie. An inexpensive A.C. Mains-operated relay signal-amplifier. *The S.A. Ind. Chemist*. Vol. 4. June, 1950. No. 6.

- OGIE, J. F. A barometer for use in the experimental study of the fine structure of the earth's atmosphere. M.Sc. Thesis — University of Pretoria.
- PHILLIPS, W. E. The permittivity of air at a wavelength of 10 centimetres. *Proceedings of the I.R.E.* Vol. 38. July, 1950. No. 7.
- SCHMIDT, E. R. The structure and composition of the Merensky Reef on the Rustenburg Platinum mine. M.Sc. Thesis — University of Pretoria.
- SNYMAN, A. The influence of population densities on the development and oviposition of *Plodia interpunctella* Hübn (Lepidoptera). *J. Entom. Soc. S.A.* Vol. XII. Sept., 1949. pp. 138-171.
- STEYN, J. G. D. Die geologie van die Bosveld-kompleks in die omgewing van Magneethoogte. M.Sc. Tesis — Universiteit van Pretoria.
- TOERIEN, M. J. The cranial morphology of the Californian lizard — *Anniella Pulchra* Gray. *S.A. J. Sc.* Vol. 46. July, 1950. No. 12.
- VAN BILJON, S. The transformation of the Pretoria series in the Bushveld complex. *Transactions and*

- proceedings of the Geological Society of South Africa.* Vol. LII. January-December, 1949.
- VAN DER MERWE, J. H. On the stresses and energies associated with inter-crystalline boundaries. *Proceedings of the Physical Society A.* Vol. LXIII. 1950. p. 616.
- VAN SON, G. The Butterflies of Southern Africa Part I — *Papilionidae* and *Pieridae*. Pretoria, Transvaal Museum. 1950.
- VERMAAS, F. H. S. The Bushveld complex and metamorphosed sediments of Northern Sekukuni-land. M.Sc. Thesis — University of Pretoria.
- VILJOEN, J. T. B. A critical analysis of the cost of small houses. *South African Architectural Record.* Sept., 1949.
- WALKER, F. The occurrence of pumice on the beaches of the Cape Province. *Transactions and proceedings of the Geological Society of South Africa.* Vol. LII. January-December, 1949.
- WILLIAMS, J. M. Some Pyridylquinolines and Isoquinolines. Ph.D. Thesis — University of London.

**Medical, Dental and Nutritional Research — Mediese, Tandheelkunde en Voedingsnavorsing**

- ARMSTRONG, T. G., A. J. Wilmot (non-bursar) and R. Elsdon-Dew. Auromycin and Amoebic Dysentery. *The Lancet.* July 1, 1950. p. 10.
- FLEMING, R. J. Double plating of fractured shafts of long bones. Interim report of work carried out at the University of the Witwatersrand Medical School.
- GOETZ, R. H. On the measurement of the collateral circulation with special reference to the indications for sympathectomy. *Angiology.* Vol. 1. No. 2. April, 1950.
- GOETZ, R. H. Effect of changes in posture on peripheral circulation with special reference to skin temperature readings, and the Plethysmogram. *Circulation.* Vol. I. No. 1. Jan., 1950.
- GOETZ, R. H. The diagnosis and treatment of vascular diseases with special considerations of clinical plethysmography and the surgical physiology of the autonomic nervous system. *Brit. J. Surgery* 1949. July and October.

- GOETZ, R. H., P. Arnold and M. L. Rosenheim (non-bursar). Effect of pentanethonium iodide on the peripheral circulation. *The Lancet.* Sept. 3, 1949. p. 408.
- IRVING, J. T. The silver impregnation method applied to the dentin matrix of rachitic rats and to that of rats with healing rickets. *J. Dental Research.* St. Louis. Vol. 29. No. 1. pp. 87-92. Febr., 1950.
- ODENDAAL, W. A., en andere. Nutrisionele toepassing in endokriniese siektes. *Trek* (Jaarblad van die Universiteit van Pretoria). 1949.
- ODENDAAL, W. A., Oral hygiene and the prevention of dental caries. *Clinical Proceedings.* Vol. 8. No. 2. June, 1949.
- ODENDAAL, W. A. Amino acid and B-vitamin supplementation between common foodstuffs in South Africa. *Clinical Proceedings.* Vol. 8. No. 3. 1949.

*Appendix/Bylae III*

**RESEARCH BURSARIES and ASSISTANTSHIPS awarded by the C.S.I.R. during 1950  
NAVORSINGSBEURSE en ASSISTENTSKAPPE wat deur die W.N.N.R. gedurende 1950  
toegeken is**

**A. GENERAL RESEARCH — ALGEMENE NAVORSING  
1. BURSARIES — BEURSE**

(i) SENIOR BURSARIES — SENIOR BEURSE (£200-£1,000)

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
EWER (Mrs.) R. F. B.Sc. (Hons.), Ph.D. £400	—	University of Natal	Studies on water balance in the Anura with special reference to endocrine control.
KOCH, C. D.Sc., Hon. Coleopterologist at the Transvaal Museum £600	1949	Transvaal Museum	Monographic Account of the Tenebrionidae (Coleoptera) of South Africa.
LAWRENCE, R. F. B.A., Ph.D., Retired Director of the Natal Museum £800	1948 & 1949	—	(a) South African parasitic mites; (b) A text book on the Cryptozoa of the South African forests (to be completed).
LOGIE, H. J. B.Sc. (Hons.), D.Sc., Lecturer £200	—	University of the Witwatersrand	Physics of Metals.
LOMBAARD, B. V. M.Sc., Ph.D., D.Sc., Professor van Geologie £225 (vir ses maande)	—	Universiteit van Pretoria	(a) Stollingsgesteentes van laat-Karooose ouderdom; (b) Die Bo-Sone van die Bosveld-Kompleks langs Bloedrivier.
SMITH, J. L. B. B.A., M.Sc., Ph.D., F.R.S.S.A., Professor of Ichthyology, £1,000	1946, 1947, 1948 & 1949	Rhodes University College	Fishes of South Africa.
ZEEMAN, P. B. B.Sc., M.Sc., Lektor in Fisika £120 (vir vier maande)	1949	Universiteit van Stellenbosch	Vibrasie en Rotasie-analise van die BS molekule.
HENKEL, J. S. Diploma of Forestry, D.Sc., Pensioner, Union and Southern Rhodesian Forest Services £100	1947, 1948 1949	University of Natal	Preparation of Key to all the Indigenous Grasses of Southern Africa.

(ii) STUDENT BURSARIES — STUDENTE BEURSE (£100-£200)

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
BOTANY/PLANTKUNDE CURRIN (Miss) M. M. B.Sc., M.Sc.	—	University of Cape Town	The interrelations of soils and plants, the ecological succession and the effects of exotics in an area of naturally regenerating Cape flora at Kirstenbosch.

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
CHEMISTRY/SKEIKUNDE BARBOUR, J. B. B.Sc.	—	University of Natal	Resins of the Euphorbia and the Euphorbiaceae.
BENNET, R. N. E. B.Sc., M.Sc.	1948 & 1949	University of Natal	The resins of the Euphorbia and the Euphorbiaceae species (Triterpenes) with special reference to Euphol.
CANHAM, P. A. S. B.Sc., B.Sc. (Hons.), M.Sc.	1948 & 1949	University of Natal	The naturally occurring Lactones.
CAPLAN, S. R.	—	University of the Witwatersrand	Physico-Chemical Properties of Polymeric electrolytes.
CHARLSON, A. J. B.Sc., M.Sc.	—	University of Cape Town	Synthesis of 3:4—Dihydro—1:2—Benzothiopyran, 3:4—Dihydro—1:2—Benzotelluropyran and 3:4—Dihydro—1:2—Benzoselenopyran, with a view to possible resolution into optical isomers and a study of the kinetics of racemization.
HARRISON, G. S.	—	University of the Witwatersrand	A problem in fat chemistry which will take the form of a contribution to a series of investigations on the fats from South African plants.
KLOPPER, S. M. B.Sc.	—	University of Natal	Further studies in the system acetic acid-acetic anhydride and some aspects of dehydration in this medium.
KOEKEMOER, M. J. B.Sc., B.Sc. (Hons.)	1948 & 1949	University of Natal	Nitrogen bases.
MILNER, (Mrs.) A. M. B.Sc.	—	University of Natal	Isotopic exchange oxygen and water.
MIRVISH, S. S. B.Sc.	—	University of Cape Town	Investigation into the structure of pyorubin, a pigment produced by the bacterium <i>pseudomonas pyocyanea</i> .
LOUW, D. F. B.Sc., M.Sc.	1948 & 1949	Universiteit van Pretoria	Derivate van feniel-ditio-karbamiensuur.
PARISH, J. R. B.Sc.	—	Rhodes University College	The illustration of the phenomenon of chemical resonance by a method dependent on optical activity.
RYDING, W. W. B.Sc.	—	Rhodes University College	Researches pertaining to the elucidation of the structure of resorcinol formaldehyde resins.
SCHOEMAN, D. J. B.Sc., M.Sc.	—	University of the Witwatersrand	The glyceride structure of the fruit-coat fat of <i>Myrica Cordifolia</i> .
SERFONTEIN, W. J. B.Sc., M.Sc.	1949	Universiteit van Pretoria	Sintese van sekere peptides; bepaling van die spektra daarvan by verskillende pH's en toepassing van die resultate op die probleem van eiwit struktuur; ondersoek na die bruikbaarheid van genoemde peptides as voedingsbodems vir sekere mikro-organismes.
SUTIN, N. B.Sc.	—	University of Cape Town	Investigation of the ferrocyanides of tetravalent tin and possibly lead.

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
TIEDT, J. B.Sc., M.Sc.	—	University of Leeds	Samstelling van wolwas en die reaktiwiteit van sy komponente.
VAN DER POL, C.	—	University of the Witwatersrand	A problem in fat chemistry which will take the form of a contribution to a series of investigations on the fats from South African plants.
WOOD, D. A. B.Sc.	—	University of Natal	The resins from the Euphorbia and the Euphorbiaceae.
GEOLOGY/GEOLOGIE HIEMSTRA, S. A. B.Sc.	—	Universiteit van Pretoria	Die Magaliesberg-etagé en oorliggende gesteentes suid van Steelpoortstasie.
VAN BILJON, W. J. B.Sc.	—	Universiteit van Pretoria	Die gesteentes bokant die Magaliesberg-etagé oos van Steelpoortstasie.
PHYSICS/FISIKA ASHWELL, P. C.	—	University of Natal	A study of atmospheric superrefraction and the anomalous propagation of radio waves at a wavelength of 150 cms.
SCHONLAND, D. S. B.Sc., B.A.	1949	Birmingham University	Applied mathematics of atomic physics.
VAN HEERDEN, I. J.	—	Universiteit van Stellenbosch	Die aanslaan elektrone veroorsaak deur mesone in die kosmiese strale.
VAN DER MERWE, J. H. M.Sc.	1949	University of Leyden	Kernfisiese Kragte (Teoreties)
ZEEMAN, P. B. B.Sc., M.Sc.	1949	Universiteit van Stellenbosch	Vibrasie en Rotasie-analise van die BS molekule.
CIVIL ENGINEERING/SIVIELE INGENIEURSWESE COLCLOUGH, C. D. B.Sc.	—	University of the Witwatersrand	Supersonic aerodynamics.
FLEMING, C. J.	—	University of Natal	To determine, as far as possible in general terms, what economies and improvement in efficiency can be effected in electric supply power station operation by the introduction of water power energy to supply peak loads on the station.
HODGSON, T.	—	University of the Witwatersrand	Investigation of cyclical variations in temperature in an internal combustion engine.
POPE, N. C. B.Sc.	—	University of the Witwatersrand	Supersonic aerodynamics.
LONSTEIN, W. B.Sc., M.Sc.	1948	University of the Witwatersrand	The potentialities of spark-assisted compression ignition in a fuel injection engine.
ZOOLOGY/DIERKUNDE CROMPTON, A. W. B.Sc., M.Sc.	1949	Universiteit van Stellenbosch	Development of the chondocranium of <i>Spheniscus demisus</i> .
DODDS, (Miss) S. E. B.Sc.	—	University of Natal	Reactions of arthropods in relation to humidity.

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
SMIT, A. L. B.Sc., M.Sc.	—	Universiteit van Stellenbosch	Die ontwikkeling van die werwel-kolom van <i>Xenopus Laevis</i> .
STOCH, (Miss) Z. G. B.Sc. (Hons.)	—	University of the Witwatersrand	Heredity of tooth anomalies (human genetics)

**2. GRANTS FOR THE EMPLOYMENT OF RESEARCH ASSISTANTS — TOEKENNINGS VIR DIE INDIENSNEMING VAN NAVORSINGSASSISTENTE**

**SKILLED ASSISTANTSHIPS — GESKOOLDE ASSISTENTSKAPPE (£350-£450)**

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
BOTHA, P. J., M.Sc., Ph.D., Senior Lektor in Plantkunde	1947, 1948 & 1949	Universiteit van Potchefstroom	Fisiologies-ekologiese studies in verband met inheemse parasitiese blomplante.
DAY, J. H., B.Sc., Ph.D., Professor of Zoology	1946, 1947 & 1948	University of Cape Town	A biological survey of South African estuaries
ELOFF, G., M.A., D.Sc., Senior Lektor	—	Universiteit van die Oranje Vrystaat	Lewenswyse van knaagdiermolle en insektivormolle met spesiale aandag aan ons inheemse soorte.
GANE, P. G., M.Sc., Ph.D., Deputy Director, Bernard Price Institute	1949	University of the Witwatersrand	Seismic travel-times in the Transvaal.
HENKEL, J. S. Diploma in Forestry, D.Sc., Pensioner, Union and S.R. Forest Services	1947, 1948 & 1949	University of Natal	Preparation of key to all the indigenous grasses of Southern Africa.
ROHWER, E. F. C. H., Ph.D., Senior Lektor in Chemie SCHEFFLER, T. B., D.Sc., Senior Lektor in Fisika	1946, 1947 & 1949	Universiteit van Stellenbosch	Ondersoek na die disperse verspreiding van soute in nie-isomorfe kristalle deur middel van 'n X-straal-vakuum-spektrograaf.

**B. MEDICAL DENTAL AND NUTRITIONAL RESEARCH—MEDIËSE, TANDHEELKUNDE EN VOEDINGSNAVORSING**

**1. BURSARIES — BEURSE**

**i) SENIOR BURSARIES — SENIOR BEURSE (£200-£1,000)**

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
HAUPTFLEISCH-NAUDE, R. M.B., Ch.B. Honorair assistente van prof. dr. Janssen, Hoof: Departement Kindergeneeskunde, Universiteit van Pretoria £200	—	Universiteit van Pretoria	Nierfunksie van die Neonatus en jong kinders.

**2. GRANTS FOR THE EMPLOYMENT OF RESEARCH ASSISTANTS — TOEKENNINGS VIR DIE INDIENSNEMING VAN NAVORSINGSASSISTENTE**

**(i) SKILLED ASSISTANTSHIPS — GESKOOLDE ASSISTENTSKAPPE (£350-£450)**

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
GOETZ, R. H., M.B., Ch.B., M.D. Research Professor, Surgical Research Department, University of Cape Town	1947 & 1949	University of Cape Town	1. Regeneration in the autonomic nervous system. 2. The cardiac output and intracardiac pressures in various pulmonary conditions, hypertension and pulmonary oedema.
HEYNS, O. S., M.A., D.Sc., F.R.C.O.G., Professor of Obstetrics and Gynaecology	1947	University of the Witwatersrand	Childbirth under primitive tribal conditions amongst various Bantu races in Africa.
IRVING, J. T., B.A., M.A., Ph.D., M.D., M.R.C.S., L.R.C.P., Professor of Physiology	1946, 1947 & 1948	University of Cape Town	Influence of endocrine and dietary factors on enamel and dentin formation.
JANSSEN, E., D.T.M. & H., M.D., M.B., Ch.B., Professor, Departement Kindergeneeskunde	1947, 1948 & 1949	Universiteit van Pretoria	1. Rooiselle in die bloed by wanvoeding. 2. Aangebore gebreke van die Neonatus.
ODENDAAL, W. A., B.Sc., M.Sc., D.Sc., Senior Lektor in Fisiologie	1947, 1948 & 1949	Universiteit van Pretoria	Die verband tussen nutrisie, endokrinologie en siekte toestande.
PIJPER, A., M.D., Professor in Siektkunde	1947, 1948 & 1949	Universiteit van Pretoria	Sigbaarmaking van sogenaamde flagella van bakterieë met „phase contrast” mikroskope.
STEYN, D. G., B.Sc., Dr.Med.Vet., D.V.Sc., Professor in Farmakologie	1949	Universiteit van Pretoria	Die moontlike kankerveroorsakende en giftige eienskappe van kleurstowwe (Nigrosine, Orange G en Benzo Purpurine) wat in ons voedsel en drank gebruik word.
VAN DER MERWE, C. F., B.Sc., M.D., SNYMAN, H. W., M.B., Ch.B., M.D., Hoof: Afdeling Sistematiese Geneeskunde	—	Universiteit van Pretoria	Bilirubine en porfirine in Interne Geneeskunde.

**(ii) UNSKILLED ASSISTANTSHIPS — ONGESKOOLDE ASSISTENTSKAPPE (£120-£240)**

Name and qualifications Naam en kwalifikasies	Previous awards Vorige toekennings	Where tenable Waar geldig	Subject of research Onderwerp van navorsing
GOTTLIEB, L. B. M.B., Ch.B., F.R.C.S.	—	University of the Witwatersrand	Investigation into the cause, and particularly the therapy, of peptic ulceration.