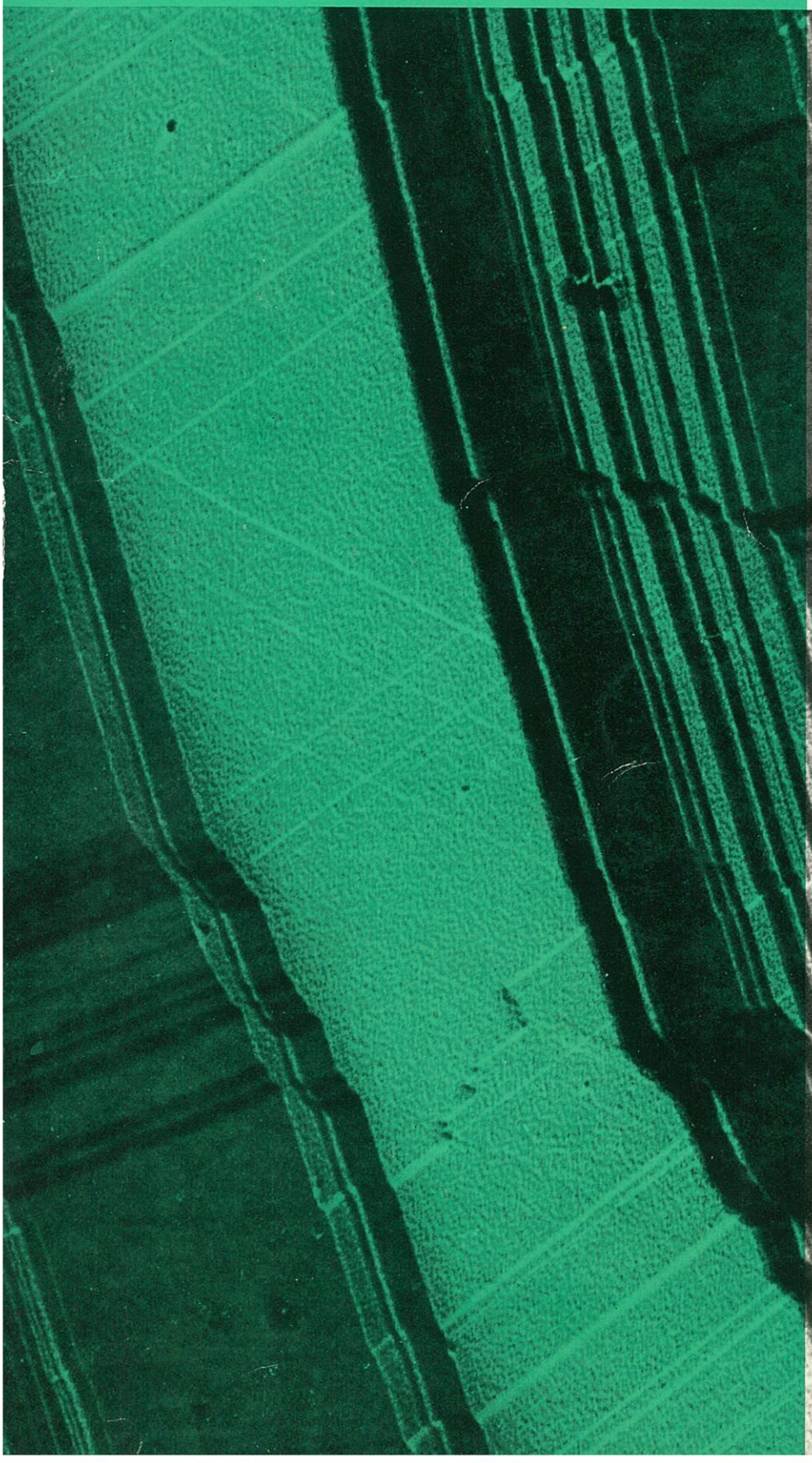
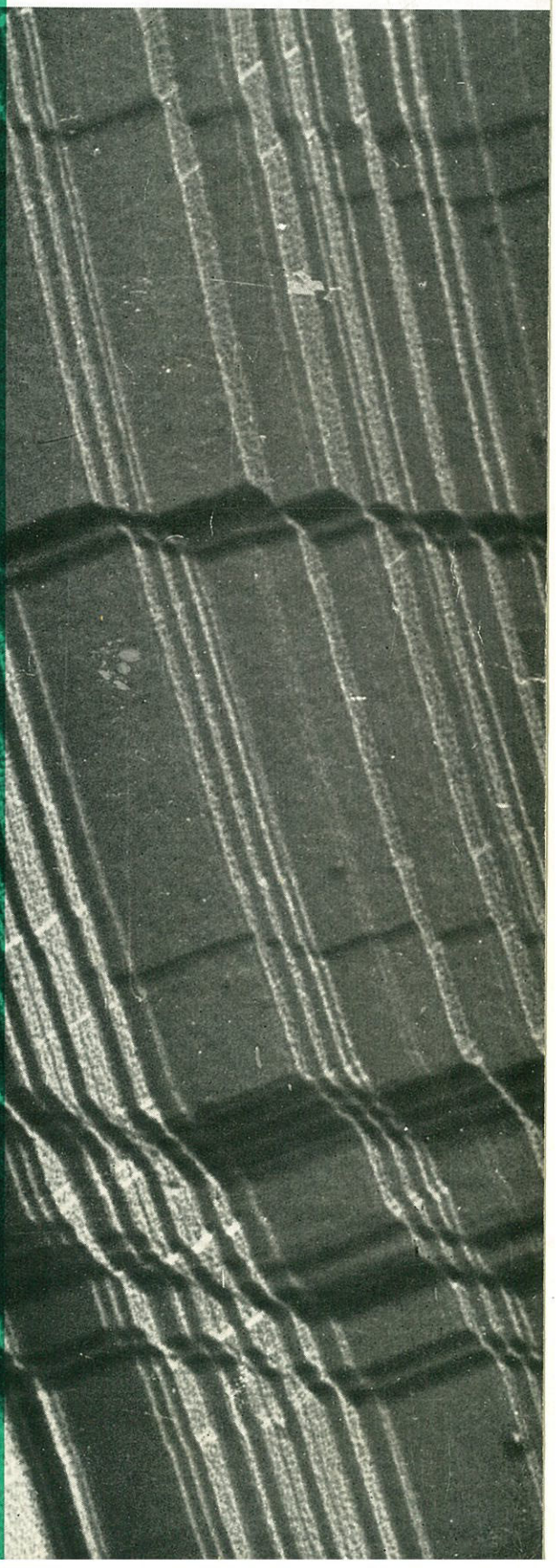
Dr. S.M. Naude,
President,
W.N.N.R.,
SCIENTIA.

CSIR

annual report 1963





P.O. Box 395
PRETORIA
1 January, 1964

Sir,

I have pleasure in presenting to you the Nineteenth Annual Report of the Council for Scientific and Industrial Research. This Report covers the period 1 January, 1963 to 31 December, 1963.

Balance sheets and statements of income and expenditure for the financial year ended 31 March, 1963, certified by the Controller and Auditor-General, are included.

I have the honour to be,

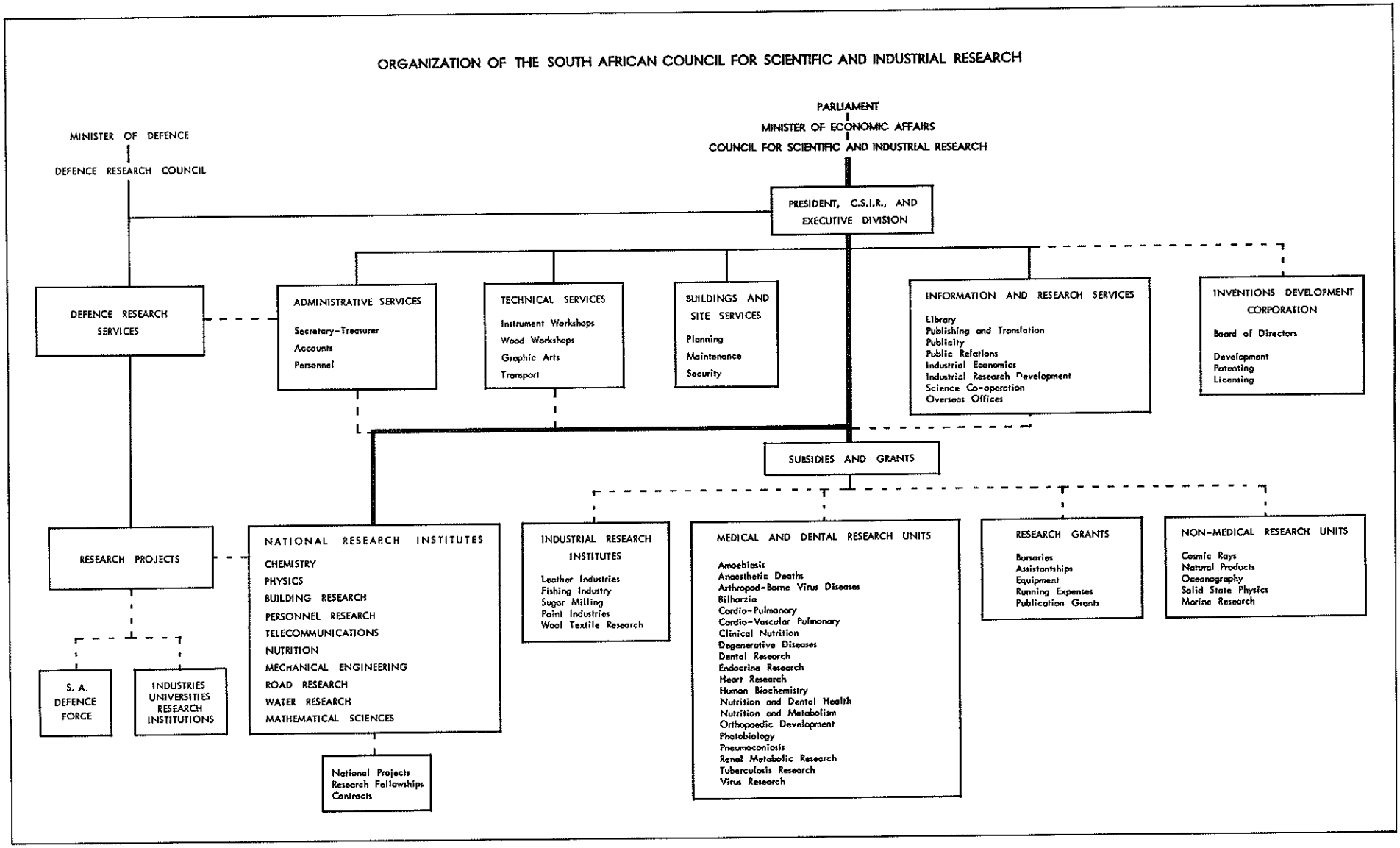
Sir,

Your obedient servant,

S.M. NAUDÉ

President: Council for Scientific
and Industrial Research

The Hon. Dr N. Diederichs
Minister of Economic Affairs
Paul Hof
Minnaar Street
PRETORIA


ORGANIZATION OF THE SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
PARLIAMENT
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COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
MINISTER OF DEFENCE
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Oceanography
Solid State Physics
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C S I R

NINETEENTH ANNUAL REPORT 1963

Afrikaans version obtainable separately

Council for Scientific and Industrial Research

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General review

Introduction

The year under review has been acknowledged as one of economic revival by leaders in commerce and industry. It is seen as the harbinger of dynamic economic and industrial growth. These developments are not without their implications for the Council for Scientific and Industrial Research which has among its responsibilities the promotion of industrial research in South Africa. During 1963, therefore, this Council turned its attention with renewed vigour to the question of research on behalf of industry.

The Council notes with satisfaction that the Scientific Advisory Council established by the Prime Minister moved into top gear during the year. Besides meeting a long-felt need, the Scientific Advisory Council, in surveying science in South Africa with a view to making good the more obvious shortcomings that have persisted over the years, will relieve the Council of many of the watchdog duties that have necessarily devolved upon it, thus enabling it to devote more energy to the requirements of industry.

The Council looks forward to effective liaison with the Scientific Advisory Council and other planning bodies such as the Economic Advisory Council and the Natural Resources Development Council, with particular reference to growing points in the national economy. Consultation with these bodies will make possible a better orientation of research towards long-term economic goals.

The present industrial expansion presents the CSIR with a special challenge. Experience has taught that when private industries are riding the crest of the wave, they are less attentive to research and development than in times of economic stagnation. Council's task is therefore to conduct industrial research, to help industries to set up research facilities, and to convince Government, industrial and local authorities that it is wise to give greater support to research.

Buoyancy in industry does not cancel the obligation to invest in industrial research: if anything, the research effort should be stepped up in order to secure a steady rate of growth. In the CSIR's experience it takes up to five years to lay the foundations for any major new research undertaking on behalf of industry. The successful hydrodynamic work carried out by the CSIR with the use of beach, harbour and estuary models (reported on in this issue) would not have been possible without the services of a team of experts built up over a considerable period.

Industries that have shown the most growth are mainly those in which major technical innovations have followed on new scientific discoveries. In such

industries the early phases of growth are marked by intensive research and development efforts to exploit the scientific breakthrough. Well-known examples are the exploitation of the transistor by the electronics industry, or the use of new materials such as polyethylene and polypropylene by the chemical industry. Technologically-based industries blaze the trail for themselves as well as for the slow-growing traditional industries.

A stage of development has been reached where the Republic should establish its own scientific and technical resources. Till now, in the nature of things, South African industries have relied heavily on imported know-how. While no country can afford to be independent of technological developments abroad, the striving should nevertheless be towards a maximum share in the creation of new skills.

Now that South African goods are becoming increasingly competitive in international markets, it will become more difficult for local manufacturers to acquire what they lack from countries with whom they may be in competition. Many South African industrial firms have been established as offshoots of parent organizations abroad; for these firms there is the inconvenience of standing in queues. Several have already reported that the demand for development facilities on their parent companies is so great that they are finding it difficult to have their problems considered.

A more virile South African technology would also strengthen the Republic's trade bargaining power. The Council looks forward to the day when the Republic will itself become a large-scale exporter of technological know-how.

The Council is aware of the trend among larger industries to set up their own research facilities. This is welcomed as it is in line with the Council's policy. For smaller or medium-sized industries the Council takes the lead until the industries concerned are able to sponsor industrial research themselves.

Conferences with industry

During the year the CSIR instituted a series of one-day symposia aimed at bringing industrial scientists and engineers to the CSIR to acquaint them with the facilities available for research and development. At the same time, research workers and administrators at the CSIR will learn more about the requirements of industry from their counterparts in industry, who will in future be asked to contribute to these symposia.

The first symposium, on fans, was held during November in the aerodynamics laboratories of the National Mechanical Engineering Research Institute. Attended by about 150 delegates, it proved a successful forerunner to nine symposia planned for 1964.

Conferences were held on matters of mutual interest to research workers and industrialists in other fields where the CSIR can be of outstanding service to industry. The National Research Institute for Mathematical Sciences, for instance, arranged a conference on digital techniques in instrumentation and several special visits to the CSIR were arranged for industrialists.

The National Institute for Water Research, in conjunction with the South African branch of the Institute of Sewage Purification, and with the support

of the Institution of Municipal Engineers of Southern Africa and the SA Institution of Civil Engineers, organized a national conference in Pretoria during October on the purification, discharge and re-use of municipal and industrial effluent.

Several hundred delegates, including experts from the US, the UK and Italy, attended the conference called to consider the mounting gravity of the inadequate water supply in South Africa and the resulting obligation on everyone to use every drop as efficiently as possible. Far-reaching resolutions relating to the purification and re-use of effluent were adopted.

Technical publications

The new CSIR monthly publication TI (Technical Information for Industry) was launched in January. Directed towards the industrialist and manufacturer, it contains the latest information on technological developments in the CSIR. The journal has been extremely well received locally and abroad, and its editorial staff as well as the contributing laboratories have been hard pressed to handle the resulting inquiries, seventy per cent of which have emanated from overseas manufacturers. Items from TI are taken up in the Technical Digest of the Organization for Economic Co-operation and Development (20 member nations) and other important abstracting journals.

Facilities for heavy industry

The need for a testing and development centre to serve heavy industry in South Africa has been brought to the attention of the Council. In recent years, local industries have been manufacturing many heavy items of machinery that were previously imported, notably large pumps, motors, fans, turbines and ancillary electrical equipment. South Africa is better placed than most overseas countries to exploit the extensive experience gained in the use of heavy equipment in the mining industry. A demand has now arisen for testing and development facilities for heavy machinery and a committee has been created to investigate the question of a testing centre. The committee is under the chairmanship of an industrialist and represents interested parties like manufacturers and users of heavy equipment, as well as the CSIR and the SA Bureau of Standards. An engineer seconded to the committee by the CSIR, collaborating with a consultant appointed by the SABS, has surveyed local requirements and is at present studying testing and development facilities abroad. He will report back to the committee on the type of facility needed in the Republic.

Finances

Detailed financial statements appear at the back of this report.

The following is an indication of the distribution of funds (for running expenditure only) among the ten national laboratories and institutes of the CSIR, which are alphabetically listed. (Funds allotted to service departments are not included.)

In the left-hand column, each institute's share of the total Parliamentary grant towards running expenses (R2,172,439 for 1962/63, to which should be added the grant of R221,237 to the National Institute for Road Research by the National Road Fund) is expressed as a percentage. In the right-hand column, the total income of each institute from the Parliamentary grant and from services rendered to industry, local authorities and Government departments, is expressed as a percentage of the total income of all the laboratories and institutes from all sources.

National Building Research Institute	12.9	13.5
National Chemical Research Laboratory	15.2	13.2
National Research Institute for Mathematical Sciences	5.0	5.0
National Mechanical Engineering Research Institute	9.9	12.9
National Nutrition Research Institute	9.0	7.5
National Institute for Personnel Research	9.9	10.3
National Physical Research Laboratory	15.4	13.8
National Institute for Road Research	11.7	9.1
National Institute for Telecommunications Research	3.7	4.2
National Institute for Water Research	7.3	10.5

Income from services rendered constituted about 22 per cent of the total income of the laboratories and institutes of the CSIR during 1962/63.

During the year under review, the CSIR received R854,232 from Parliament towards subsidies and grants that were passed on to the industrial research institutes and medical research units (see later chapters) and to bursary holders.

Two senior members of staff left the Council's service: Dr P.J. du Toit, FRS, a former President of the CSIR, and formerly research adviser to the President of the CSIR; Mr E.W. Dohse, adviser to the President on building matters, and a former Vice-President of the CSIR, who has taken up an appointment as adviser on its building programme to the SA Bureau of Standards.

New appointments

The following senior appointments were made: Dr W.H. Craib, a former professor of medicine at the University of the Witwatersrand, joined the CSIR as associate adviser on medical research; Dr J.P.A. Lochner, Head of the Acoustics Division of the National Physical Research Laboratory, was appointed Director of the National Institute for Rocket Research; Mr J. van der Staaij, Head of the Technical Services Department, became Director of the TSD; Dr T.H. Bothwell, Department of Medicine, University of the Witwatersrand, was appointed Director of the Iron and Red Cell Metabolism Research Unit of the CSIR.

Regional activities

The CSIR is called upon regularly to apply its knowledge to regional problems throughout the Republic and South West Africa, with the result that its regional services are constantly growing.

During the year, Mr H. van Eck, chief research officer in the National Institute for Water Research, was appointed officer-in-charge of the Natal regional unit of the NIWR. This unit in addition to assisting local authorities and industry in Natal with effluent and water treatment problems, and studying the hydrobiology of Natal rivers, is associated with the National Physical Research Laboratory in the operation of an Oceanographic Research Group accommodated in the Natal Regional Research Laboratory of the CSIR, in Durban. Pending the establishment of a regional liaison office for Natal, Mr van Eck will be responsible for general matters concerning the CSIR in the province.

A Regional Liaison Office for the Western Cape has been established under Dr P. le R. Malherbe, who has been in charge of the SA Scientific Liaison Office, Cologne, during the past five years. Dr Malherbe will be accommodated in the new buildings of the CSIR's Western Cape Regional Laboratory, Bellville, on ground donated by the municipality of Bellville.

Dr G.G. Cillie, formerly biochemist of the Paarl Municipality, has been appointed Officer-in-charge of the Cape regional unit of the National Institute for Water Research. The NIWR now has regional laboratories in Bloemfontein, Windhoek, Durban and Bellville. The Institute has also set up a hydro-biological research group at Rhodes University, Grahamstown.

The National Building Research Institute has appointed a regional research officer in Windhoek, with financial support from the SWA Administration. This follows the successful operation of the Institute's regional services in the Western Cape. The regional officer in Windhoek is Mr O.H. Müller.

Industrial research associations

Dr C.C. Kritzinger, Director of the South African Wool Textile Research Institute, left the Institute to become manager of the Mohair Board, Port Elizabeth. He was succeeded by Dr D.P. Veldsman, formerly research manager of Fine Wool Products SA Ltd, Uitenhage.

Sir Frederick White, Chairman of the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), who visited the Republic in 1962 to advise on the organization and future development of wool research here, recommended that all wool textile research should fall under the CSIR, while the Department of Agricultural Technical Services should be responsible for all biological and agricultural facets of wool research. The implementation of this recommendation is being considered by the various authorities involved.

Medical research

The decentralized medical research activities of the CSIR have reached the stage where more effective co-ordination is essential. With this in mind, the Council has appointed Dr W.H. Craib, a former professor of medicine at the University of the Witwatersrand, as fulltime Associate Adviser on Medical Research to assist the honorary adviser, Prof. S.F. Oosthuizen, and two part-time associate advisers, Prof. J. Barnetson and Dr R. Alexander.

The importance and quality of medical research in South Africa were highlighted during September in the holding of a CSIR-sponsored international conference on porphyria attended by experts from the UK, US, Sweden and France. Major contributions were made by South African scientists.

South African work on bilharzia received international recognition in the secondment of Dr R.J. Pitchford, head of the CSIR Bilharzia Research Unit at Nelspruit, to the World Health Organization as senior adviser in Iran for a year at the request of the WHO.

The outstanding work being done by Dr T.H. Bothwell in the Department of Medicine, University of the Witwatersrand, in the field of iron metabolism was recognised by the Council in the establishment of an Iron and Red Cell Metabolism Research Unit under his direction.

Defence research

Defence research has been in progress at the CSIR for 18 months, and some notable successes have been recorded. The country has been saved hundreds of thousands of rands on equipment developed by the CSIR that would otherwise have been purchased overseas. Production contracts have been negotiated with industry and indications are that defence research will act as a considerable stimulus to the economy.

Close collaboration has been maintained with the South African Defence Force, whose personnel are working together with research scientists as never before. Liaison is also being maintained with the universities.

During the year the establishment of a National Institute for Rocket Research was announced.

Documentation

The CSIR was represented at a conference on scientific and technical documentation held in Lourenço Marques in August, under the joint auspices of the Scientific Research Institute for Moçambique and the Institute for Medical Research in Moçambique. Papers contributed by the CSIR reviewed: documentation in South Africa, applied linguistics and its rôle in technical and scientific information and documentation, and technical translation and the standardization of technical terms.

Dr Zeferino Ferreira Paulo, Director of Portugal's Scientific Documentation Centre for the overseas provinces, and Vice-President of the International Federation for Documentation (FID) visited the CSIR to acquaint himself with its work on documentation.

The CSIR's Director of Information and Research Services, Mr D.G. Kingwill, who is a member of the FID committee on technical information for industry, attended the general assembly of the FID in Stockholm in September/October. While in Stockholm, he also attended a conference of the Organization for Economic Co-operation and Development, as an observer.

A symposium on information for industry organized by the Industrial Information Centre supported by the CSIR at the University of Natal, in collaboration with the South African Library Association, took place in Durban during September.

International scientific co-operation

The Council's Science Co-operation Division was responsible for organizing the symposium on Antarctic geology and the 7th meeting of the Scientific Committee on Antarctic Research of the International Council for Scientific Unions, both held in Cape Town during September. Prominent overseas scientists attended these highly successful meetings, which were preceded by a geological excursion through the four provinces that showed up the similarities between South African and Antarctic geology.

The Division also completed the preliminary work required to enable South African upper-atmosphere physicists to participate in the detailed scientific programme organized for the International Years of the Quiet Sun, beginning in 1964.

Consideration is being given to the part South Africa might play in another international investigation - the Upper Mantle Project. It is probable that South Africa, with its extensive mining experience, will be able greatly to assist in this worldwide investigation of the earth's crust.

In connection with South Africa's membership of the International Scientific Unions, particular mention is made of the fact that strong South African

delegations were sent to the general assemblies or congresses of the International Council for Scientific Unions (ICSU), in Vienna; the International Union of Pure and Applied Chemistry (IUPAC), in London; the International Union of Geological Sciences (IUGS), in Rome; the International Union of Geodesy and Geophysics (IUGG), Berkeley, California; and the International Scientific Radio Union (URSI), in Tokyo.

The CSIR also played a significant part in laying the groundwork for an agreement between the French and South African Governments on the establishment of a French satellite-tracking station near Pretoria.

Co-operation with research organizations in other countries has featured prominently in the activities of the national research laboratories and institutes. The CSIR's overseas offices in London, Washington and Cologne have continued to help South African scientists to keep abreast of scientific developments overseas, and have acted as bases for visiting South African scientists from the CSIR, the Atomic Energy Board, the South African Bureau of Standards and the universities. Information on international conferences attended by members of the Council's staff appears elsewhere in this report.

The following were among the prominent scientists who visited Scientia during the year:

Prof. T. Monod, Universite de Dakar, Chairman of the Scientific Council for Africa
Prof. W.H. McCrea, F R S, University of London
Prof. D.E. Blackwell, Oxford University
Prof. R.O. Redman, F R S, Cambridge University
Prof. D.H. Wilkinson, F R S, Head of Nuclear Physics, Oxford University
Dr Willoughby Lathem, Scientific Representative in London of the International Research Fellowship Programme of the U S National Institute of Health
Dr Karl F. Meyer, Emeritus Director, George Williams Hooper Foundation, San Francisco Medical Centre, University of California
Sir Arthur Coles, C S I R O, Australia
Mr Walter Ives, C S I R O, Australia
Prof. Dr D.H. Th. Vollenhoven, Vrije Universiteit, Amsterdam
Dr W.M. Hamilton, Secretary, Department of Scientific and Industrial Research, Wellington, New Zealand
Mr J.P. Shelton, Principal Research Liaison Officer, C S I R O, Australia
Dr L. Rohde, Rohde and Schwarz, München, Germany
Mr Fred H. Felberg, Deputy Chief, Engineering Mechanics Division, Jet Propulsion Laboratory, California Institute of Technology
Prof. G. Ippolito, Professor of Hydraulics, University of Naples, Italy
Mr D.H.A. Price, Chemical Inspector, Ministry of Housing and Local Government, London
Mr H.W. Poston, Regional Director of United States Public Health Service Water Supply and Pollution Control Division, U S A.

Training of technicians

The growth of the national laboratories of the CSIR, in many ways a barometer of the impact of science on the community, has been accompanied by a parallel demand for more highly-skilled technicians to support the scientist with precision instruments and other specialised apparatus not available commercially, or requiring to be built up from scratch because of special features related to local conditions.

The ratio of technicians to research graduates is constantly increasing, and the CSIR, in conjunction with the Department of Education, Arts and Science, is considering ways and means of ensuring a greater output of skilled technicians in the Republic.

Meanwhile, individual laboratories and institutes of the CSIR are making use of the sandwich courses offered at Technical Colleges in subjects like

electronics. The Technical Services Department of the CSIR continues to train a limited number of technicians in its own workshops.

Buildings

The National Mechanical Engineering Research Institute moved into its new complex of buildings at the CSIR site, Scientia, early in 1963. Additions are now being made to the aeromechanics building of the NMERI and a wing to house a new 5 x 7 ft windtunnel has been completed. The windtunnel is still being built and will probably be installed during 1964. Extensions to the National Building Research Institute began late in the year.

In December, the Technical Services Department occupied a new block adjacent to the existing Central Workshops. The various sections of TSD, previously scattered about the CSIR site, are now virtually all accommodated under one roof.

The National Institute for Road Research, last of the CSIR institutes occupying cramped premises in Pretoria, will move into its new buildings at Scientia during 1964.

Aerial view of the CSIR

National laboratories and institutes

Building research

About 400 million rand is spent on building and construction (excluding roads) in South Africa annually, and the chief objectives of the National Building Research Institute (N B R I) are to serve the industry and the professions behind this multi-million-rand investment. The N B R I is in essence a practical, applied research organization maintaining close contact with the building and construction industries. Its research is directed towards improved building design and services; improved structural and foundation engineering, lighting, ventilation, heating and cooling in buildings; improved performance of building materials such as concrete, stone and plastics and a better understanding of the effect of climate and weather on both building materials and the environment within a building. Special service has been rendered to the community in the planning of schools, hospitals and housing for all population groups. The N B R I earns about one quarter of its budget by undertaking contract work for sponsors. Research findings are actively applied by means of publications, lectures and central and regional information activities.

In this report three of the fifty-two research projects on the Institute's research programme are described briefly.

Chemical research

The National Chemical Research Laboratory (N C R L) serves as a centre where the latest developments in chemical science are brought to bear on problems of national significance. The N C R L

is organized into divisions of organic chemistry, biochemistry and physical chemistry, the last-named taking in physical chemistry proper as well as inorganic and analytical chemistry. The N C R L also supervises a chemical engineering group. Since chemistry is a meeting ground for many other sciences and technologies, priority is given to collaborative projects with Government departments, with industry and with other institutes of the C S I R.

Mathematical sciences

The National Research Institute for Mathematical Sciences keeps abreast of developments in the mathematical and electrical engineering sciences. These two disciplines are vitally involved in the refinement of methods of measurement and analysis of data demanded by science and technology, by industry, commerce and public authorities. The Institute has established specialist divisions to this end.

The Mathematical Sciences Research Department consists of divisions for mathematical analysis, statistics, and numerical analysis. These deal with problems such as the elastic behaviour of steel cables in mine hoist systems, statistical evaluation in introducing automation to mail sorting, and computer programming in the planning of a highway.

The Electrical Engineering Research Department consists of four divisions: for automation, applied electronics, solid state electronics, and electronic instrumentation. These handle diverse assignments such as the design of an evaporation monitoring instrument for use in South West Africa, the development of a simple, reliable and cheap device for harnessing solar energy to produce small amounts of electricity for communication purposes in remote areas, the use of ultrasonic waves in conjunction with existing methods of desalting water, or the modernization of a borehole logging device.

Mechanical engineering

Research in the National Mechanical Engineering Research Institute (N M E R I) is devoted largely to the development of promising new engineering techniques, to the improvement of machinery used in industry, so that production costs can be reduced, and to research fields such as rock mechanics, where the aim is to improve efficiency and safety in mining. A large proportion of the Institute's work is done on a contract basis for South African industries, for Government departments and for provincial or local authorities. To meet the growing demand for its services, N M E R I has installed a new testing floor with a capacity of 150 tons and is constructing two new wind tunnels (low-speed and supersonic) for aerodynamic testing.

Nutrition research

Food and nutrition research consist in the investigation of malnutrition (i.e. underfeeding and overfeeding) among all groups of the population, as well as the study of methods and foods designed to combat these conditions.

The functions of the National Nutrition Research Institute may be summarized as follows:

- Research aimed at the improvement of existing foods and at determining the nutritional status of all groups of the population in South Africa.
- Rendering of services to Government departments.
- Rendering of services, on a basis of remuneration, to private industry.
- Keeping in touch with local and foreign organizations concerned with nutrition and food.

Personnel research

In any work situation there are certain factors directly affecting the worker's productivity and happiness. The National Institute for Personnel Research (N I P R) is concerned with these factors, which include the following:

- definition of the characteristics of work, i.e. physical and psychological demands on the worker, job description, the value of a specific task in relation to others, and the performance of duties;
- placing the right man in the right job (use of aptitude tests, interest tests, and others);
- improvement of working conditions and equipment in order to suit the task to the worker and to eliminate unnecessary strain, fatigue and risk;
- studying the socio-psychological aspects of work, e.g. manpower shortages, human relations in the work situation, work motivation and the worker's attitude towards his job, his fellow-workers and his superiors;
- investigating problems arising from maladjustment to work e.g. absenteeism, accidents, occupational disorders and group conflicts.

Physical research

The National Physical Research Laboratory (N P R L) has the statutory function of maintaining national standards of physical measurement for mass, length, electricity, radiation, etc. These standards are of special interest to bodies like the Assize Division of the Department of Commerce and

Industries, the S A Bureau of Standards, Universities and other laboratories which employ highly accurate instruments for checking commercial measurements and articles. These bodies periodically check their standards against those of the N P R L.

It is also the function of the N P R L to extend knowledge of physics and to apply that knowledge in industry. Basic research is undertaken in optics, spectroscopy, acoustics, solid state physics and nuclear physics. The knowledge gained in this way is used in the solution of problems of atmospheric pollution, acoustics in buildings, the employment of radio-active nuclides in industrial control processes, chemical analysis by physical methods and the determination of the age of geological formations.

Road research

Work at the National Institute for Road Research is aimed at developing economic methods of building and maintaining better, safer roads in the Republic. This includes research on soil mechanics and road foundations; bituminous binders; instruments for accurate control of the various processes used in road building; the economics of road building; traffic engineering and road safety.

The Institute works in close co-operation with national and provincial road departments and other authorities responsible for roads, on a variety of problems, such as road failure, cracking, landslides, and scouring of bridge foundations.

Telecommunications research

The programme of the National Institute for Telecommunications Research (N I T R) is directed towards the solution of problems confronting the various users of radio waves in South Africa for civil or military purposes.

Important parts of this programme are the study of the propagation of radio waves through the lower and upper atmosphere and an investigation into the nature of atmospheric disturbances and their effect on radio-receiving systems as far as radio communication and radio aids to navigation are concerned. More recently, the N I T R has investigated ionospheric absorption and high frequency radio noise, in order to facilitate the reliable planning of high frequency communications systems.

The N I T R has investigated the application of semi-conductors at high frequencies and the development of very low noise receiving systems. Such techniques are appropriate to specialized types of radio equipment such as the "Tellurometer" system of distance measurement invented by the N I T R, and now applied throughout the world.

The N I T R operates two advanced radio systems for tracking artificial satellites and space research vehicles as part of the U S programme for the peaceful exploration of outer space.

Water research

South Africa is unfortunately not endowed with abundant water, and a growing population as well as rapid industrial development will in course of time be straining water resources to the utmost. Available supplies must therefore be used as effectively as possible. This involves not only judicious planning of industrial complexes with progressive research into control of water pollution, and into effective re-use of water, but also a comprehensive study of the flora and fauna in South African waters, since these play a vital rôle in the self-purification of waters and can supply valuable information on pollution levels. Giving effect to this programme is to a large extent the responsibility of the National Institute for Water Research.

Technical services

The function of the Technical Services Department is the design and construction of specialized instruments for the laboratories of the C S I R and also for industry, when these are not readily obtainable elsewhere. During the year liaison with industry was improved and there was an increased demand for these services.

It is evident from a survey made among the universities and certain big industries conducting applied research, that there is an urgent need for instrumentation technicians of the type trained by the C S I R. This is an indication of the national demand for man-power of this kind and partly explains the constant loss of technical staff from the C S I R. A training centre for instrumentation technicians, which will be unique in the Republic, is now being planned and it is hoped that it will assist in relieving the shortage.

Progress in research

– a selection of projects

Planning hospital buildings

Since 1955, the National Building Research Institute (N B R I) has been investigating the planning of hospital buildings on behalf of the Department of Health and the four Provincial Administrations. Progress in medical science, improved techniques of diagnosis and treatment, and industrial and technological development in general, have a great influence on the planning of these complex buildings.

A series of reports on various aspects of hospital planning has already been published, and includes reports on infant feeding services, the design of polyclinics, the organization of a central sterilization department and the layout of wards. Research on the design and layout of operating theatres and X-ray departments is still in progress and an extensive investigation is being made into installations for medical gases as part of a comprehensive study of the technical services in hospitals.

Closer liaison between the research worker and hospitals throughout the country should assist in the co-ordination of the planning of hospital buildings. The hospital authorities will also benefit from applying the results of the research work on an experimental basis.

It is significant that the Central Health Services and Hospitals Co-ordinating Council, which originally requested the investigation into the planning of hospital buildings, recently recommended that the steering committee should take active steps to increase the scope and tempo of this research.

Research on sewers

Several years ago, at the request of the South African Division of the Institute of Municipal Engineers, the C S I R commenced an investigation into the corrosion of sewers and made a number of important recommendations for combatting this problem. Both the Institute of Municipal Engineers and the manufacturers of sewer pipes have urged the continuance of this project, and a survey is now being made to determine the incidence of corrosion in all types of sewers and the effectiveness of the C S I R's recommendations in practice.

In co-operation with the National Institute for Water Research, the National Building Research Institute (N B R I) is carrying out research on various aspects of sanitation. Special attention is being paid to the needs of small communities which cannot afford efficient sanitation systems of the conventional type. It is apparent from a nation-wide survey conducted by the C S I R in 1958 that many of the smaller local authorities are in urgent need of an economic and efficient sanitation system.

The N B R I is now investigating the design, installation and cost of sewers. An important aspect of sewer design is the choice of the most efficient size of pipe, and for this purpose information about flows in sewers is necessary and is being collected with the co-operation of various local authorities. The C S I R's electronic computer is being used for the processing of data which were not previously taken into consideration in the design of sewers, e.g. fluctuating peak periods in the flow of sewage in different areas, the rapidity of sewage flow, the flow time in the system, and the storage capacity of sewer pipes.

The Institute has also developed a new and successful method of air testing for locating leaks in underground sewer pipes. This method is already in use for testing sewer pipe joints and for determining the efficiency of different pipe-laying methods.

Steam curing of concrete

Pretensioned concrete units, in which steel rods or cables under high tensile stress are used to place the concrete under compressive stress, are being employed on an increasing scale in the construction of bridges, buildings and other projects where high strength is required in the construction. Concrete

is much stronger under compressive stress than under tensile stress, and tensile stress is considerably reduced or even completely eliminated in pretensioned concrete.

At ordinary temperatures, concrete sets slowly but if the temperature is raised this process is accelerated. By treating the concrete with steam after it has been cast the temperature is raised and the humidity necessary for the hydration of the cement is provided. Steam curing is coming into increasing use as a means of strengthening concrete at an earlier stage than is possible with normal curing methods.

The process is mainly used in the manufacture of precast concrete products and is particularly suitable for the manufacture of pretensioned concrete units. With steam-treated concrete the tension in the steel can be transferred much more rapidly from the anchorages to the concrete than is possible with concrete cured in the normal way. Also the output from a set of moulds or stressing gear can be more than doubled by using steam-cured concrete, an important economic consideration where such expensive equipment is used.

Steam curing of concrete, however, has a detrimental effect on the bond between the concrete and the steel. The National Building Research Institute is investigating this in order to ascertain the influence of curing by steam on the tension in stressed concrete. An investigation into the properties of South African steel when pretensioned is also nearing completion.

— *National Building Research Institute*

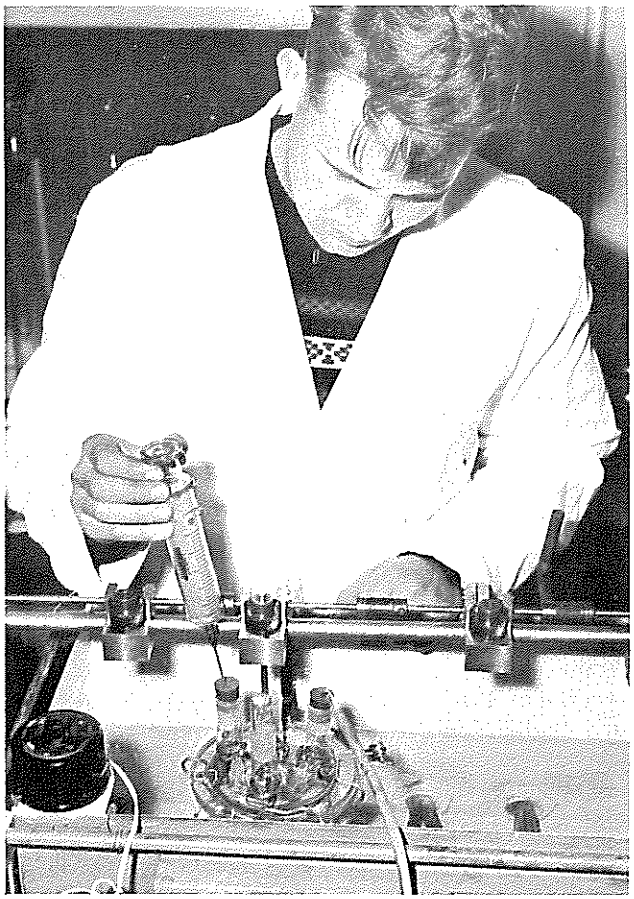
Livestock feeding

Feeding trials provide only a part-answer to the question of what to feed sheep and cattle. A more fundamental approach is to understand those facets of metabolism which are peculiar to ruminants like sheep and cattle because of their unique digestive systems.

With this in mind, the C S I R and the Veterinary Research Institute at Onderstepoort have combined forces in a special joint unit, known as the D M R Unit, for research into digestion and metabolism in ruminants. Other bodies interested in this particular field of research are the Meat Control Board, the Wool Board, and the Dairy Industry Control Board. The Unit has devised an artificial sheep's stomach which enables it to pursue its research with greater flexibility and speed than would be possible if only animals were used.

As the rumen is a type of stomach which functions by fostering bacterial growth, and not by the action of digestive juices, the D M R group has developed techniques for identifying and counting the bacterial population of the rumen. The group has demonstrated for the first time how the bacterial flora varies when the animal's diet is modified. Knowledge of this nature is important to farmers changing animals from summer to winter grazing areas, or from one pasture to another, since animals are most likely to develop digestive upsets during the adaptation period.

Further research is concerned with a digestive upset which leads to the formation of excessive amounts of ketones (certain chemical compounds) in the blood when sheep are subjected to stresses



Withdrawing a sample from the artificial rumen for chemical analysis.

such as temperature variations, pregnancy toxaemia, milk fever and railroad sickness, which are greater than those to which they are normally accustomed.

The use of urea to supplement poor grade pastures is now widespread, but urea must be fed with care, in combination with carbohydrates, usually sugar in the form of molasses, or starch in the form of mealies. A current study suggests that, though mealies are preferred to molasses in some countries, the preference is not well based. The use of biuret in place of urea, is also being studied, as it can be fed safely in large quantities.

Probing the chemistry of wool

In addition to supporting the Wool Textile Research Institute, the Wool Board has contributed financially over the past fifteen years to an investigation by the National Chemical Research Laboratory (N C R L) into the fundamental chemistry of the wool fibre. In 1962, it renewed and increased an annual grant for five years.

Earlier studies in the N C R L have dealt with the effect of copper-deficient diets on the properties of fine wools. More recently, the N C R L has shown that an oxidised wool is soluble in suitable solvents and that four sulphur-rich fractions can be separated in a fairly pure state. This in itself is a definite step towards an understanding of the structure of wool, which still eludes scientists. Also, it has led to the finding that according to the proportions in which they are present, these fractions can be used to characterize different keratinous fibres.

Thus, in collaboration with a chemist seconded from the Wool Textile Research Institute, it has been shown that mohair yields similar fractions to wool when oxidised, but in entirely different proportions. Again, studies of the effect of ultraviolet light on the degradation of wool have led to the conclusion that the high sulphur components are attacked preferentially.

Work continues on defining the properties of the high sulphur fractions. By use of new chromatographic methods, the fractions can now be prepared more quickly and in a higher state of purity. Amino-acid analyses have shown that the four fractions differ considerably in composition from one another and from the composition of the whole fibre. Further work on the characterization of keratinous fibres by the analysis of terminal amino-acid groups, is under way.

— *National Chemical Research Laboratory*

Spectrograph analysis

Analysis that keeps pace with the tempo of production is essential for successful process and quality control. The spectrograph is a useful control instrument (for example in the steel industry) but has the drawback that it can only operate successfully in a controlled environment.

A direct-reading spectrograph which is less sensitive to changes in temperature and air pressure - and therefore more useful in industrial situations - is being developed jointly by the National Research Institute for Mathematical Sciences and the National Physical Research Laboratory.

Planning and interpreting experiments

The National Research Institute for Mathematical Sciences (N R I M S) assists scientific organizations and industry in the planning of experiments and the interpretation of results.

Tasks undertaken during the past year covered a wide range e.g.

(a) the determination of the distribution of mail as part of a project in automation of mail sorting;

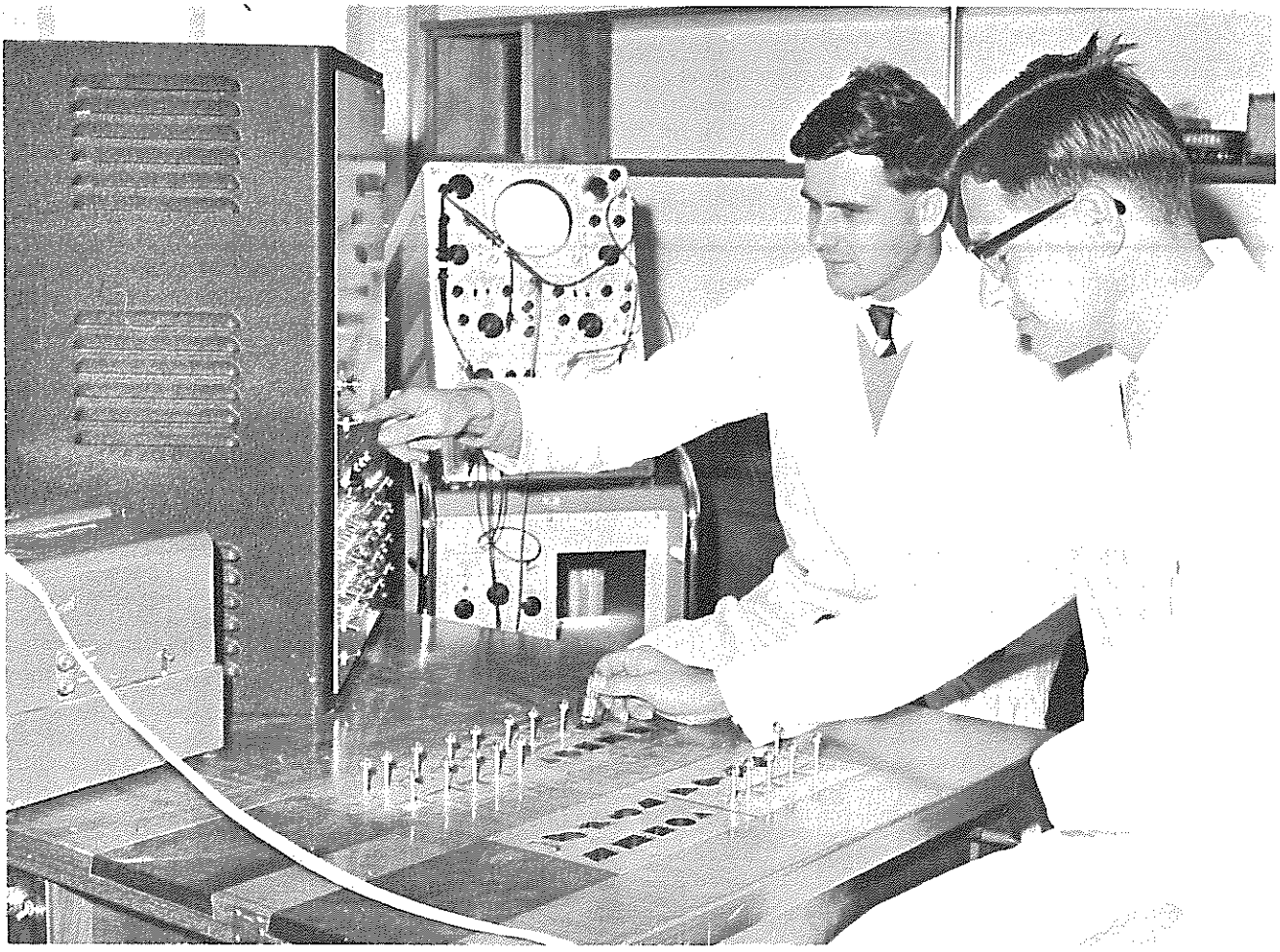
(b) analysis of data to determine factors responsible for the difference in the incidence of tooth decay in two different districts;

(c) the study of the dynamics of mine hoist systems in which cables act as visco-elastic elements, by means of a mathematical formulation of the behaviour of cables; and

(d) preparation and use of computer programmes whereby the optimum distribution of materials from loading to processing centres, with minimum transportational costs, could be determined.

Automation and data processing

Electronic instruments which automatically record data in a form suitable for direct use in a computer have so many advantages (elimination of human error; ease of handling; recording and calculation of data on a massive scale) that requests for the development of this type of instrument are received from



Two members of the National Research Institute for Mathematical Sciences demonstrate special apparatus devised in collaboration with the National Institute for Personnel Research to measure reaction time in certain tasks. (see Automation and Data Processing).

many quarters.

A prototype instrument for measuring water loss due to evaporation is being developed for the National Institute for Water Research which is assessing and studying water supplies in South West Africa. The equipment will maintain a pre-set water level in an experimental sand-filled tank, and will measure and record, at regular intervals, the volume of water added to maintain this level. At the same time measurements of temperature, wind velocity and humidity will be recorded on punched paper tape for subsequent computer analysis.

The establishment of standards for certain jobs and tasks in industry requires time and motion studies of many kinds. In collaboration with the National Institute for Personnel Research, an instrument was built which records the time taken by different operators to move a number of variously shaped objects from certain positions to their counterpart positions. The time taken for each component of motion was electronically measured to an accuracy within $\pm$ 0.01 second, stored, and subsequently punched on paper tape in a form suitable for further analysis by a computer.

This device is now being modified so that it will be useful also in the analysis of electro-encephalographic results.

— *National Research Institute for Mathematical Sciences*

Mining research

Research into measures for ensuring stability of the ground surrounding colliery excavations was continued in collaboration with the SA Fuel Research Institute and the Geological Survey of the Department of Mines, on behalf of the Coal Mining Research

Controlling Council.

As part of a long-term program, measurements have been taken of surface and ground movements down to the excavations themselves, as well as of the stresses in coal pillars. The mechanical properties of the rock formations overlying the workings and of the coal-bearing rock itself were determined. These rock properties and ground stresses were also studied by means of models in the laboratory.

The aim of this research is to devise rules and formulae which can be applied by the mining engineer in designing the layouts of underground mining excavations, and which will enable him to choose methods of mining that will allow maximum coal extraction with maximum human safety.

Research into related problems of rockbursts and strata movements was continued under the sponsorship of the Transvaal and Orange Free State Chamber of Mines. Emphasis was placed on laboratory investigations to determine the mechanism of initiation and propagation of rock fracture. An improved theory of fracture was developed, as a further step on the long road to a clearer understanding of the rockburst phenomenon and of other ground movements in gold mines.

Equipment recently developed by the CSIR uses a novel method of measuring stresses in underground rock. Electrical resistance strain-gauges are cemented to the rock core, which is then trepanned. Stresses in the trepanned rock are recorded by the strain-gauges.

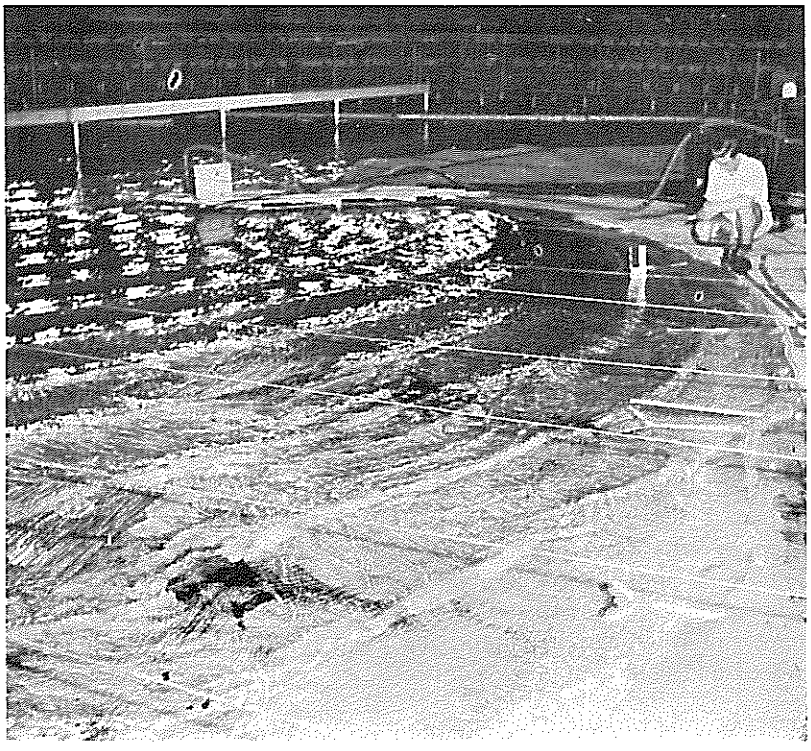
These new developments attracted considerable interest at a recent international conference held in the USA on problems associated with stresses in the earth's crust.

Coastal engineering

The ever-increasing number and sizes of ships using Durban harbour has focused attention on dredging requirements at the port entrance. At the same time, apparent erosion and instability of the bathing beaches is causing concern. On behalf of the SAR and the Durban City Council, the National Mechanical Engineering Research Institute (NMERI) has carried out an investigation into these problems.

An extensive scale model reproducing such features as wind, wave and tide variations, was constructed in a hanger on Maydon Wharf. Field studies together with model tests helped to determine the pattern of sand movement. It was found that while there is little hope of preventing altogether the coastal drift of sand towards the harbour, a different dredging technique would reduce the amount of dredging required. The full implications of these findings are under review.

A study was also made of the St Lucia estuary which provides for flow, in both directions, between the lakes and the sea. It is important that the estuary should remain open, in order to maintain the stable



This photograph of the Durban harbour model shows the beach area. The groyne in the foreground (right) is near the north beach, while the white object (centre right) is the West Street Pier. Waves can be seen breaking realistically on the shore, which is made of white sea sand.

conditions of salinity and the free interchange of water between sea and estuary necessary for the survival of fish life.

Model tests conducted at the request of the Natal Provincial Administration, showed that a specially designed system of breakwater structures could be expected to keep the mouth of the estuary open under all conditions.

Winding rope fatigue

Steel ropes are integral parts of the mine hoisting system used to convey men and material between the surface and underground workings of mines. Owing to the arduous conditions under which they operate winding ropes are heavily stressed and are liable to deterioration, particularly in the local mines where hoisting depths are greater than anywhere else in the world. It is therefore vitally important for the safety and economy of mining that more efficient ropes should be developed and that inspection methods should be continually improved.

In the course of a research project sponsored by the Transvaal and Orange Free State Chamber of Mines and local industry it became clear that improvement of rope strength could be expedited if a machine for testing rope fatigue were developed which could duplicate satisfactorily the actual conditions of loading on winding ropes.

Research has progressed to the stage where the requirements for such a machine have been clearly defined. An entirely new type of machine has been designed by the National Mechanical Engineering Research Institute. It promises to be superior in all respects to any other developed to now.

— *National Mechanical Engineering Research Institute*

Legumes and nutrition

The protein deficiency in the diet of the Bantu can be partly supplemented by soya beans. This is shown by the results of tests on various South African legumes carried out by the National Nutrition Research Institute as part of an extensive inquiry into foods and food products which could be used with milk and milk powder in combating protein deficiency diseases like kwashiorkor.

Since August, 1962, when kwashiorkor was declared a notifiable disease in South Africa, cases of kwashiorkor have been brought to the attention of the authorities and given treatment at an earlier stage. The Government grant for the distribution of protein-rich skimmed milk at present amounts to some R40,000 per annum, and more than 1,000,000 lbs of milk powder have been distributed during the past two years.

It has been established by the N N R I that bean protein is generally less digestible than the protein in other foods and that the body is, moreover, seldom capable of utilising more than 60% of the digestible part. However, in the case of the soya bean about 92% of the protein is digestible of which the body can assimilate 71%. Further research on the use of soya beans in food products would therefore be of value.

Although the taste of the soya bean is not generally popular, it would be worthwhile in view of the nutritive value of this type of bean to attempt to make it more palatable by technological means.

Diet, metabolism, and thrombosis

On the whole, the white population of South Africa tends to overeat and in addition its food is too rich. This diet can lead to an abnormal carbohydrate and fat metabolism which in turn is related to the high incidence of coronary thrombosis in this group. It has been suggested in explanation of this abnormal carbohydrate and fat metabolism that the diet of many whites gives rise to disturbances in the mechanisms which control carbohydrate metabolism.

This hypothesis was corroborated by the observation that a reduction in the intake of calories, proteins and fats among whites with this abnormal metabolism restores a normal carbohydrate and hence a normal fat metabolism.

Nineteen experimental subjects, roughly half of whom had previously suffered from attacks of coronary occlusion, and all of whom, by laboratory standards, displayed an abnormal consumption of carbohydrates and fats, were placed on a diet for a period of from 8 to 12 months. The daily intake of the subjects was approximately 1800 calories of which about 60% was derived from carbohydrates (mainly starches) and 25% from fats. The protein intake was limited to about 55 grams a day. (The experimental subjects were volunteers and their diet was not under stringent control.)

Among other things, the results show that the carbohydrate utilization of all the experimental subjects gradually improved. The average total fat content of their blood also dropped from an abnormally high value at the beginning of the

experiment to a normal value at the end. The abnormally low concentrations of essential fatty acids in the blood, which normally are low when the total fat content is high, also rose to normal values.

An investigation is envisaged to determine the extend to which the favourable biochemical picture revealed in the experimental persons after dietary treatment is followed by or coincides with similar improvements in the clinical picture and in the condition of the arteries.

Nutrition survey of the Bantu

There is, in general, no serious incidence of protein deficiency among Bantu school-children in Pretoria. A preliminary analysis, however, of the results of biochemical tests of blood and urine samples taken from 600 Bantu children in Pretoria primary schools in the course of a nutrition survey carried out by the National Nutrition Research Institute, indicates that there are vitamin deficiencies in their diet.

The survey of Bantu children is part of the N N R I's extensive investigation of the nutritional status of all primary school children in Pretoria. The general state of health and the physical condition of some 600 white children in Pretoria were closely investigated and a detailed study was made of their eating habits and food-intake. Valuable information was also gained about the survey

Bantu children being measured, weighed and X-rayed at the civic centre at Mamelodi by a C S I R official, as part of a survey of eating habits.

methods and laboratory techniques used in investigations of this type.

The data collected in the course of the surveys will be of value to doctors and dieticians and will contribute to the formulation of criteria for determining the nutritional status of different groups of the population. Certain consequences of incorrect nutrition have been established by means of this data and it is clear that more attention should be paid to the nutrition of the over-fed child.

— *National Nutrition Research Institute*

Attracting building apprentices

At the request of the National Federation of Building Trade Employers and with financial support from the National Development Fund for the Building Industry, the National Institute for Personnel Research (N I P R) carried out a survey within the building industry in an attempt to find out why that industry had attracted so few apprentices during preceding years. Research workers of the Institute interviewed a large number of artisans and apprentices in the building trades, as well as managers of building firms, apprentices in other trades, and youths who were leaving school. The most important findings are summarized below.

There appears to be considerable ignorance amongst youths - those leaving school and others - about the opportunities offered by a career in the building industry. It is therefore important that this industry should be better publicized.

The majority of employers in the building industry regard the existing system for the training of apprentices as unsatisfactory, while artisans are dissatisfied mainly because the building industry offers no security of employment. Other causes of dissatisfaction are inadequate wages and benefits, lack of opportunity for advancement, lack of status and frustration of pride in fine workmanship.

Generally speaking, Coloured people are more satisfied with employment in the building industry than Whites, and White employers and employees alike are well-disposed towards Bantu employees.

These findings were submitted to the building authorities. A start has been made with a series of radio talks, newspaper articles and an advertising campaign aimed at acquainting the public with the building industry. The other recommendations of the N I P R are also receiving attention. In the meantime the recession which existed in the building industry a year ago, has disappeared and more people are being drawn into the industry.

Marking papers mechanically

During the past year the National Institute for Personnel Research, in collaboration with the departments of Chemistry and Psychology and certain departments of the medical school of the University of the Witwatersrand, has been doing research on a new examination technique in which a machine is used for marking the papers.

Under this system the student answers questions by making a pencil mark on a special answer sheet against the answer that he considers to be correct. Each correct answer appears on the sheet together with four or five 'distractors' i.e. misleading or wrong answers, which are carefully chosen so that even the student who knows his work well must think carefully before he can select the right answer. The answer sheets are then fed into the marking machine where pencil marks are converted into electrical impulses and the answers are checked.

This method not only saves time for both the student and lecturer, but also ensures complete objectivity and a uniform standard throughout. In addition, it makes it possible for the complete syllabus to be covered, thus eliminating 'spotting' and 'padding'.

Various departments of the university have already used this device to such good effect that they have offered to contribute towards the hiring of a larger machine from 1964.

Within a very short time after an examination, the new machine will check all the answers and print the marks gained on each sheet. An hour or so later, printed lists of the names of candidates and the marks they obtained will be available. There will also be punched cards, with data in a form suitable for analysis in an electronic computer, so that the examiner will be able to find out which questions best tested the students' knowledge, which questions were the most difficult and which did not come up to the required standard. These punched cards will then be filed in order to build up a stock of standardized questions on which examiners can draw from time to time.

This machine could also be used in numerous other fields, for example in sociological surveys, inventories, registration of students - in short, in any application where information can be given by means of a pencil mark against a word, figure, letter or other symbol.

One of six safety posters used to determine how effectively the safety message is conveyed to Bantu employees. Many of the test subjects who read the poster were under the impression that the man on the right had put his arm through the window and knocked the hammer off the sill on to his colleague's head, or that he and the man on the extreme left were waving a greeting to each other.

How the Bantu see posters

During an investigation carried out by the National Institute for Personnel Research (N I P R) into the perceptual ability of the Bantu, the question of the efficacy of safety posters used in industry was raised. The National Occupational Safety Association, which is concerned with the prevention of accidents in industry in this country and which makes extensive use of such posters, commissioned the Institute to investigate the matter.

Six safety posters were shown to a sample group of 270 Bantu employees and a trained Bantu scientist then interviewed the test subjects to find out how effectively the safety message had been conveyed by these posters.

The results were used by the N I P R to draw up certain principles for the design of effective safety posters:

- Posters must as far as possible depict one scene only and not a series, because the majority of Bantu employees are unable to associate the different scenes in a series with one another.
- Interpolation and reduction in size of figures as used, for example, to obtain an effect of depth in the illustration, should be avoided. Previous investigations have shown that the Bantu experiences considerable difficulty with depth perception in pictures.
- Colours and shapes should be carefully chosen, as these might have some symbolic meaning for the Bantu which could defeat the object of the poster. Red for instance is often seen as blood or fire.
- Any action depicted in the poster should be in accordance with the Bantu's traditions, otherwise he is likely to misinterpret it. For instance, a person receiving something should be shown holding out both hands, or the Bantu observer might think that he is handing over the object.

The N I P R has also established that even a clear caption cannot convey the message of a vague poster, though verbal explanation may help employees to understand it - especially illiterate employees.

— *National Institute for Personnel Research*

Fall-out on the decline

Since 1956, the C S I R has been taking regular measurements at various points in the Republic and South West Africa of the radio-active fall-out from nuclear bomb explosions. The measurements of monthly and also accumulated fall-out are recorded at the National Physical Research Laboratory (N P R L) and plotted on a graph.

Owing to the progressive decay of the radio-active fall-out which has already collected on the earth's surface and the cessation of nuclear tests in November 1962, there has been a decline in accumulated fall-out since January 1963. At the end of July the figure for accumulated fall-out was only 170 millicuries compared to 240 millicuries per square mile in January 1963.

In May and June this year, there was a slight

increase in the monthly fall-out, an unusual phenomenon for that time of the year especially in view of the fact that there were no nuclear bomb explosions.

In accordance with expectations, the monthly fall-out for the first few months of 1963 was higher than that for the corresponding period in 1962. This increased fall-out was the result of nuclear bomb explosions in the series of tests conducted during the period from May to November last year.

Measurements made in the last few years in South Africa indicate that the radio-activity from fall-out caused by nuclear bomb explosions is still less than 1 per cent of the background radio-activity from cosmic radiation and radio-active elements, like uranium and thorium. There will be a further reduction in fall-out now that the ban on nuclear bomb tests has come into force.

Underground measuring device

To locate possible sink-holes in the vicinity of important structures, extensive boring programmes have been launched, and a number of cavities have been penetrated. As it is important to know the size and locations of such cavities the National Physical Research Laboratory (N P R L) was requested to develop a measuring device which could be lowered into these bore-holes in order to ascertain the structure of the underground cavities.

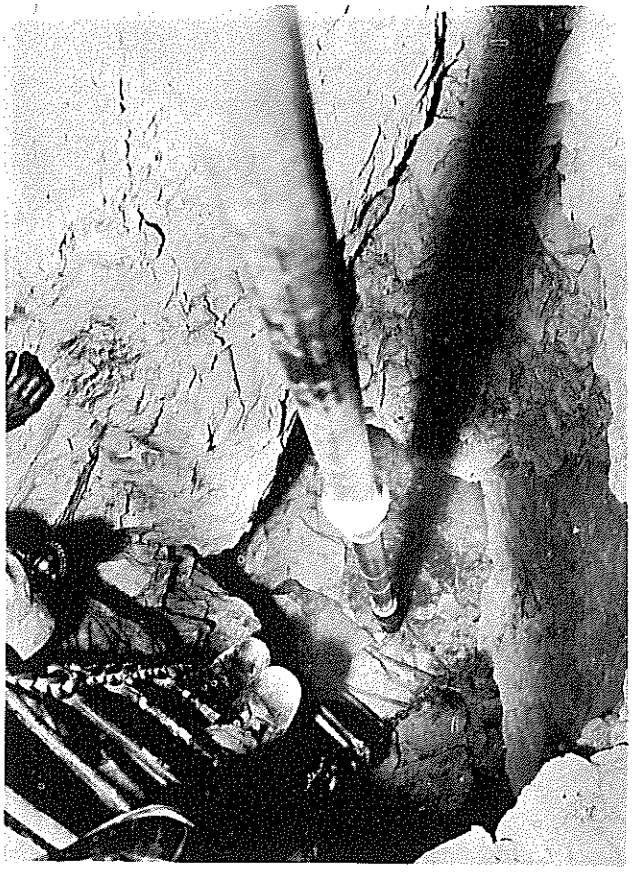
An acoustical method of measurement had already been developed for the purpose but it was found that only trained acoustics engineers could evaluate the data obtained.

In the course of tests made with the acoustic apparatus in a cave near Pretoria, a scientist illuminated the cave wall with a torch and this suggested the idea of experimenting with an optical method of measurement. Experimental equipment was built along these lines in the laboratory and subjected to exhaustive tests in the same cave. The results were most promising and a full-scale apparatus was built.

The apparatus functions in the following manner: a narrow, well-defined beam of light, free from stray light, is projected horizontally through a window in the apparatus. The light falling on the wall of the cavity has the appearance of a bright patch. A rotating mirror and a high quality lens behind a second window throw an image of the patch of light on to a photo-sensitive tube which generates an electrical impulse. By measuring the angle through which the mirror must turn in order to reflect the light image on the photo-tube, the distance between the apparatus and the patch of light on the cavity wall can be determined. Repeated measurements for different positions of the apparatus indicate the size of the cavity.

The shape of the cavity is automatically plotted by a recorder. This method is very rapid.

— National Physical Research Laboratory



The optical measuring device in action. It has been guided into a cavity at the end of two lowering tubes.

Road accidents soar

Road accidents are taking an increasing toll of lives in the Republic, despite efforts by the S A Road Safety Council and other bodies to make road users more safety-conscious. Almost 3,600 people lost their lives on the roads in 1962.

The National Institute for Road Research (N I R R) has been making surveys of road accidents and vehicle mileage in the Republic to obtain information about traffic conditions generally and the accident pattern. The object is to place exact data at the disposal of those authorities responsible for devising and enforcing preventive measures.

In a survey of the drivers of vehicles registered in Pretoria, the Institute established i.a. that more young White men under 21 and elderly Whites over 65 are involved in serious and fatal accidents per million vehicle miles, than drivers in the intermediate age group; that more Bantu men between 21 and 55 years are involved in serious and fatal accidents than Whites in the same age group; that fewer serious and fatal accidents are reported for White women drivers than men, and that motor scooter and motor cycle riders in Pretoria are in greater danger of becoming involved in accidents than motorists. These findings are probably true of all large urban areas.

To obtain the same type of data about vehicles in rural areas, the Institute has taken Lichtenburg and Potgietersrus as typical rural towns and is now making a similar survey among the drivers of vehicles registered in these towns.

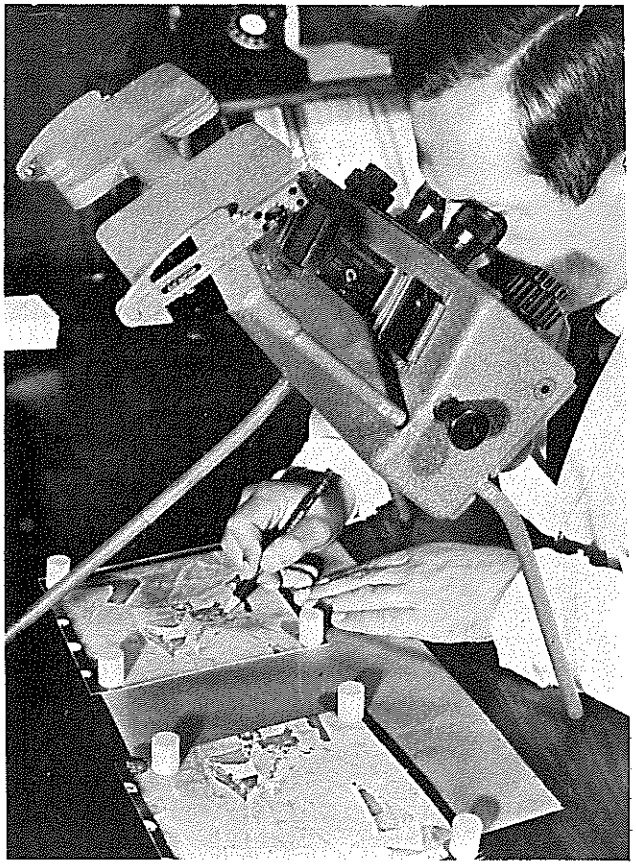
Statisticians in the Institute have calculated that licensed motor vehicles in the Republic (including scooters) covered a total of 9,246 million miles in 1960 as compared with 7,105 million miles in 1956. In 1960, buses covered an average of 15,000 miles each, cars and commercial vehicles 7,800 miles each and scooters, mopeds and motor cycles about 4,900 miles each.

The number of accidents in which people have been injured, mutilated or killed has increased alarmingly between 1956 and 1960. About thirteen accidents took place for every million miles travelled on our roads in 1960, compared with eleven in 1956. These accidents have claimed 22 per cent more lives per million vehicle miles than in 1956. The figure for fatal injuries was 0.33 for every million vehicle miles in 1960 as against 0.27 in 1956. Compared with the figure for the United Kingdom for the same year (0.103) and the U S A for 1962 (0.05), the incidence of fatal accidents in South Africa is disturbingly high.

Aerial photographs in road planning

Knowledge of the characteristics of the terrain through which a road is to run is indispensable in planning stable and economic road foundations. This information is normally obtained by digging holes, taking soil samples and testing these at various points along the planned route - an expensive and time-consuming method. The National Institute for Road Research (N I R R) in collaboration with provincial road departments and other interested parties has now developed a completely new technique for the purpose.

The essence of the technique is to study aerial photographs - readily available for almost every part of the country - with a stereoscope. From the



A research officer of the N I R R studies aerial photographs through a stereoscope to obtain a three-dimensional view of the terrain over which a new road is to be laid.

resulting three-dimensional picture of the area and samples of the types of soil found there, an engineering soil map is compiled enabling road engineers to determine the characteristics of the entire terrain through which the road will run. The maps show the various types of soil in the area, making it possible for road engineers to plan the most suitable route and to design the most economic foundations. At the same time, the engineer is able to plan prospecting for suitable road building materials on the route much more effectively, realizing further savings in time and money.

The Institute has demonstrated this technique at various points throughout the country. The technique has been employed with great success, for instance, in planning roads between Howick and Nottingham Road in Natal, between Adelaide and Bedford in the Cape Province and between Marienthal and Asab in South West Africa. Road authorities and engineers are making increasing use of the new technique.

The cost of this type of mapping is about R100 per mile of terrain. This is not excessive in the light of the total cost of the road and the eventual saving which results from the technique. No special equipment is required - merely two sets of aerial photographs and a simple stereoscope. The work demands special training, however, and the University of the Witwatersrand is now offering a special course.

During a symposium on the interpretation of aerial photographs recently held in Delft, a paper compiled with the assistance of the CSIR was delivered. It was well received and it appeared that few other countries have advanced so far in the technique of engineering soil mapping for road-laying.

New road engineering devices

A number of new instruments for testing road building materials and road structures have accrued from research in the National Institute for Road Research (NIRR).

One of these is the portable seismic apparatus for investigating foundation conditions for roads and concrete structures. It can also be used to advantage in prospecting for road building materials.

The technique used in the seismic apparatus consists mainly in exciting shock-waves at pre-determined distances from the apparatus. A plate on the ground is struck with a sledge-hammer and the resulting shock-wave moves downwards in the earth, follows the course of the various soil and rock strata and is detected again at a specific distance on the surface. By varying the distance between the point of excitation and the detector, the depths and physical characteristics of different soil-strata can be inferred from the time intervals between the hammer-blows and the detection of the shock-waves.

Accurate control of moisture content and density are of extreme importance in road building and the conventional methods for achieving this are unsatisfactory. The NIRR has therefore developed an instrument for rapidly and accurately determining the moisture content and density of the soil without damaging the road surface. This instrument, known as the Hidrodensimeter, consists of a surface probe which radiates the foundation with gamma rays and neutrons and an apparatus which measures the back-scattered rays. The intensity of these rays indicates within two minutes the density and, by a simple switch-over, the moisture content of the foundation.

This equipment results in considerable economies in road building. The apparatus is already being manufactured in South Africa and also being marketed overseas.

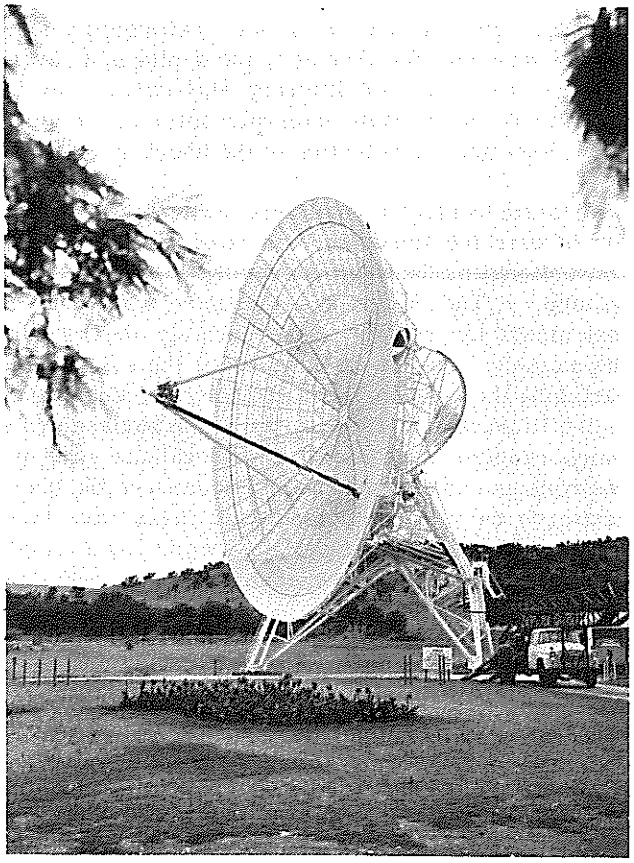
— National Institute for Road Research

Space research

The Minitrack Station at Hartebeesthoek forms an important link in the network of tracking and telemetry stations of the U S National Aeronautics and Space Administration for the near-satellite programme. The importance of this local Minitrack station stems largely from its geographical position and is illustrated by the fact that during one particular period, a quarter of all the data recorded at thirteen minitrack stations throughout the world, came from Hartebeesthoek.

The responsibilities of the station are continually increasing and a major expansion programme is in progress. This is centred around a new 40-ft steerable paraboloid antenna to be used primarily for receiving high information rate telemetry, Associated with this antenna will be a new operations building. An additional facility for which preparations are in progress, is an advanced tracking system which measures a satellite's range and rate of change of its range. This information, combined with angular data from the existing interferometer system, will make it possible to determine full orbital data in one pass.

Of particular interest to South Africa, were the "Telstar", "Relay" and "Syncom" communications satellite experiments. Satellites of this type may revolutionize long distance communications, and



The radio telescope at the Radio Space Research Station, Hartebeesthoek, operated by the C S I R on behalf of the U S National Aeronautics and Space Administration.

participation in these pioneering experiments provided valuable experience.

The Deep Space Station at Hartebeesthoek is also being extended. The operations building is being added to in order to accommodate new equipment.

The availability of the 85-ft radio telescope between missions made it possible to initiate a programme of radio astronomy. The microwave radiation from the local galaxy, at 960 Mc/s, was surveyed as a purely South African venture. For this purpose it was necessary to build specialized receiving equipment entirely different from that required for tracking radio signals from spacecraft. The resulting radiometer has an incremental measuring accuracy of about 0.5°K when used for the galactic plane survey and about 0.1° K when used for studying the Magellanic Clouds.

The lower ionosphere

A special study of the lower ionosphere commenced during the International Geophysical Year (1957-58). This is an attractive field of research in South Africa because considerably less interference from radio transmissions is experienced here than at many of the larger ionospheric research centres overseas.

The work continues and an electron density profile for the lower ionosphere can now be specified in accordance with experimental observations. Of particular interest is the conclusion that most of the absorption of radio waves, in the case of E layer reflections, occurs within a few kilometres of the point of reflection and not at considerably lower heights as was believed for a long time.

During the International Year of the Quiet Sun (1964-65) many of the observations made during the International Geophysical Year will be repeated in a more sophisticated and extended form. Measurements will be made of vertical absorption at a number of frequencies, of partial reflections from the lower regions of the ionosphere using high powered equipment, and of cross modulation occurring in the ionosphere as observed by the interaction of pulsed transmissions on two different frequencies. The resulting knowledge of the lower ionosphere should greatly facilitate the calculation of ionospheric absorption on communications circuits.

— *National Institute for Telecommunications Research*

Compost from municipal waste

An investigation on behalf of the Soil Conservation Board into the conversion of municipal wastes into compost has been completed and an extensive report issued.

The investigation was prompted by the fact that while a lack of organic material in South African soils is largely responsible for low productivity and soil erosion, large quantities of urban waste with a high organic content are daily being lost in garbage dumps. Efficient and hygienic conversion of garbage into compost would not only solve a major

problem for municipal authorities, but would make a valuable contribution towards restoring the organic content of humus-poor soils.

At the outset of the investigation it was realized that the old-fashioned compost cell system, with its attendant fly-breeding and odour nuisances, was not the best system for garbage conversion. With financial assistance from the Pretoria City Council a mechanized composting unit was developed, which could produce economically a hygienically acceptable product. It was found for instance that the virus of poliomyelitis, when inoculated into the plant, was completely eliminated during the process.

In the mechanical process, correct quantities of refuse and sewage sludge or nightsoil are combined, and the fine screenings from the crude refuse are incorporated in the end-product.

Oysters to sample sea-water

It is difficult to conduct studies of the pathogenic bacteria which reach the sea from outfalls of sewage because samples of seawater obtained for analysis are not necessarily representative. Pathogenic bacteria are not present in large numbers, so that they are very likely to be missed in the small samples usually analyzed.

Experiments indicated, however, that integrated samples from a specific area could be obtained by using oysters, which sample the water in the area more or less continuously. Oysters filter large quantities of water per day to obtain their food, and bacteria are retained by them with small quantities of organic debris.

The possibility of finding pathogens within these filter feeders is therefore likely to be high, and this sampling technique could be employed to advantage by coastal authorities for monitoring the bacteriological content of bathing waters.

Stabilization ponds

A national survey conducted in 1958 revealed that many of the smaller communities urgently sought an economic solution to their sanitation problems, and that the high cost of installing and maintaining sewerage works is a factor militating against the adoption of water-borne sewerage systems.

An investigation carried out by the Sewerage and Sanitation Research Group of the C S I R indicated that a stabilization-pond system could provide an economic method for treatment of sewage. This system involves introduction of the raw sewage into a primary pond and the continuous passage of effluent from this pond through a further series of ponds.

Purification is effected through the action of various forms of fauna and flora, and the result is a well stabilized final effluent. Odour and aesthetic aspects of the system proved satisfactory. The following factors were investigated and reported on: the influence of climatic conditions, rate of sludge accumulation, evaporation and seepage, design criteria and maintenance requirements for the pond-systems.

— *National Institute for Water Research*

Medical research

Introduction

The C S I R has not established a national institute for medical research but supports research in the medical sciences in the following way:

- by awarding ad hoc grants to individual scientists;
- by setting up units, groups and projects in collaboration with university medical schools and other institutes such as the S A Institute for Medical Research and the Veterinary Research Institute at Onderstepoort.

Units are normally established under the direction of a scientist who has made an outstanding name for himself in a particular field, whereas medical research groups consist of individual researchers of more or less equal status working on a common problem.

For the financial year 1963/64 the C S I R allocated some R380,000 for medical research; it also administered a further allocation of R263,000 for pneumoconiosis research provided by the Transvaal and Orange Free State Chamber of Mines and the State. In addition, grants from the U S Public Health Service for amoebiasis research, from the Transvaal Provincial Administration for bilharzia research and from the Transvaal, Natal and Orange Free State Provincial Administrations for research on death associated with aneasthesia and surgery were administered through the C S I R.

The following illustrates the work done by medical units and groups supported by the C S I R.

Acute respiratory failure

The Cardio-Pulmonary Unit has made an intensive study of lung function over the years. Wherever possible, it has related lung function to practical problems of clinical medicine.

Effort is directed mainly towards studying the passage of oxygen from the respired air into the blood, and the passage of waste carbon dioxide from the blood through the lung to the expired air. Also of importance is the blowing off of water vapour, one of the mechanisms of body heat loss, and the amount of work that the breathing muscles perform in the act of breathing. When any of these functions fails, bedside examination and laboratory tests can pinpoint the fault.

Failure of lung function may be unassociated with disease of the lung itself. For example, one of the commonest factors responsible for severe and fatal lung failure is obesity, which mechanically impedes the normal lung.

In the course of the Cardio-Pulmonary Unit's studies of respiratory failure, it was observed that during failure, the mouth temperature may remain normal but the body temperature taken rectally may rise abruptly in a few hours to catastrophically high levels such as 108° F and above. Many cases of death following chest surgery, surgery in the obese, or other illness in the obese, have clearly been due to the excessive body temperature, unmeasurable by mouth, associated with acute respiratory failure. The Unit has studied the various factors that might be responsible for this strange phenomenon.

High body temperature in these cases was found to be not entirely due to infection; it occurred especially in obese persons, in persons nursed in overheated wards or operating theatres, covered with blankets and other coverings so that their only important source of heat loss was via the lungs through the mouth.

The exact cause of these catastrophic rises in temperature has not yet been defined, but experience has shown that in such cases artificial cooling saves patients from certain death.

The technique of artificial cooling with the patient in the nude covered by wet sheets under an electric fan and the administration of iced water by rectum, appears contrary to the traditional care of patients who are very ill. But it has been clearly shown that if the temperature is brought down by these active measures in a matter of an hour, recovery at least from acute respiratory failure is the rule.

The Unit continues in its attempts to elucidate the cause of this highly dangerous phenomenon. The importance of air-conditioning in operating theatres has been demonstrated as a result of its researches. A special ward in which air-conditioning is an important structural feature has been established at the Johannesburg General Hospital for the treatment of cases of acute respiratory failure.

— *Cardio-Pulmonary Unit*
University of the Witwatersrand

Sun damage to the skin

Much progress has been made towards the understanding of sun damage to the human skin. Studies on sun-sensitivity in nutritional disease and porphyria, both common disorders in South Africa, have revealed interesting new facts about the chemistry of these conditions. Exposure to heat can cause excessive sweating which results in disabling disorders of the body. These are being studied extensively in relation to underground conditions in the mines. The first complete apparatus for the accurate measurement of ultraviolet radiation applied to human skin has been set up, and is yielding results. During the year a drug was found which relieves certain abnormal reactions to sun exposure.

— *Photobiology Research Group*

Artificial heart valve

A distinct break-through in heart surgery has been the development of artificial heart valves made of plastic. It is probable that these will be available in the near future to replace the worn-out, diseased heart valves which so frequently induce chronic ill-health or cause death.

The University of Cape Town lenticular prosthesis for replacing diseased heart valves is a new advance in this field. This exciting work has already resulted in the saving of lives, though a great deal has still to be learned in the laboratory with animals and testing machines before the valves can be of general use. The encouraging preliminary results have, however, evoked world-wide interest, for they place heart surgery on the threshold of a new era.

— *Cardiovascular-Pulmonary Research Group, University of Cape Town*

Work capacity

Normal work capacity standards for male subjects have been established by using four submaximal work loads, from which the maximal work capacity or oxygen uptake can be estimated. The technique used was that described by Astrand, and consists of the measurement of pulse rate, oxygen uptake and ventilation after the subject has reached a steady state of exercise.

Customarily the maximum oxygen uptake or working capacity is related to body weight, body surface area and age. However, it was found that heart and lung areas measured from the conventional chest X-ray allowed a more accurate estimation of maximum work capacity, when these measurements were related to body weight. A more accurate estimation of work capacity reduces the range of maximum oxygen uptake in normal subjects and allows an earlier diagnosis of disability. In addition, increases in heart and lung areas can be associated with heart and lung diseases and emphasize the differences between normality and abnormality.

— *Pneumoconiosis Research Unit*

Protein metabolism

Studies on children with kwashiorkor confirm that mortality is still high in the absence of treatment, and that even in the milder form of protein/calorie malnutrition, susceptibility to many types of bacterial invasion is greatly increased.

Many deaths among children attributed in the past to gastro-enteritis or pneumonia are due largely to protein/calorie deficiencies which are widely prevalent in under-privileged urban communities. Turnover studies with radio-active labelled albumin have shown how the body reacts to protein depletion and protein repletion, and have established that reserves of protein stored in the body are small.

— *Clinical Nutrition Research Unit, University of Cape Town*

The heart in health and disease

The energy utilized for the extrinsic work of contracting the myocardium is produced by the enzymatic degradation of foodstuffs to carbon dioxide and water. The main cardiac fuels are fatty acids (67%) and carbohydrates (35%). Measurement of the extraction of substrates by the heart is being employed by the Degenerative Diseases Research Group for obtaining information on possible alterations in cardiac metabolism in man or in intact animals. Extraction of substrates may reflect their fate in the cell and can thus be utilized in the investigation of intermediary metabolism.

Basic studies are being pursued in which either isolated heart tissue is perfused, utilizing a beating rat heart preparation in a closed perfusion system, or sliced tissue is incubated with a variety of chemicals.

When C^{14} labelled substances such as glucose are used, the metabolism of the heart is studied by observing the fate of the C^{14} (determined by scintillation techniques). The production and utilization of the energy producing substances, namely fatty acids, pyruvates and lactates, are determined by enzymatic means and the levels of these compounds measured in the heart tissue and in the perfusate. Such methods have defined the pathways of metabolism of carbohydrate and lipid in normal heart muscle of animals and to a limited extent in the heart muscle obtained from man during heart operations.

The effect of various changes in the biochemical environment of the heart on its utilization of energy can be studied. Thus a change in pH of the perfusing fluid (acidity or alkalinity) has been observed and there is wide scope for the observation of the effect of various hormones and other chemicals which may be added or subtracted from the perfusing fluid or the surrounding medium during incubation.

The mechanical effect of increasing the work load on the heart can also be studied both in relation to the changes in chemistry and concurrent changes in the electrophysiology.

The other aspect of the Group's approach has been the determination of the overall extraction of carbohydrates and lipid substrates from the blood by the human heart in situ.

— *Degenerative Diseases Research Group, University of Stellenbosch*

The effect of heavy metals

It has recently been found that cadmium ions can cause proteinuria in dogs and monkeys, as well as in man and rabbits. The quantity of protein in the urine is small and appears in each case to contain both low and normal molecular weight albumin. The low molecular fraction is being concentrated for amino acid analysis and for metabolic studies. This work should help towards an appreciation of why cadmium is so toxic when absorbed by workmen exposed to it in industry.

— *Protein Research Unit, University of Cape Town*

Industrial research

Introduction

As the scientific and technological research carried out in its national laboratories and institutes is not necessarily applicable to industrial or manufacturing problems, the C S I R engages also in industrial research, under contract, at the request of industrial firms or groups. It also takes part in fellowship schemes sponsored, or partly sponsored, by industry.

Experience has shown that the most effective way of serving a particular industry is by building up a team of experts in the relevant field of technology, in this way forming an industrial research unit like those which already serve the timber, ceramics and Bantu beer industries.

Units may develop later into industrial research institutes like those established by the C S I R to serve the paint, sugar milling, wool textile, leather and fishing industries. The C S I R shares support of these institutes with the industries concerned, on a R for R basis, but leaves their detailed operation largely to industry.

A brief review of the work of these institutes follows.

Raw sugar quality

Improving the quality of South African raw sugar is at present the main research assignment for the sugar industry as the quality of raw sugar for export is gaining more attention. The correlation between cane variety and sugar quality is being studied, as well as the influence of the quality of the cane, its age and deterioration after cutting.

Sugar milling control project

The efficiency of cane juice extraction by a milling tandem is dependent on many variables, the effects of which are not fully known. A long-term investigation into the process is therefore being undertaken. Data are supplied regularly by the different sugar mills, and these are studied with the aid of C S I R statisticians and an electronic computer.

— Sugar Milling Research Institute

Leather and Footwear

The Leather Industries Research Institute has continued its research programme in four interrelated fields of activity: processing and storage of hides and skins; use of wattle tannin; leather manufacture and related processes; and footwear production.

Perhaps the most significant development has been the invention of a novel range of impregnated fabrics for stiffening the heels of footwear. These are now being marketed by Messrs Liri Components, a company formed by the Footwear Manufacturers' Federation to market the Institute's 'Liripuff' materials some eight years ago. The new 'Liriplast' materials supplement the earlier 'Liripuff' range and are designed to suit mass production trends in the manufacture of modern footwear.

Tannery effluents

The Institute has collaborated with the Department of Water Affairs in seeking to achieve satisfactory disposal of tannery effluents. The publication overseas of the Institute's 'No Effluent' Rapid Sole Leather Tanning Process has roused wide interest.

Wattle

Tanning methods specially suitable for wattle tannin are still being developed by the Institute, and these are being publicised overseas in order to assist the South African Wattle Industry which is experiencing serious over-production. Several new chemical derivatives from wattle extract have been synthesized so that auxiliary uses can be investigated.

— Leather Industries Research Institute

Fungicides

Unsatisfactory performance of paints used in the building industry is frequently a result of attack by fungi. The use of fungicides as ingredients in paints is increasing, but no one material is effective against all fungi. Work at the Paint Industries Research Institute has established the value of certain organic tin compounds as components of emulsion paints.

Chalking and fading

The fading of titanium dioxide/phthalocyanine blue mixtures has been investigated, and also the connection between this fading and the way in which the pigment affects the rate of oxidation (deterioration by ageing) of a paint. The results of the investigation will be published shortly.

— *Paint Industries Research Institute*

Fish meal

Fish meal contains a certain amount of oxidized oil, and the effects of the oil on the nutritive value of the meal have been studied. It has been shown that such oils do not affect the retention of Vitamin A in chick livers, and also that they have considerable calorific value.

Formaldehyde, used as a preservative for fish that are to be processed into fish meal, has been shown to react with fish protein in such a way as to cause a reduction in the available lysine and in the biological value of the resulting fish meal.

The quality of F I R I fish flour has been improved. By counter-current extraction it has been possible to reduce the alcohol used to a small fraction of that needed for the batch system, and the cost of production has been substantially reduced. Acetaldehyde was found to form reddish compounds; by reducing the aldehyde content of the alcohol used the colour of the fish flour has been greatly improved. Further improvement has been achieved by counter-flow water washing of the press cake prior to drying.

— *Fishing Industry Research Institute*

Wool fibre

Scientists in the S A Wool Textile Research Institute have continued their basic studies on the wool fibre and have paid particular attention to the changes in length and diameter that occur during the processing of raw fibres to final yarn. In this context, mention may also be made of a theoretical study of yarn irregularity, and its application in a yarn survey being conducted throughout the wool textile industry.

Various aspects of the shrinkproofing of all-wool goods, especially blankets, by a number of recognized methods have received attention, as well as techniques for assessing the amount of dieldrin and DDT taken up during mothproofing treatments.

— *South African Wool Textile Research Institute*

International conferences attended by CSIR staff during 1963

Dr S. M. Naudé, President of the C S I R, attended the meeting of the executive of the *Scientific Council for Africa South of the Sahara* (C S A) in Paris, from 28 to 30 October.

The meeting of the *Seventh Scientific Committee on Antarctic Research* (S C A R) held in Cape Town from 23 to 27 September, was attended by Dr S. M. Naudé and Mr E. Boden, Head of Science Co-operation.

The *Tenth General Assembly of the International Council of Scientific Unions*, held in Vienna from 22 to 30 November, was attended by Dr S. M. Naudé, Mr J. A. King (South African Scientific Liaison Office, London), and Mr C. G. Hide (South African Scientific Liaison Office, Cologne).

Dr N. Stutterheim, Vice-President of the C S I R, attended the *United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas*, in Geneva from 4 to 30 February.

The General Assembly of the International Union of Pure and Applied Physics (I U P A P), in Warsaw from 20 to 23 September, was attended by Mr J. A. King (S A S L O, London).

The *First International Congress on Reprography*, held in Cologne from 14 to 19 October, was attended by Mr C. G. Hide (S A S L O, Cologne).

Mr D. R. Masson (South African Scientific Liaison Office, Washington), attended the meeting of the *American Association for the Advancement of Science* (A A A S) held during the last week of December 1962, in Philadelphia.

Mr D. R. Masson attended a meeting of the *Special Libraries Association*, Denver, from 9 to 13 June; a meeting of the *International Congress of Medical Libraries* in Washington D.C. from 16 to 22 June; and the *Antarctic Treaty Meeting on Telecommunications* held in the Department of State, Washington D.C. from 24 to 28 June. On 5 July Mr Masson was present at a one-day symposium on the shark hazard problem held by the *American Institute of Biological Sciences* (A I B S) Shark Panel in Philadelphia. From 8 to 12 July, Mr Masson attended the *Gordon Conference* on *Scientific Information Problems in Research* held in Hampton, New Hampshire.

A colloquium on *Scientific and Technical Documentation*, sponsored by the *Scientific and Medical Research Institutes of Moçambique*, was held in Lourenço Marques during August. It was attended by Mr D. G. Kingwill, Director of Information and Research Services and Mr A. Kirsipuu of the Language Services Section. Mr Kingwill read a paper on documentation in the Republic and Mr Kirsipuu delivered a series of lectures.

Mr D. G. Kingwill attended the general assembly of the *International Federation of Documentation* (F I D) in Stockholm from 30 September to 6 October. From 7 to 9 October Mr Kingwill was present at a conference on the *Communication of Scientific and Technical Knowledge to Industry*, sponsored by the Organization for Economic Co-operation and Development, Scandinavian Council for Applied Research, in Stockholm.

Dr P. C. Carman, Director of the National Chemical Research Laboratory, and Dr. J. R. Parrish of the same laboratory, attended the *Twenty-second Congress of the International Union of Pure and Applied Chemistry* (I U P A C), held in London from 10 to 17 July. Mr J. A. King (South African Scientific Liaison Office, London) attended the meeting of the I U P A C Secretary-General with National Secretaries, held during the above conference.

Dr H. M. Schwartz, of the National Chemical Research Laboratory, attended the *Central African Scientific and Medical Congress* in Salisbury during August.

The *Spring Meeting of the Building Materials Section* of the *British Ceramic Society*, held in Northern Italy from 31 March to 7 April, was attended by Mr R. O. Heckroodt of the National Chemical Research Laboratory. The *Second Joint Meeting of the Basic Science Section* of the *British Ceramic Society* and the *Netherlands Ceramic Society*, at Noordwijk-Aan-Zee from 13 to 17 May, was also attended by Mr Heckroodt, as well as the *International Clay Conference* at Stockholm from 12 to 16 August.

Mr G. K. Nelson, of the National Institute for Personnel Research, attended the *Seventeenth International Congress of Psychology* in Washington, D.C., from 20 to 26 August and the *Annual Congress of the American Psychological Association*, Philadelphia, from 29 August to 4 September. At both congresses Mr Nelson gave an extempore ten-minute talk.

The *Central African Scientific and Medical Congress* in Lusaka, Northern Rhodesia, held from 16 to 30 August, was attended by Mr. R. D. Griesel of the National Institute for Personnel Research who read a paper by G. K. Nelson entitled *The electroencephalogram in sequelae of kwashiorkor and other diseases in Africans.*

Dr F. J. Hewitt, Director, National Institute for Telecommunications Research, attended the *Fourteenth General Assembly of the International Scientific Radio Union* (U R S I), in Tokyo, Japan, from 9 to 20 September 1963.

Mr G. D. Nicholson, of the National Institute for Telecommunications Research, attended the *Fourth International Space Science Symposium* and the *Sixth Plenary Meeting of the Committee on Space Research* (C O S P A R), in Warsaw, Poland, from 3 to 11 June 1963.

The *Third International Mining Congress* held at Salzburg from 15 to 21 September was attended by Dr H. G. Denkhaus, Director of the National Mechanical Engineering Research Institute. Dr Denkhaus read a paper by Mr J. P. G. Pretorius of the C S I R entitled *The collection and analysis of rockburst data from some deep-level gold mines in South Africa.* On 27 and 28 September, Dr Denkhaus was present at the *Fourteenth Colloquium of the International Society of Rock Mechanics.* The *Fifth Conference of the International Bureau of Rock Mechanics* was held at Leipzig during the period 4 to 10 November. At this conference, Dr Denkhaus read a paper entitled *Strength of rock material and rock systems.*

A conference on *Wind Loads on Structures* held at Teddington, Middlesex, from 26 to 28 June, was attended by Mr V. A. L. Chasteau of the National Mechanical Engineering Research Institute.

Mr E. Hoek, of the National Mechanical Engineering Research Institute, was present at the *Spring Meeting of the Society for Experimental Stress Analysis* held at Seattle, Washington, from 8 to 10 May. Mr Hoek read a note entitled *Rock mechanics research in South Africa*, at the *International Conference on the State of Stress in the Earth's Crust*, held from 12 to 13 June in Santa Monica, California.

The *Joint International Conference on Creep* was held in London from 30 September to 4 October. It was attended by Mr C. J. van Lamp of the National Mechanical Engineering Research Institute.

Dr F. W. Quass, Director of the National Nutrition Research Institute, and Mr J. P. de Wit of the same Institute, attended the *Food and Agriculture Organization (F A O) Congress* in Washington D.C., U.S.A., during the period 4 to 18 June.

Mr D. J. de Lange and Dr A. le R. van der Merwe, of the National Nutrition Research Institute, were present at the *Sixth International Nutrition Congress* which was sponsored by the *International Union of Nutrition Sciences* in Edinburgh, Scotland from 9 to 15 August.

The *Fourth Annual Federation Meeting* sponsored by the *Federation of American Societies for Experimental Biology*, at Atlantic City, New Jersey from 16 to 20 April, was attended by Dr J. J. Theron of the National Nutrition Research Institute.

Mr C. P. Joubert of the National Nutrition Research Institute attended a *Symposium on the Biology of Survival*, arranged by the *Zoological Society, the Physiological Society*, and the *Society for the Study of Human Biology*, at Regent's Park, London on 7 and 8 May. Mr Joubert also attended meetings arranged by the Laboratory Animal Centre.

Dr A. J. Burger, of the National Physical Research Laboratory, attended the General Assembly of the *International Union of Geodesy and Geophysics* in Berkeley, California from 19 to 31 August. Dr Burger read a paper entitled *The origin of the Vredefort Ring Structure in the light of new isotopic data.* The authors of the paper were L. O. Nicolaysen, A. J. Burger, and C. B. van Niekerk.

The *Sixth Assembly and International Congress, International Union of Crystallography*, held in Rome from 9 to 18 September was attended by Dr G. Gafner of the National Physical Research Laboratory. Dr Gafner presented a paper: *The determination of interatomic interaction potentials from known crystal structures.*

Dr. E. C. Halliday of the National Physical Research Laboratory attended the following:

General Assembly of the International Union of Geodesy and Geophysics, held in Berkeley, California from 19 to 31 August 1963.

Symposium on Air Pollution of the *American Chemical Society Meeting*, in New York from 12 to 13 September.

Annual Conference of the National Society for Clean Air, Scarborough, England from 9 to 11 October.

Expert Committee on Air Pollution at the World Health Organization (W H O) Conference, Geneva, from 15 to 21 October.

The *International Symposium on the Dynamics of Large-scale Processes*, sponsored by the *International Commission for Dynamic Meteorology* of the *International Union of Geodesy and Geophysics*, was held from 27 August to 12 September, at the National Center for Atmospheric Research, Boulder, Colorado. Dr A. P. Burger, Director of the National Research Institute for Mathematical Sciences, read a paper on *Initial value problems in baroclinic flow* at the Symposium. Dr Burger's journey was supported by the *International Council of Scientific Unions.*

Industrial research institutes

Dr D. P. Veldsman, Director of the South African Wool Textile Research Institute (S A W T R I), attended the *Hanover Textile Machinery Exhibition* from 22 September to 1 October and then proceeded to Melbourne, Australia, for a meeting of the *Wool Textile Research Committee of the International Wool Secretariate* on 15 October 1963.

Medical research units

Dr R. Elsdon-Dew, Director of the Amoebiasis Research Unit, attended the *New York Academy of Sciences Symposium* on *Immunological aspects of the host-parasite relationship* from 23 to 25 April, and on 8 May delivered the *Theobald Smith Memorial Lecture* to the *New York Society of Tropical Medicine.* His trip was sponsored by the William Hale Harkness Foundation. From 1 to 11 September, Dr Elsdon-Dew attended the *Seventh International Congress on Tropical Medicine and Malaria* in Rio de Janeiro.

Dr M. Nellen, Chairman of the South African Cardiac Association, represented South Africa and the Cardiovascular-Pulmonary Research Group at the *Third World Congress of the International Society of Cardiology* in Mexico City, from 7 to 10 October 1962. His paper was on the effects of the vasoactive drugs and summarized work done in the Cardiac Clinic at Groote Schuur Hospital, Cape Town, during the previous five years.

The Director of the Clinical Nutrition Research Unit, Dr J. F. Brock, attended an *International Symposium* arranged by the *Ciba Foundation* in London from 26 to 29 November 1962, on *The Future of Man.* The report has been published: *Man and His Future*, London, J. and A. Churchill, 1963.

Several members of the Clinical Nutrition Research Unit attended the *Annual Congress of the Nutrition Society of Southern Africa* in Durban, from 17 to 19 April.

Dr L. J. A. Loewenthal, of the Photobiology Research Group, attended the *Seventh International Congress of Tropical Medicine and Malaria* in Rio de Janeiro from 1 to 12 September and delivered a paper in the section on Tropical Physiology. Dr Loewenthal thereafter attended conferences in Washington from 15 to 20 September, with the Research and Development Command of the United States Armed Forces.

Members of the Photobiology Research Group participated in the *Porphyria Congress* arranged in Cape Town in September.

The South African Inventions Development Corporation

First annual report

DIRECTORS:

Dr S. M. Naudé (Chairman)
Mr G. S. J. Kuschke
Mr D. Lion-Cachet
Dr N. Stutterheim (Alternate: Mr D. G. Kingwill)
Dr R. L. Straszacker

OFFICERS:

Manager: Mr A. M. Schady
Assistant Manager: Mr E. W. Fogg

AUDITORS:

Messrs Hoek, Wiehahn & Cross

BANKERS:

Volkskas

HEAD OFFICE:

Administration Building,
Scientia,
PRETORIA.

P.O. Box 395,
PRETORIA.
11th November, 1963.

The Hon. Dr. N. Diederichs,
Minister of Economic Affairs,
Paul Hof,
Minnaar Street,
PRETORIA.

Sir,

I have pleasure in presenting to you the Directors' Report, together with the statement of accounts and auditors' report for the period 8th August, 1962, to 28th February, 1963.

I have the honour to be,
Sir,
Your obedient servant,

S. M. NAUDÉ
Chairman: South African Inventions Development Corporation

Directors' report to shareholders

Your Directors submit herewith the Corporation's Balance Sheet and Statement of Income and Expenditure for the period 8th August, 1962, to 28th February, 1963, including the report of the Corporation's Auditors.

Following proclamation of the Inventions Development Act on the 31st March, 1962, the Corporation commenced operations on the 8th August, 1962. An agreement was reached with the CSIR effective from the latter date, whereby the Corporation would take over the administration of the Council's existing portfolio of inventions. In return for this service, the Council would pay over to the Corporation such royalties as it may receive from licence agreements relating to these inventions. In order to facilitate the changeover, the agreement also provided for the pro rata apportioning of expenditure on these inventions during CSIR's financial year ending 31st March, 1963, in accordance with the royalty income received by the two organizations during the period 1st March, 1962, to 28th February, 1963.

In terms of this agreement, royalties received by the Council totalled R62,425.78 and by the Corporation R16,331.51, during the period 1st March, 1962, to 28th February, 1963. Applying this to the total expenditure of R78,757.29 incurred by CSIR on the administration and development of inventions for the period 1st April, 1962, to 31st March, 1963, the Council's share of this expenditure was assessed at R58,862.24 and the Corporation's share at R15,399.26. In addition, expenditure of R1,210 was incurred by the Corporation, resulting in a net loss of R278 as shown by the Income and Expenditure Account. The accounting procedures for the current year will be considerably simplified as all new expenditure on invention development for the current financial year will be to the account of the Corporation.

Royalty income for the current year is likely to be seriously reduced and a loss must be anticipated. When the Corporation was established, it was anticipated that a reduction in the royalty income from inventions presently held by the Corporation would occur in time. It is unfortunate that this set-back has occurred so early in the history of the Corporation,

particularly as royalty income on the same inventions formerly held by the Council has averaged over R100,000 p.a. during the last five years. Nevertheless, these fluctuations in income are due to factors over which the Corporation has no control and are inherent in the nature of these operations.

Your Board has considered the advisability of drastically reducing its already very modest expenditure on the further development of inventions offered to the Corporation. As this expenditure is in the nature of an investment, the Board has been reluctant to do so and has decided to meet the expected shortfall in the current year from its capital resources. No early uptrend in income from inventions is expected and the basic problem of financing at an adequate level essential work on invention development from royalty income remains unsolved. In the long term, the Board will have no alternative but to reduce operations to a level in line with the low level of royalty income expected, unless additional financial support can be obtained.

In this respect it is necessary to face up to the inherent difficulties associated with operating a business of this nature. Firstly, the Corporation has no control over the quality of its "raw material", its freedom of action being limited to the selection from the many propositions submitted to it, of those inventions deemed to be novel and of commercial significance. Experience has shown that only a small percentage of inventions are ever commercialized, nevertheless all propositions must be examined to a greater or lesser extent to select the worthwhile ones. This not-inconsiderable expenditure on screening all propositions must be carried by the small percentage of successfully licensed inventions that produce a significant revenue.

Furthermore, considerations of national interest require your Board to accept inventions with a limited income potential, despite the fact that the return to the Corporation might not justify this expenditure of effort.

Time lag

Of greater importance is the unavoidable time lag between conception of an invention and its eventual exploitation. This, coupled with the restricted lifetime of the patent, seriously reduces the pay-off time during which royalties can be earned.

Psychological and economic reasons tend to prevent royalties being increased to a level to take care of the short "pay-off" time. On the other hand, these basic limitations do not apply to the manufacturing licensee who during the period of the licence is able to build up assets and goodwill which will permit him to continue trading successfully, after the expiry of the patent monopoly. Because, and rightly so in the Board's opinion, the Act does not permit the Corporation itself to engage in manufacture, its income-earning potential is subject to inherent restrictions not applicable to companies in a position to make trading profits.

While your Board has deemed it vital to give some idea of the problems inherent in financing a patent licensing activity, it should be stressed that the value of the Corporation's work to the country should be the guiding factor in its operations. Firstly, it offers a means of channelling new research ideas into manufacturing industry, thus ensuring that the products of research are made available to the public. Over the last six years, the value of new products manufactured under licence from the patents now administered by the Corporation exceeds R12 million. Furthermore, the patent policy originating with the CSIR and now continued by your Corporation resulted in the establishment of two new South African companies, both manufacturing instruments of a strategic nature, the bulk of which are being exported.

In cases where local manufacture is not feasible, the protection of foreign patents can be utilized to export South African scientific "know-how" by way of overseas licensees. While the benefits from these operations are not to be compared with local manufacture, such licences do ensure some return on the initial research investment, and improve the Republic's bargaining position at the same time as affording recognition for the country's progress in science and technology.

Thus, while your Board considers that there will be little disagreement with the value of the Corporation's services to the country, the nature of its operations are such that it is unlikely to be in a position to fulfil the responsibilities given to it by Parliament, under the present method of financing. While your Board believes that the Corporation's direct expenses in terms of administration, litigation and patenting-costs can on average, be met from royalty income, some form of financial assistance will be required to cover essential investment on development work to take inventions to the stage where industry can consider their manufacture. In view of the situation outlined above it is considered that the logical source for such financial support should be the State.

During the period 8th August, 1962-28th February, 1963, one invention was licensed to a South African firm. Since the 28th February, a further two inventions have been licensed. These licence agreements however will not materially affect the Corporation's financial position.

Dr P. E. Rousseau resigned as a member of the Council for Scientific and Industrial Research with effect from 30th June, 1963, and automatically ceased to be a director of the Board of this Corporation. His valuable services to the Corporation are gratefully acknowledged. He was replaced by Dr R. L. Straszacker. In accordance with the terms of his appointment, Dr S. M. Naudé retired from the Board on the 8th August, 1963, but has been re-appointed for a further period of three years.

DIRECTOR: (Sgd) S. M. Naudé

DIRECTOR: (Sgd) R. L. Straszacker

11th November, 1963.

SOUTH AFRICAN INVENTIONS DEVELOPMENT CORPORATION

(Incorporated by Act No. 31 of 1962)

BALANCE SHEET AT 28th FEBRUARY, 1963

	R	R		R	R
SHARE CAPITAL:			REPRESENTED BY:		
Authorised		200,000	**Cash at Bank**		100,000
200,000 Ordinary Shares of R1 each	200,000		**Current Account:**		
Issued:			Council for Scientific and Industrial Research		932
100,000 Ordinary Shares of R1 each fully paid	100,000				100,932
Less: Excess of Expenditure over Income to 28th February, 1963		278			
		99,722			
Liabilities		1,210			
Creditors	1,210				
		100,932			

INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD 8th AUGUST, 1962 TO 28th FEBRUARY, 1963

EXPENSES	R	INCOME	R
Administration Expenses	4,681	Royalties Received	16,332
Directors Remuneration	560	Excess of Expenditure over Income	278
Development Grants	11,269		
Auditors Remuneration	100		
	16,610		16,610

NOTE: No provision has been made for possible foreign taxation.

SIGNED ON BEHALF OF THE BOARD OF DIRECTORS:

S. M. NAUDÉ
R. L. STRASZACKER
G. S. J. KUSCHKE
N. STUTTERHEIM

Auditor's report

We have examined the books, accounts and vouchers of the South African Inventions Development Corporation for the period 8th August, 1962 to 28th February, 1963.

In our opinion and according to information and the explanations given to us and as shown by the books of the Corporation the above Balance Sheet and Income and Expenditure Account give a true and fair view respectively, of the state of the Corporation's affairs at 28th February, 1963, and the Income and Expenditure for the period ended on that date.

HOEK, WIEHAHN & CROSS
Per: A. R. J. CROSS

REGISTERED ACCOUNTANTS AND AUDITORS

PRETORIA
6.11.1963.

Financial Statements and Appendix

STATEMENT No. 1

Balance Sheet as at 31st March, 1963

Liabilities				Assets			
1961-62			1962-63	1961-62			1962-63
R		R	R	R		R	R
	CAPITAL				FIXED ASSETS		
	Capital Fund — see Statement No. 2:			5,236,274	Land and Buildings (at cost) — see Statement No .2		5,893,467.19 (*a*)
5,832,206	Building and Reserve Capital Fund		6,334,885.98				
5,079,955	General Capital Fund		5,692,760.53	4,325,078	General Capital Account Assets (at cost) — see Statement No. 2		5,147,986.84
R10,912,161			R12,027,646.51	R9,561,352			R11,041,454.03
	CURRENT LIABILITIES				CURRENT ASSETS		
223,474	Advances received for— Investigations, tests and services		189,872.39	90,464	Investigations and Tests in Progress		161,120.92
495,460	Sundry Creditors—			676,731	Sundry Debtors		606,504.68
	Department of Commerce and Industries	47,349.67(*b*)		—	Unsatisfactory deliveries		26,564.70
	Other	405,909.56		49	Disallowances		135.64
				306,687	Research grants paid in advance		201,160.59
			453,259.23	1,490,400	Investments with Public Debt Commissioners		1,175,945.62
291,542	Provision for firm commitments on Running Expenses Account as at 31st March, 1963		428,834.50	57,591	Cash—		
260,637	Appropriation Account		183,584.36		(1) S.A. Reserve Bank—Current Account	27,227.25	
					(2) On Imprest Accounts	2,664.79	
					(3) On Deposit	40,418.77	
							70,310.81
1,271,113			1,255,550.48	2,621,922			2,241,742.96
R12,183,274(*c*)			R13,283,196.99	R12,183,274(*c*)			R13,283,196.99

(*a*) R5,893,467.19 for land and buildings does not include the value of the site donated by the Pretoria University to the Council, valued at R41,800 for transfer purposes.
(*b*) Unexpended balance of grant for research projects on behalf of Government Departments to be surrendered (see also Statements Nos. 2 and 3.)
(*c*) Excluding amounts i.r.o. S.A.B.S. as at 31.3.1962.

S. M. NAUDÉ
President

A. J. MILLER-SMIT
Secretary/Treasurer

PRETORIA, 2nd October, 1963.

The above Balance Sheet has been audited in accordance with the provisions of section 56 of the Exchequer and Audit Act, No. 23 of 1956, read with section 14(1) of the Scientific Research Council Act, No. 32 of 1962, and I certify that it is a true reflection of the accounts of the Council for Scientific and Industrial Research.

I. T. MEYER
Controller and Auditor-General.

PRETORIA, 27th December, 1963.

Capital Fund:
Statement of Transactions for the Year ended 31st March, 1963

STATEMENT No. 2

Expenditure					Receipts				
Details	Accepted Estimates	Totals as at 1 April 1962	1962–63 (net) expenditure	Totals as at 31 March, 1963	Details	Accepted Estimates	Totals as at 1 April, 1962	1962–63 (net) Income	Totals as at 31st March, 1963
	R	R	R	R		R	R	R	R
(A) *Building and Reserve Capital Account*					(A) *Building and Reserve Capital Fund*				
Land and Buildings	450,000	5,236,273.71	657,193.48	5,893,467.19(*a*)	(1) Parliamentary Grants	450,000	5,103,300.00	450,000.00	5,553,300.00
Balance Unexpended	—	595,932.67	(−)154,513.88	441,418.79	(2) Donations	—	67,619.23	—	67,619.23
					(3) Interest on Investments	—	504,950.34	52,679.60	557,629.94
					(4) Transfers from Appropriation Account	—	156,336.81	—	156,336.81
TOTALS	R450,000	R5,832,206 38	R502,679.60	R6,334,885.98	TOTALS	R450,000	R5,832,206.38	R502,679.60	R6,334,885.98
(B) *General Capital Account*					(B) *General Capital Fund*				
Furniture, Fittings and Office Equipment	24,700	354,227.89	28,874.73	383,102.62	(1) Parliamentary Grants	542,900	4,218,657.00	542,900.00(*b*)	4,761,557.00
Laboratory and Workshop Equipment	431,269	2,964,090.74	579,389.78	3,543,480.52	Statutory Objects... Research Projects for Government Departments	25,000(*c*)	—	16,175.44(*c*)	16,175.44
Equipment under Construction	107,517	346,180.84	78,186.48	424,367.32	(2) Donations	—	38,809.56	15,065.08	53,874.64
Stores on Hand	2,500	206,965.75	(−)2,343.37	204,622.38	(3) Revenue	35,441	198,395.52	38,664.85	237,060.37
Vehicles and Cycles	6,060	165,071.77	(−)3,535.00	161,536.77	(4) Transfers from Appropriation Account	—	624,093.08	—	624,093.08
Subsidized Cars (at cost less repayments)	—	114.00	1,826.65	1,940.65					
Books and Journals	31,295	277,909.48	40,509.27	318,418.75					
Prefabricated Structures	—	10,517.83	—	10,517.83					
Shares	—	—	100,000.00	100,000.00(*d*)					
Cost of Assets	603,341	4,325,078.30	822,908.54	5,147,986 84					
Balance Unexpended	—	754,876.86	(−)210,103.17	544,773.69					
TOTALS	R603,341	R5,079,955.16	R612,805.37	R5,692,760.53	TOTALS	R603,341	R5,079,955.16	R612,805.37	R5,692,760.53
TOTALS OF (A) AND (B)	R1,053,341	R10,912,161.54(*e*)	R1,115,484.97	R12,027,646.51	TOTALS OF (A) AND (B)	R1,053,341	R10,912,161.54(*e*)	R1,115,484.97	R12,027,646.51

NOTES.—(*a*) R5,893,467.19 for land and buildings does not include value of site donated by Pretoria University which was valued at R41,800 for transfer purposes.
(*b*) Parliamentary Grant (R462,900) increased by transfer of R80,000 from Running Expenses Account (Refer Statement No. 3—Note (*a*)).
(*c*) Parliamentary Grant (R10,600) increased by transfer of R14,400 from Runnning Expenses Account (Refer Statement No. 3—Note (*b*)). Balance of Grant (R8,824.56) surrendered on 12.6.63.
(*d*) Shares of the S.A. Inventions Development Corporation acquired in terms of Section 10(3) of Act 31 of 1962.
(*e*) Excluding amounts i.r.o. S.A.B.S. as at 31.3.62.

ALLOCATION OF UNEXPENDED FUNDS

(i) Firm commitments against Equipment Capital Fund (estimated)	R280,886.00
(ii) Held by Universities for purchase of capital equipment	31,723.27
(iii) Reserved for Capitalisation of equipment manufactured within the CSIR	80,000.00
(iv) Not committed at 31st March, 1963, but earmarked pending receipt of quotations or further investigations regarding suitability of equipment	152,164.42
	R544,773.69

Pretoria, 2nd October, 1963.

S. M. NAUDÉ
President

A. J. MILLER-SMIT
Secretary/Treasurer

STATEMENT No. 3

Running Expenses and Appropriation Accounts for the year ended 31st March, 1963

1961–62	Details	Accepted Estimates	1962–63	1961–62	Details	Accepted Estimates	1962–63
R		R	R	R		R	R
3,064,487	Salaries, Wages and Allowances	3,675,858	3,546,030.20		Parliamentary Grant:		
1,394,781	Consumable Stores and Services	1,576,864	1,323,974.47	3,741,400	Statutory Objects	3,894,000(a)	3,894,000.00
211,228	Subsistence and Transport	250,000	249,268.67	305,527	Research Projects for Government Departments	463,000(b)	424,474.89(b)
705,056	General Expenses	890,000	731,543.31	994,274	Investigations, Tests and Services	1,580,543	1,307,670.48
392,107	Research Grants	602,510	401,159.87		Contributions towards:		
252,456	Subsidies: Industrial Research Institutes	274,359	254,369.77	4,000	Research Activities	—	17,960.00
				108,753	Royalties	101,159	62,981.53
				4,247	Publications	2,700	6,343.01
6,020,115		7,269,591	6,506,346.29	12,036	Sundry Revenue	—	9,257.61
611,319	*Less:* Charges for Internal Services and Running Expenses Capitalised in Equipment manufactured	729,010	756,322.66	394,528 396,210	Reimbursement of Cost of Capital Facilities Allocated from Appropriation Account in terms of Section 15 (4) of Act No. 32 of 1962	— 552,179	90,579.30(c) 552,178.90
5,408,796		6,540,581	5,750,023.63				
—	*Add:* Adjustment of previous years expenditure	—	3,003.23				
5,408,796		6,540,581	5,753,026.86				
552,179	Balance carried forward to Appropriation Account	53,000	612,418.86				
R5,960,975		R6,593,581	R6,365,445.72	R5,960,975		R6,593,581	R6,365,445.72
				167,903	Balance as at 1st April, 1962		260,637.23
	Allocation by Council to:			228,307	Provision for firm commitments as at 31st March, 1962		291,541.67
396,210	(1) Running Expenses Account (1962/63)		552,178.90				
			552,178.90				552,178.90
87,804	(2) Building and Reserve Capital Account		52,679.60				
291,542	(3) Provision for firm commitments at 31/3/63		428,834.50	552,179	Balance brought forward from Running Expenses Account		612,418.86
775,556				87,804	Interest on Investments for allocation to Building and Reserve Capital Account		52,679.60
260,637	Balance for allocation by Council in terms of section 15 (4) of Act No. 32 of 1962		183,584.36				
R1,036,193(*d*)			R1,217,277.36	R1,036,193 (d)			R1,217,277.36

NOTES:
(a) Parliamentary Grant (R3,974,000) reduced by transfer of R80,000 to Capital Fund (Refer Statement No. 2—note (b)).
(b) Parliamentary Grant (R647,500) reduced by transfer of R14,400 to Capital Fund (Refer Statement No. 2—note (c)). Balance of grant surrendered (R170,100 on 31/3/63 and R38,525.11 on 12/6/63).
(c) Cost of Capital Facilities (i.e. buildings, roads, etc.) at Hartebeesthoek which is by agreement fully recoverable from the National Aeronautical Space Administration (U.S.A.)
(d) Excluding amounts in respect of S.A.B.S. as at 31.3.62.

S. M. NAUDÉ
President

A. J. MILLER-SMIT
Secretary/Treasurer

Pretoria, 2nd October, 1963.

STATEMENT No. 4

CSIR Budget 1963/64
A. Running Expenditure

Activities	EXPENDITURE								FUNDS		
	Salaries	Supplies and Services	Subsistence and Transport	Scientific Services	Grants and Subsidies	General Expenses	LESS: Internal Recoveries	Total	Parliamentary Grant	Recoverable Expenditure	Carried forward from 1962/63
	R	R	R	R	R	R	R	R	R	R	R
CSIR Laboratories and Departments.....	4,392,408	1,213,654	285,141	196,954	—	754,771	763,633	6,079,295	3,674,253	2,352,042	53,000
Grants to Universities etc.....	145,676	11,882	14,804	1,400	463,742	—	—	637,504	610,047	27,457	—
Subsidies to Industrial Research Institutes....	—	—	—	—	287,800	—	—	287,800	287,800	—	—
TOTALS.....R	4,538,084	1,225,536	299,945	198,354	751,542	754,771	763,633	7,004,599	4,572,100	2,379,499	53,000

B. Capital Expenditure

Activities	EXPENDITURE										
	Books/ Journals	Technical Equipment	Furniture/Office Epuipment	Vehicles			Buildings	Total			
CSIR Laboratories and Departments.....	38,990	816,661	24,700	10,800			400,000	1,291,151	900,600	390,551	—
Grants to Universities, etc.....	100	83,650	—	—			—	83,750	83,750	—	—
TOTALS.....R	39,090	900,311	24,700	10,800			400,000	1,374,901	984,350	390,551	—
						GRAND TOTALS R		8,379,500	5,556,450	2,770,050	53,000

(A) Members of the Council for Scientific and Industrial Research (during 1963)

S. M. NAUDÉ, M.Sc. (Stell.), Ph.D. (Berlin), D.Sc.h.c. (Potchef.), D.Sc. h.c. (Rand.), LL.D. h.c. (Cape), F.R.S. (S.A.)	*President, C S I R.*
C. A. DU TOIT, M.Sc. (Stell.), Ph.D. (Cape), F.R.S. (S.A.)	*Professor of Zoology, University of Stellenbosch.*
P. J. DU TOIT, B.A. (Stell.), Dr. Phil. (Zurich), Dr. med. vet. (Berlin), D.Sc. h.c. (Cape), D.Sc. (Rand), Dr. Agric.Sci. h.c. (Stell.), Dr. Vet. Sci. h.c. (Utrecht), LL.D. h.c. (Glasgow), LL.D. h.c. (Rhodes), F.R.S.	*Scientific Adviser to C S I R and former President of the C S I R.*
B. GAIGHER, D.Sc. (Pret.)	*Chairman, Fuel Research Board and Standards Council. Member, Board of Trade and Industries.*
G. C. V. GRAHAM, B.Sc. (S.A.)	*Managing Director, Fine Wool Products of S.A. Limited.*
F. G. HILL, B.Sc. (Eng.) (Rand.), B.A. (Juris.) (Oxon.), M.I.M.E., M.I.M.M. (Lond.), M.S.A.I.M.M.	*Technical Manager and Consulting Engineer, Rand Mines Limited.*
S. F. OOSTHUIZEN, M.D. (Cape), D.Sc. (Pret.), D.Sc. h.c. (Natal), F.R.C.P. (Edin.), F.A.C.R. (U.S.A.), F.F.R. (Lond.)	*President of the South African Medical and Dental Council. Professor of Radiology, University of Pretoria.*
R. L. STRASZACKER, M.Sc. (Eng.) (Rand.), Dipl. Ing. and Dr. Ing. (Berlin-Charlottenburg), M.I.M.E., M.S.A.I.M.E.	*Chairman and Consulting Engineer, Escom and Member, Atomic Energy Board.*
H. J. VAN ECK, M.Sc. (Stell.), Dr.Ing. (Charlottenburg), LL.D. h.c. (Drexel Inst. of Tech., Phil. U.S.A.), LL.D. h.c. (Natal), LL.D. h.c. (Rand.), LL.D. h.c. (Cape), D.Com. h.c. (Stell.)	*Chairman and Managing Director of Industrial Development Corporation of South Africa Ltd.*
F. L. WARREN, D.Sc., Ph.D. (Lond.), A.R.C.S., D.I.C., F.R.I.C., F.R.S.A.	*Dean, Faculty of Science, University of Natal.*
J. E. WORSDALE, B.Sc. (Lond.), A.R.C.S., F.R.I.C.	*Director and Adviser, White's S.A. Portland Cement Co., Ltd.*

(Dr. T. ALTY's appointment terminated on 29th March, 1963, and that of Dr. P. E. ROUSSEAU on 30th June, 1963).

Secretary/Treasurer

A. J. MILLER-SMIT, B.A., M.Com.

MEMBERS OF THE EXECUTIVE COMMITTEE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (UNTIL 4TH OCTOBER, 1963)

Dr. S. M. Naudé (Chairman); Dr P. J. du Toit and Mr F. G. Hill (with Dr B. Gaigher, Prof. S. F. Oosthuizen and Prof. R. L. Straszacker as floating alternates to Dr du Toit and Mr Hill).

(B) Executive

CSIR COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

P.O. Box 395
Pretoria
Telephone 74–6011

Executive Division

President S. M. NAUDÉ, M.Sc., Ph.D., D.Sc., LL.D., F.R.S. (S.A.)

Vice-Presidents N. STUTTERHEIM, D.Sc., A.M.I.Chem. E., Hon. M. (S.A.) I.C.E.

E. J. Marais, D.Sc.

L. J. le Roux, M.Sc., B.Com., D.Sc.

W. H. Craib, M.D., LL.D. h.c., F.R.C.P. Medical Adviser (full-time associate)

Secretary/Treasurer Accountant, etc. see ADMINISTRATION SERVICES DEPARTMENT

(C) Administration

ASD ADMINISTRATIVE SERVICES DEPARTMENT
P.O. Box 395
Pretoria
Telephone 74–6011

Secretary/Treasurer A. J. MILLER-SMIT, B.A., M.Com.

Under Secretary/Treasurer (Finance) A. E. MAKIN, B.Com., A.C.I.S.

Under Secretary/Treasurer (General) J. H. Visagie, B.A., B.Com.

Staff and General Administration L. A. W. Skinner, B.Econ.

Accountant G. C. Breedt, B.A., B.Com.

Registry Mrs. M. M. du Plessis

(D) Estates

ESTATES DEPARTMENT,
CSIR
P.O. Box 395,
Pretoria
Telephone 74–6011

Head D. J. J. BISSCHOFF

Accommodation W. de Beer

Administration and security A. Kruger

Mechanical and Structural Maintenance P. J. Greeff

(E) Technical Services

TSD TECHNICAL SERVICES DEPARTMENT
P.O. Box 395
Pretoria
Telephone 74–6011

Director J. VAN DER STAAIJ

Administration J. H. BOSCH

Design Office	I. le Seuer
Electrician	S. J. Botes
Glass Blowing (NCRL)	D. M. Seymour
Graphic Arts	J. B. Kirstein
Instrument Makers	G. O'Grady, A. de Kleijn
Sheet Metal and Welding	P. J. Fourie
Stores	A. B. Groenewald
Transport	I. E. Badenhorst
Woodwork	F. Kolb

The Technical Services Department also maintains specialized workshops at six laboratory buildings on the C S I R site at Scientia, as well as an engineering design office at N B R I

(F) Information and Research Services

IRS INFORMATION AND RESEARCH SERVICES
P.O. Box 395
Pretoria
Telephone 74–6011

Director D. G. KINGWILL, M.Sc.

Administration J. SALES, A.I.B.A., A.C.C.S.

Industrial Economics	L. A. Beard, B.Com., M.B.A.
Industrial Research Development	R. G. Shuttleworth, Ph.D., F.R.I.C.
Information (Publishing and Language Services)	J. F. Herbst, B.A.
Library	(Miss) J. I. Greijbe, B.A., F.S.A.L.A.
Publicity	A. C. Papageorge, B.A.
Public Relations	D. R. Maude
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