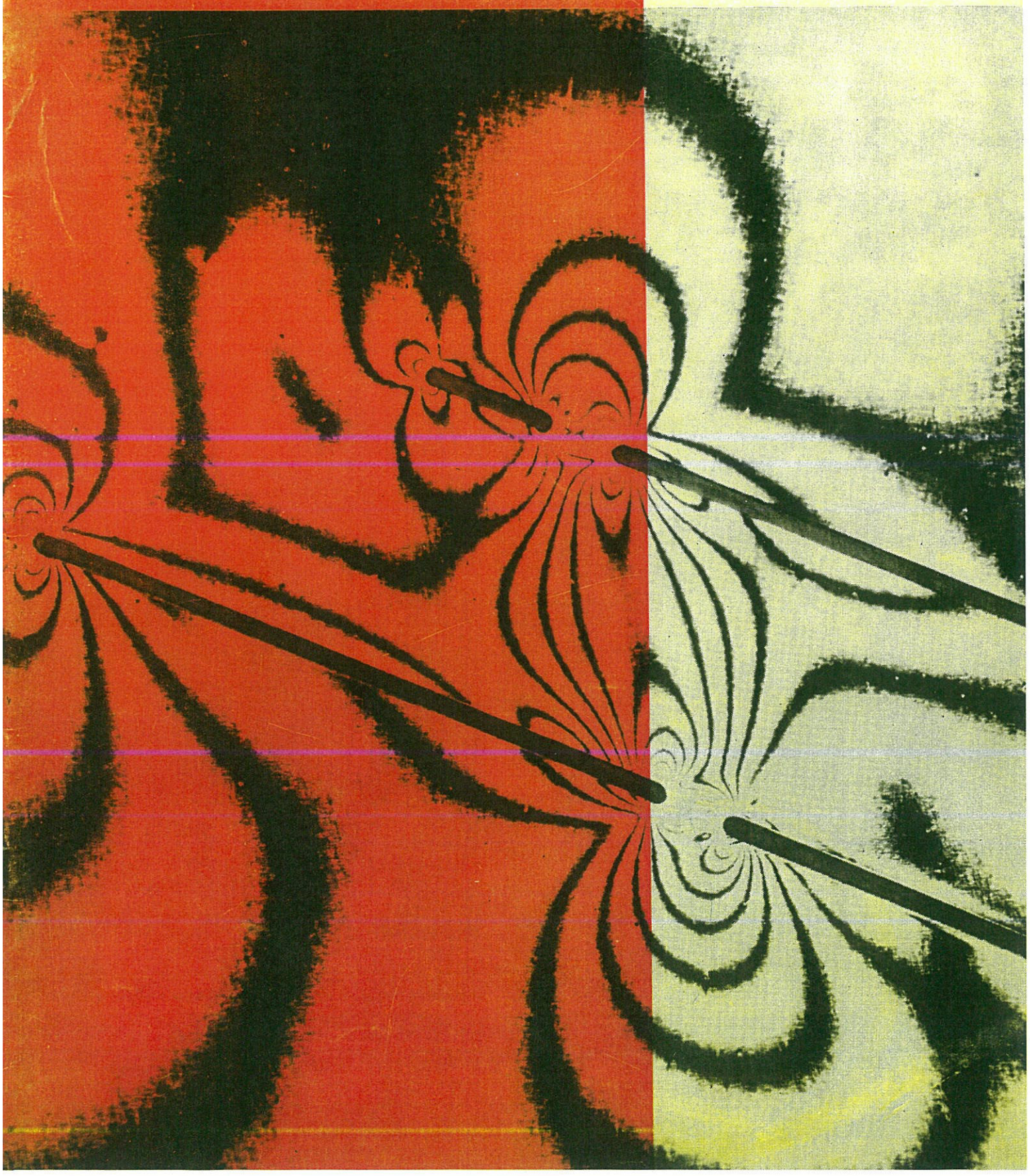
CSIR

annual report 1965



CSIR Periodical Publications

Scientiae	Monthly. Recent events at the C S I R; feature articles on scientific topics: comment on topics of current scientific interest. Gratis
Research Review	Six-monthly list of articles and reports published under the auspices of the C S I R, with author summaries where available. Gratis
TI (technical information for industry)	Monthly. Notes and short articles on aspects of C S I R research with industrial application. Gratis
C S I R Library Information and Accessions	Monthly. News and views on information and documentation; recent translations by the C S I R Information Division; latest accessions to the C S I R Library. Gratis
Psychologia Africana	Journal of the National Institute for Personnel Research, C S I R. R3.00 for three issues
N B R I Information Sheets	Every two months. Brief questions and answers on technical and practical problems related to building. Gratis
Houtim	Quarterly. Technical news for the timber industry, compiled by the C S I R Timber Unit. Gratis
Via	March and September. Summarized reports (mostly of an interim nature) by the National Institute for Road Research, C S I R. Gratis
Register of current scientific research at South African universities	Annual Gratis
Annual Report	Gratis
Radio-propagation predictions for Southern Africa	Monthly. Issued by the National Institute for Telecommunications Research. Gratis
Monthly bulletin of ionospheric characteristics observed at Johannesburg and Cape Town	Issued by the National Institute for Telecommunications Research. Gratis
Enquiries	The Distributor of Publications, C S I R, P O Box 395, Pretoria Telephone: 74-6011 Extension 435

P.O. Box 395
PRETORIA
1 Jan. 1966

Sir,

I have pleasure in presenting to you the Twenty-first Annual Report of the Council for Scientific and Industrial Research. This Report covers the period 1 *January*, 1965 *to* 31 *December*, 1965.

Balance sheets and statements of income and expenditure for the financial year ended 31 *March*, 1965, *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. Adv. J. F. W. Haak
Minister of Planning
Private Bag 319
PRETORIA

C S I R

TWENTY-FIRST ANNUAL REPORT 1965

Ook in Afrikaans verkrygbaar

Council for Scientific and Industrial Research

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General review

Introduction

During the twenty years since the establishment of the C S I R, South Africa has taken its place among the scientifically orientated countries of the world. The C S I R has contributed its share to this development in carrying out its obligations under the Scientific Research Council Act of 1945, as amended. The objects of the C S I R as stated in the Act are:

(*a*) to promote the utilization of the natural resources of the Republic and the productive capacity of its population;

(*b*) to seek new knowledge through research, investigations and tests in such a manner as it may deem advisable, mainly with the object of improving technical processes, methods and services and industrial products, and of developing processes and methods which may promote the expansion of existing, or the establishment of new industries or the better utilization of raw materials and waste products;

(*c*) to undertake or aid scientific research in connection with such matters as the Minister may refer to it for investigation;

(d) to provide and control facilities for the testing and calibration of precision instruments, gauges and apparatus, the determination of their degree of accuracy and the issue of certificates in regard thereto;

(*e*) to provide and control facilities for research in connection with standardization in industry and commerce;

(*f*) to maintain primary scientific standards of physical quantities for the Republic and to provide for their comparison with international standards from time to time;

(*g*) to foster the training of research workers and to establish and award research bursaries;

(*h*) to encourage and promote scientific research generally, and to contribute thereto financially;

(*i*) to foster, recognize and aid the establishment of associations of persons engaged in industry for the purpose of carrying out scientific industrial research, and to co-operate with and, subject to the conditions approved by the Minister, make grants to such established or recognized associations;

(*j*) to establish and control facilities for the collection and dissemination of information in connection with scientific and technical matters;

(*k*) to act as a liaison between the Republic and other countries in matters relating to scientific and industrial research.

National research laboratories and institutes

Twenty years ago the C S I R was a small organization accommodated in cramped offices in the S A Mint Building. Today it controls thirteen national laboratories and institutes, several research units and other services.

The functions of the national research laboratories and institutes, as well as some examples of the progress made with research projects during the past year are briefly described elsewhere in this report.

Since its inception the C S I R has also helped to promote research at universities. A scheme of senior scholarships, assistantships, post-graduate study bursaries, and grants for special equipment and running expences was immediately inaugurated for the benefit of research at the universities.

Research at universities

The experience of the C S I R with research units at the universities has shown very clearly that small units, built around outstanding persons in university departments without becoming permanent organizations, offer excellent means of developing research within the universities in a manner which conforms entirely with academic traditions.

A list of research units and groups supported by the C S I R appears on page 33.

At first, the universities were not able to utilize the whole sum of money made available for this purpose by the C S I R and, until 1956, the demand kept pace more or less with the availability of funds. The annual increase of the State grant to the C S I R, however, was then pegged at 7½ per cent, so that the C S I R was obliged to divide its budget into various sections and to allow each section an annual increase of only 7½ per cent. The need for research funds at the universities consequently increased at a far more rapid rate than the funds the C S I R had available for this purpose.

Through the intervention of Dr H. O. Mönnig, the Prime Minister's Scientific Adviser, a supplementary amount of R246,000 was granted to the C S I R for this purpose last year; and it is hoped that the situation will improve further over the next few years.

Medical research

Shortly after its establishment, the C S I R was given the responsibility of surveying the entire field of medical research in South Africa. This mandate was carried out in consultation with medical workers and a committee for research in the medical sciences under the chairmanship of Prof. S. F. Oosthuizen, President of the S A Medical and Dental Council . Prof. Oosthuizen recently handed over his responsibility as adviser on medical affairs to Dr W. H. Craib, who was appointed a Vice-President of the C S I R. Prof. Oosthuizen will remain chairman of the Committee for Research in the Medical Sciences.

The C S I R has not established separate medical research bodies but prefers to support, for instance, research at the South African Institute for Medical Research and the medical schools of universities and hospitals. By giving its support to about

25 research units, groups and projects, the C S I R has ensured the continued progress of research under the leadership of eminent research workers in fields considered to be of particular importance for South Africa.

The State grant for medical research that is administered by the C S I R has increased progressively over the years. In the financial year 1965–1966 the grant was almost R695,000.

Medical research supported by the C S I R is reviewed later in this report.

Co-operative industrial research

Since its inception, the C S I R has developed research for specific sectors of industry in South Africa — notably through the establishment and support of co-operative industrial research institutes.

These institutes, whose activities are reviewed later in this report, have successfully served the industries which contribute to their upkeep.

The Government has actively participated in the development of this research through an arrangement whereby part of the C S I R's annual parliamentary grant is made available and administered by the C S I R as a separate fund used exclusively for the promotion of co-operative industrial research in South Africa. Contributions to the Institutes by the industries themselves, which are guaranteed for five-year periods, are matched where possible on a R for R basis. Allocation of funds and planning of activities are guided by the C S I R's Advisory Committee for the Development of Research for Industry (A C D R I).

For the financial year 1965/66 the Industrial Grants Fund amounted to R209,000.

During the year, sub-committees whose membership included leading industrialists were appointed to review the work of the Leather Industries Research Institute (L I R I) and the Fishing Industry Research Institute (F I R I) over the period 1960–1965, and to make recommendations on the financing of these institutes for the ensuing five-year period.

The Leather Industries Research Institute serves an industry with a gross output value of R121 million a year, including exports to the value of R32 million. This Institute is financially supported by virtually the whole of the leather and allied products industry in South Africa and is probably the only research organization in the country which, through its accumulated knowledge and status, can contribute to the survival and further development of this industry (which includes the footwear, hide, skin and wattle industries).

The scientific and technological standards of the South African fishing industry and the Fishing Industry Research Institute are highly respected internationally. The products of the fishing industry (such as fish meal, canned fish and frozen rock lobster) are recognized as among the best in their class by world standards. The approximate gross output of the industry's main products sold on the local and export markets during 1964 was R54 million.

South Africa is also the accepted world leader in the fundamental aspects of fish flour production and improvements in nutritional quality; prevention of the spontaneous combustion of fish meal; odour abatement in the fish reduction plant and advances in the rapid determination of protein quality in fish meal.

The expansion and survival of the fishing industry depends primarily on research. Inferior research or inadequate quality control could be disastrous for the industry, especially in the export market. F I R I's work in such fields as rapid freezing, the determination of optimum storage conditions, and the heating and cooling of stacks of cartons for the inshore lobster industry has contributed to the development of a rock lobster export market worth R11 million in 1964.

The Republic is among the world's largest sugar exporting countries. Normally its sugar exports earn about R34 million a year. The Sugar Milling Research Institute assists this industry by keeping it technologically up to date and enabling it to meet the specifications of sugar importing countries.

To assist industries which are not yet in a position to establish their own separate industrial research institutes, the C S I R has adopted a policy of developing units to serve particular sectors of industry.

Examples of this type of unit which have achieved considerable success are the Bantu Beer Unit and the Timber Unit.

Finances

The income of the C S I R during the year under review was made up as follows:

(*a*) Normal Parliamentary grant	
(i) For the C S I R research institutes and service departments.....	41.5%
Current Expenditure..... 33.1%	
Capital Expenditure..... 6.6%	
Buildings..... 1.9%	
(ii) For bursaries and research grants at universities, medical institutes, hospitals and industrial research institutes.....	8.0%
	49.5%
(*b*) Funds granted by Parliament for research projects commissioned by State departments.....	29.3%
(*c*) Contract income from the National Aeronautics and Space Administration (N A S A) of the U S A, for the operation of the Radio Space Research Station at Hartbeeshoek (current and capital costs).....	13.3%
(*d*) Income from contracts and contributions (i.e. for work done on behalf of industry, mining, local authorities, provincial administrations, etc.).....	6.0%
(*e*) Funds received from the Chamber of Mines for pneumoconiosis research (funds for this purpose are also granted on behalf of the Department of Mines under (*b*) above).....	1.6%
(*f*) Funds received from the Chamber of Mines and African Wire Ropes for research on mining equipment.....	0.2%
(*g*) Sundry income (donations, sale of publications, etc.).....	0.1%
	100.0%

The C S I R is experiencing an increasing demand for direct research services from Government Departments, the private sector (especially manufacturing industry) and overseas scientific organizations such as N A S A. The fulfilment of these demands provides a relatively substantial source of income for the C S I R - so much so that, whereas in its infancy the C S I R depended almost entirely on Government subsidy for its income, it now earns nearly 50 per cent of its income from direct services and contract work.

Scientific co-operation

In carrying out its task of promoting science the C S I R must take into account conditions in South Africa and relationships with world scientific bodies outside our boundaries. Participation in international scientific programmes is to the mutual advantage of all participants. In this way, South African scientists can keep abreast of the latest developments in specific fields (space research is an obvious example) while South Africa, with the knowledge acquired here and because of its unique geographical position, can make valuable contributions towards the advancement of knowledge in other fields. In addition, such participation serves as a stimulus for the development of science in the country.

The Science Co-operation Division recently announced that the South African National Committee for the Upper Mantle Programme had allocated to various projects the amount of R136,000 which the Government had made available for the Republic's participation in the International Upper Mantle Programme. Some of these projects are already under way and the remainder will be commenced shortly. The programme embraces a comprehensive study of the outer layer of the earth's crust (to a depth of 1,000 kilometres).

For the financial year 1965/1966, the Government has made available an amount of R100,000 towards the establishment of a co-ordinated and directed National Programme for Oceanographic Research. This amount is administered by the C S I R in consultation with the S A National Committee for Oceanographic Research. A National Oceanographic Data Centre has been established under the auspices of the C S I R .

Activities in connection with the International Biological Programme are still in the planning stage. This programme is described as a world-wide study of organic production on land, in fresh water and in the sea, and of the potentialities and uses of new as well as existing natural resources. The programme also includes a study of man's adaptability to changing circumstances. Not only is South Africa able to make an important contribution in this field, but can herself derive benefit from participating in this programme.

Arrangements were made for South African representation at the following general meetings, congresses and symposia of international scientific unions and committees of the International Council of Scientific Unions (I C S U), to which the C S I R adheres on behalf of South Africa:

- International Years of the Quiet Sun (I Q S Y) — 3rd General Meeting, Madrid, April 1965
- International Biological Programme (I B P) — Meeting on adaptability, Warsaw, April 1965
- Scientific Committee on Space Research (C O S P A R) — 8th plenary meeting and 6th International Symposium on Space Research, Mar del Plata, Argentina, May 1965

International Union of Pure and Applied Chemistry (I U P A C) — 23rd Conference and 20th Congress, Paris and Moscow, July 1965

International Union of Geodesy and Geology — Symposium on Electromagnetic Distance Measurement, Oxford, September 1965

International Upper Mantle Programme — International Symposium on Deep Drilling, Ottawa, September 1965

International Biological Programme (I B P) — Symposium on Large, Wild and Tame Herbivores, Aberdeen, September 1965

International Union of Pure and Applied Physics — 4th International Conference on the Tuition of Physics, and 9th International Conference on Cosmic Rays, London, July and September 1965

Arrangements were also made for attendance at the following meetings of bodies not affiliated with I C S U:

Conference on radio noise from Jupiter — Maryland, April 1965

Symposium on Problems Involved in the Influence of Climate upon Buildings— Vienna, May 1965

1965 Conference of Directors of Building Research of the English-speaking World— London, August 1965

Third International Congress of the Council for Building Research, Studies and Documentation (C I B) — Copenhagen, August 1965

International Research and Engineering Conference on Expansive Clays — Texas, August 1965

Sixth International Conference on Soil Mechanics and Foundation Engineering — Montreal, September 1965

Nineteenth Meeting of the Permanent Committee of the International Union of Testing and Research Laboratories for Materials and Structures (R I L E M), Turkey, September 1965

23rd International Physiological Congress — Tokyo, September 1965

1st International Symposium on Water Desalting — Washington, October 1965

4th Session of the Inter-state Oceanographic Commission (I O C) — Paris, November 1965.

Appointments

During the year Prof. F. L. Warren, former Head of the Department of Chemistry and Chemical Technology of the University of Natal, relinquished his membership of Council and was succeeded by Prof. E. T. Woodburn of the Department of Chemical Engineering of that university.

Mr T. F. Muller, Managing Director of the General Mining and Finance Corporation, who retired as member of Council in November, was succeeded by Dr A. J. A. Roux, Director-General of the Atomic Energy Board.

Dr N. Stutterheim, Vice-President of the C S I R, was appointed member of the Board of Directors of the Southern Oil Exploration Corporation.

During the year the following senior appointments were made in the C S I R:

Dr W. H. Craib who had been full-time Adviser on Medical Research to the C S I R since 1963, was appointed a Vice-President.

The post of Vice-President responsible for Defence Research has not been filled since Prof. L. J. Le Roux's resignation in September 1965. Meanwhile, the President himself has taken charge of this function.

Dr T. J. Hugo, former Head of the Optics and Spectroscopy divisions of the National Physical Research Laboratory, was appointed Director of the National Institute for Defence Research.

Dr J. J. Theron, former Head of the Division of Toxicology of the National Nutrition Research Institute, was appointed Director of that Institute in succession to Dr F. W. Quass who left the services of the C S I R to become General Manager of the Southern Oil Exploration Corporation.

Mr D. J. M. Vorster was appointed Director of the National Institute for Personnel Research. He succeeded Dr D. J. Gouws who became Managing Director of a personnel consulting company founded by S A N L A M. Prior to his appointment as Director of the N I P R, Mr Vorster had been Divisional Personnel Manager for the East Rand Mines of the Anglo American Corporation of S A Ltd.

During the year Dr W. S. Finsen retired as Director of the Republic Observatory. His successor has not yet been appointed.

Mr T. van Olst was appointed Manager of the Estates Department in place of Mr D. J. J. Bisschoff.

Building programme

The C S I R's building programme of the past year consisted in the enlargement of existing buildings to make provision for expanding activities. A second wing was added to the building of the National Building Research Institute mainly to accommodate the C S I R Timber Unit and a number of service divisions. Additional laboratories and offices were provided for the National Institute for Water Research while the space available for the Technical Services Department's Woodwork shop has been practically doubled. Extensions to the building in Cottesloe, Johannesburg, where the Mine Equipment Research Unit is accommodated, have also been completed.

However, because of the Government's attempts to combat excessive inflation in the building industry, building funds were limited and there is an increasing backlog in the provision of accommodation.

A testing site for the National Institute for Road Research was acquired at Silverton during the year. The site is to be used, for example, for testing methods of road

building developed with the aid of laboratory tests, and for smaller experiments, prior to putting them into practice on public roads. The site will also be used for other research purposes such as traffic studies and research into soil mechanics. A large shed has already been erected and further facilities will be provided shortly.

The City Council of Port Elizabeth has made a 60 morgen site at Driftsands available to the C S I R at a nominal amount. The new building complex of the South African Wool Textile Research Institute will be the first to be erected on this site. Construction work was started during December and the transfer of the Institute, which is still housed in Grahamstown, will probably be completed within a year.

The new buildings erected for the Republic Observatory in Johannesburg were completed by the Department of Public Works during the year.

Technical information for industry

In accordance with its Act of establishment, a considerable part of the C S I R's activities is directed towards furthering research on behalf of industry. However, in many instances, industry is not fully aware of the facilities available to it. Consequently the C S I R regularly arranges short industrial symposia or full-scale conferences to bring industry and science together.

A symposium with the theme "Science in the service of industry" was held in Durban in collaboration with the National Development and Management Foundation of S A for the purpose of promoting communication between the C S I R and the industrialists of Natal. About 70 industrialists representing 25 companies attended the symposium. The speakers from the C S I R covered many fields of research in order to give an indication of the variety of C S I R services available to industry.

Other symposia held during the year were: a two-day symposium on mould infestation of foodstuffs, organized in collaboration with the Department of Agricultural Technical Services; a symposium on human factors in industry, organized in collaboration with the S A Institute for Mechanical Engineers and a symposium on South African timber.

A conference on corrosion, which lasted a week, was held in Cape Town in collaboration with the S A Corrosion Council. It is estimated that corrosion costs South Africa R80 million annually in preventive measures and loss of metal. This amount does not include the value of lost time, labour and production directly or indirectly due to corrosion. The purpose of the Corrosion Conference held in Cape Town, was to bring about more effective control of corrosion by co-ordinating research and by bringing to the attention of users the limitations and advantages of different products under different circumstances. In addition to South African authorities, three corrosion experts from the U S A and Great Britain took part in the conference.

The C S I R, in collaboration with the S A Library Association, held a short course for industrial librarians in August. The programme included instruction in various information techniques and library procedures such as the storage, handling and retrieval of documents. The course was very well attended.

National laboratories and institutes

Astronomy

The Republic Observatory is not limited in function to pure research, but also performs duties of a civil nature in the field of astronomy, in particular the maintenance of the national time service. This is made available to the public by the time signal and standard frequency transmitters ZUO (one, of low power, operated by the Observatory, and another, of high power, by the Post Office). In addition, these signals are distributed by land line to the Post Office, the S A B C and other public institutions.

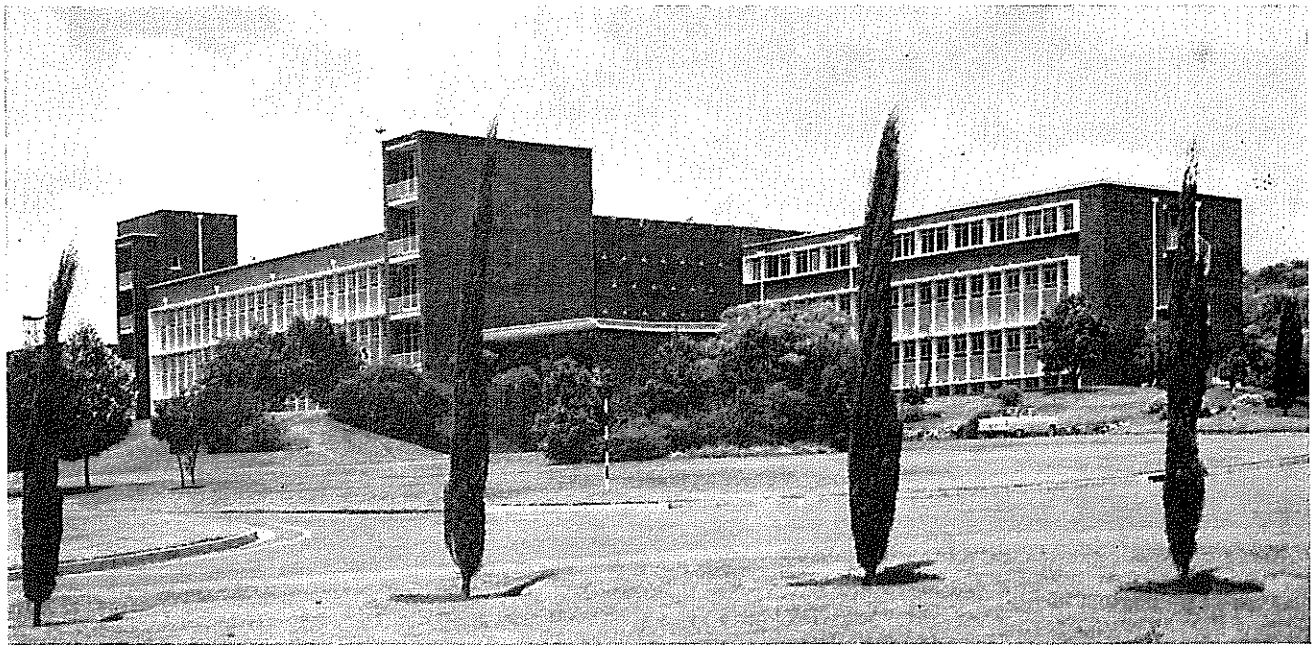
The principal long-term programmes of the Observatory comprise observational and theoretical research in the field of visual double stars (recently extended to include eclipsing binaries) and photographic observations of minor planets and comets. For half a century the Observatory has been identified with these programmes to such a degree that they have almost become international commitments. The programme for investigating minor planets and comets has led to the discovery of several new comets and more than 500 new minor planets, many of which have been given typical South African names like Pretoria, Transvaalia, Nerina, Gaika, Umtata, Outeniqua, etc.

The short-term projects of the Observatory have included the successful search for Proxima Centauri, our nearest known stellar neighbour apart from the sun, the detection and measurement of the rotation of the minor planet Eros, the "splitting" of Nova Pictoris, the publication of a photographic star atlas of the southern sky, and a series of colour photographs of the planet Mars.

Building Research

In South Africa about 450 million rand is spent annually on building and construction (excluding roads) 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 improving building design and services, structural and foundation engineering, lighting, ventilation, heating and cooling in buildings. Another aspect of the work undertaken is the bettering of the performance of building materials such as concrete, stone, paint and plastics and research which will

The National Building Research Institute in Pretoria.



bring about a better understanding of the effect of climate and weather on both building materials and the environment within a building. Special service is rendered to the community by research applied to the planning of schools, hospitals and housing for all population groups. The N B R I earns between a quarter and a third 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.

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.

Defence Research

Defence research has been in progress at the C S I R since 1962 and some notable successes have been recorded. The country has been saved hundreds of thousands of rand on equipment developed by the C S I R 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.

Information and Research Services

The development of a national research organization is not simply a matter of creating a number of research laboratories; for the scientific life and industrial development of the country as a whole, it has broader implications. From the time of its inception, the C S I R has explored the country's needs and the best ways of meeting them, and from tentative and experimental beginnings, specialized national services have been developed. These are now grouped together in separate divisions co-ordinated under a Director of Information and Research Services.

There are divisions for: library, industrial economics, the development of industrial research, information (including publishing and language services), publicity and science writing, public relations, university and medical research, and science co-operation (which includes scientific liaison offices in Washington D C, London and Cologne).

The C S I R library serves as a central scientific and technical library for the country and operates a loan service for all scientists and technologists in South Africa. It also provides a centre for the development of specialized techniques in documentation and information processing.

Mathematical Sciences

The National Research Institute for Mathematical Sciences (N R I M S) is devoted to research in the mathematical and electrical engineering sciences. These two disciplines are vitally involved in the theoretical and experimental aspects of research in all scientific fields.

The Mathematical Sciences Research Department consists of divisions for mathematical analysis, statistics and numerical analysis. These deal with the various branches of mathematics and their application to research. Typical activities concern theoretical fluid dynamics, stress-deformation theory, operations research, statistical decision techniques and design of experiments, and numerical and non-numerical computations on digital computers.

The Electrical Engineering Research Department consists of five divisions for automation, applied electronics, solid state electronics, electronic instrumentation and power electrical engineering. Work is done in such diverse fields as the application of digital techniques in data processing, analogue computing, the use of ultrasonics for analysis and processing of materials, semiconductor applications, microminiaturisation and thin film technology, and studies of problems peculiar to the Republic in heavy current applications.

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 and materials 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.

The Institute is equipped with machinery, instruments and qualified personnel for research in the fields of metallurgy, strength of structures, rock mechanics, aeromechanics (including aeronautics), hydromechanics (including harbour and river engineering) and heat mechanics (including air-conditioning and refrigeration).

To meet the growing demand for its services, N M E R I is, *inter alia*, installing two new wind tunnels (low-speed and supersonic) for aerodynamic testing. The Mine Equipment Research Unit (formerly the Government Mechanical Laboratory) at Cottesloe, Johannesburg, is part of the N M E R I and deals with investigations related to mine ropes and winding equipment.

Nutrition Research

The National Nutrition Research Institute is concerned mainly with applied research aimed at improving the nutrition of the South African population, and advises government and other authorities on ways of combating malnutrition.

The activities of the Institute include:

- Investigations into the nutritional status of all groups of the South African population
- The study of methods for combating malnutrition and controlling deficiency diseases
- Research on the nutritional value and improved utilization of foods produced in South Africa
- Research on the harmful substances found in some foods
- Research on food processing, including investigations on behalf of private industries.

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
- Selecting and placing the right man in the right job (by means of aptitude tests, interest tests, and others) and giving him the necessary training
- 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 main function of the National Physical Research Laboratory (N P R L) is to contribute to the development of physical science in the Republic through research aimed at the adaptation of existing knowledge as well as the creation of new knowledge for the solution of technological and industrial problems of national importance. In addition the N P R L has statutory responsibilities for maintaining national standards of physical measurement for mass, length, electricity, radiation, etc.

Within the N P R L, groups of research workers constitute a nucleus of research manpower for both basic and applied research in the following fields: optics, nuclear physics, solid state physics, acoustics, spectrochemistry, infra-red spectroscopy, electron microscopy, geophysics, electron spin resonance, geochronology, oceanography and high-pressure physics.

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 and surfacings; 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 wide range of problems relevant to their task of designing, building and maintaining roads and streets.

These road authorities, including the South West Africa Administration, provide nearly all the funds needed to carry out this research work.

Technical Services

The Technical Services Department (T S D) has been instituted to provide essential services to the national laboratories and institutes of the C S I R and has successfully designed and produced equipment for scientific and industrial research ranging from the most delicate instruments to heavy machinery.

This has led to a wealth of knowledge and experience which is made available to other research organizations and industries in South Africa and overseas.

Photographic, printing, stores and transport services are also provided.

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 for civil or military purposes in South Africa.

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 semiconductors 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 A programme for the peaceful exploration of outer space.

Water Research

South Africa is 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 the control of water pollution, and into the effective re-use of water, but also a comprehensive study of the flora and fauna of South African waters, since these play a vital role 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 (N I W R).

Wool Research

The South African Wool Textile Research Institute (S A W T R I) is concerned with the behaviour in processing of the South African wool and mohair clips, with the improvement of current methods of processing and the development of new ones. It also carries out research on "easy-care" properties that can be introduced into end-commodities manufactured from these natural fibres. S A W T R I thus assists the entire line of industries responsible for South Africa's major agricultural product. Its research programme covers the entire field from fibre to fabric and includes fundamental and applied work. Separate departments, which work in close co-operation, have been formed for protein chemistry, textile physics, mechanical processing and dyeing and finishing, whilst a special section deals with enquiries from the wool textile industry.

In the processing field, aspects of scouring, carding, gilling, combing and knitting are investigated. It is intended to expand these activities to include drawing and spinning as well as weaving when the Institute is resited in a new building complex in Port Elizabeth during the coming year. Closer collaboration will then be established with the Technological Division of the S A Wool Board which will have a pilot laboratory on the same campus.

In future, the training of textile technicians and technologists by the Technical College and by the new University of Port Elizabeth will be undertaken with the assistance of S A W T R I staff and facilities.

Progress in research

— a selection of projects

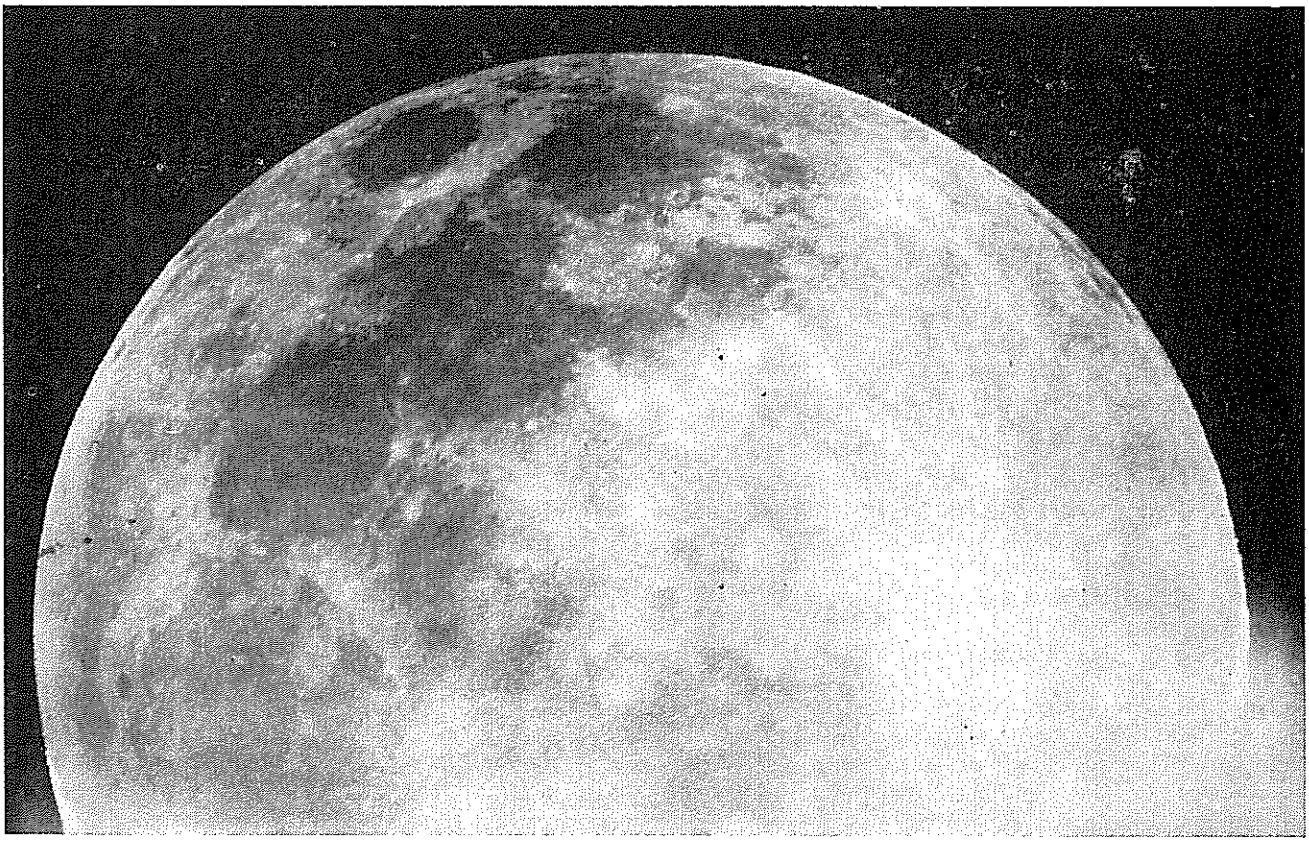
Photographs of the earth-lit moon

The Republic Observatory has made a valuable contribution to lunar astronomy by obtaining rare photographs of the earthlit moon. This achievement was acknowledged in a report published in the United States of America by the Franklin Institute for Research and Development on a project for ascertaining whether earthbased telescopes can be used successfully for accurately determining the 'figure of the moon' (i.e. the true shape of the moon and its elevations and depressions) and for mapping the lunar surface to a scale greater than any so far achieved.

The project, initiated by the U S Army Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA) required that the moon be photographed not only when full, but also when nearly new, and therefore when it was only faintly lit by the light reflected from the earth. Photographs taken at these phases would show a minimum of shadow effects, and thus increase the accuracy of measurement of lunar features.

The essence of the project was the choice of dates of full and new moon when the moon was at opposite extremes of its libration cycle. To photograph the full moon is comparatively simple, but many difficulties are encountered when photographing the earthlit moon. As it is then only faintly lit, comparatively long exposures are necessary, and the telescope must therefore be accurately guided to follow the moon's motion in the sky. Furthermore, at this phase the moon is close to the sun, and the photographs must be taken at twilight with the telescope nearly horizontal, a position in which the telescope is difficult to control. The greatest difficulties of all arise from the fact that the light from the moon has to traverse a far greater depth of atmosphere than when it is overhead, and also the turbulence

One of the few successful photographs in existence of the earthlit moon. This was taken at the Republic Observatory in Johannesburg.



of the atmosphere has the effect of throwing the moon's image into comparatively violent agitation, which the observer must attempt to 'iron out' by literally pushing the telescope to follow the image.

As the circumstances of this particular experiment were such that the earthlit moon would be most favourably placed in the southern hemisphere at the time of the experiment, the Republic Observatory was one of three southern observatories invited to collaborate, the others being in Indonesia and Australia. As the Republic Observatory does not normally undertake lunar photography, a great deal of preparation and improvisation had to be carried out rather hurriedly.

Notwithstanding all the difficulties, the programme was on the whole more successful than perhaps had been anticipated and the Observatory can find satisfaction in having played a significant part in the important early stages of this project.

— *Republic Observatory*

Plastics in building

As there is still a lack of information regarding the durability of plastic building materials under South African conditions, the National Building Research Institute has for some time been investigating the properties of plastics and other new building materials in order to determine the applications for which they are suitable.

The use of plastics in the building industry is rapidly increasing. This relatively new material in its many forms and compositions is, however, frequently used for permanent structures without authoritative information as to its suitability and durability, and where they are used incorrectly they often have to be replaced at high cost. Some forms of plastics reputed to be weather-resistant have deteriorated and/or changed colour within a year; caulking and sealing compounds have become brittle and have lost their waterproofing and jointing properties.

Although the accelerated tests used on these materials provide a valuable basis of comparison between materials, long-term tests are required to establish a correlation between the results of accelerated tests and behaviour under natural conditions. Work at present in progress includes studies on plastic flooring materials, waterproofing agents and coatings, sealers for curtain walling, plastic pipes and pipe jointing systems.

Numerous enquiries concerning the correct application of adhesives, polyester resins, plastic sheets as damp-proof courses, foam plastics, etc., are received by the C S I R. The handling of such enquiries often necessitates laboratory testing.

Housing for the aged

A study is being made of a scheme for housing the aged designed by and built under the supervision of the National Building Research Institute. An experimental home at Witbank, Transvaal, was occupied in October, 1964. A report which includes the views of residents and staff is expected to appear in 1966 and should provide valuable guidance in the planning of accommodation for the aged.

A C S I R report on the planning of housing for the aged was published in 1960 and recommended that provision should be made for the maximum independence, privacy and freedom of movement of the residents as well as for services for their assistance and care. The solution is seen in a group of housing units of three types: households run by the residents, households conducted for the residents and units for residents who require care.

In 1962, the Institute was requested to design a housing scheme for the aged in Witbank, which was to be financed by a State loan. Although the implementation of the proposals in the 1960 report was restricted by financial considerations, the general features of the Witbank scheme were based on this report and certain modifications were introduced on the basis of more recent research results.

Industrialized or preconstructed building in South Africa

Growing demands for buildings and the critical shortage of labour in the building industry, particularly overseas, have led to the development of industrialized building in order to improve the productivity of the industry. This can be achieved by using machines and unskilled labour to replace skilled labour. Important research work in this field has been carried out by the National Building Research Institute during the past few years.

The Institute was represented on a small committee appointed by the Minister of Community Development to investigate and report on the different aspects of industrialized building for housing and its application to South African conditions. Two overseas visits, one sponsored by industry, were also undertaken.

Various methods of industrialized building have been investigated locally to determine their suitability. Attention has been given, for example, to timber houses with different claddings and concrete panel and steel frame systems.

Research is being carried out on the thermal performance and the resistance of lightweight housing constructions to rain penetration, on the use of plastics

in such buildings, fire hazards in new constructions and the acoustic problems that result from the use of unconventional structures.

The possibility of changes in building regulations to allow the use of new materials and building methods is also being investigated. In co-operation with the Transvaal Provincial Administration, a procedure has been evolved for evaluating and approving the use of new building methods which do not conform to the existing building by-laws of local authorities.

The Institute has concluded that while the use of industrialized methods will in the long term increase, they are likely to play only a supplementary role in the immediate future. The extent and nature of their application will be determined by four factors, namely, the technical performance of buildings erected by such methods vis-a-vis traditional structures, their costs, both initial and maintenance, the extent to which they are considered by their occupants to be acceptable and the labour position. It would furthermore appear that, quite apart from the possible use of industrialized or preconstructed buildings, there is an urgent need for more industrialization and rationalization in the industry.

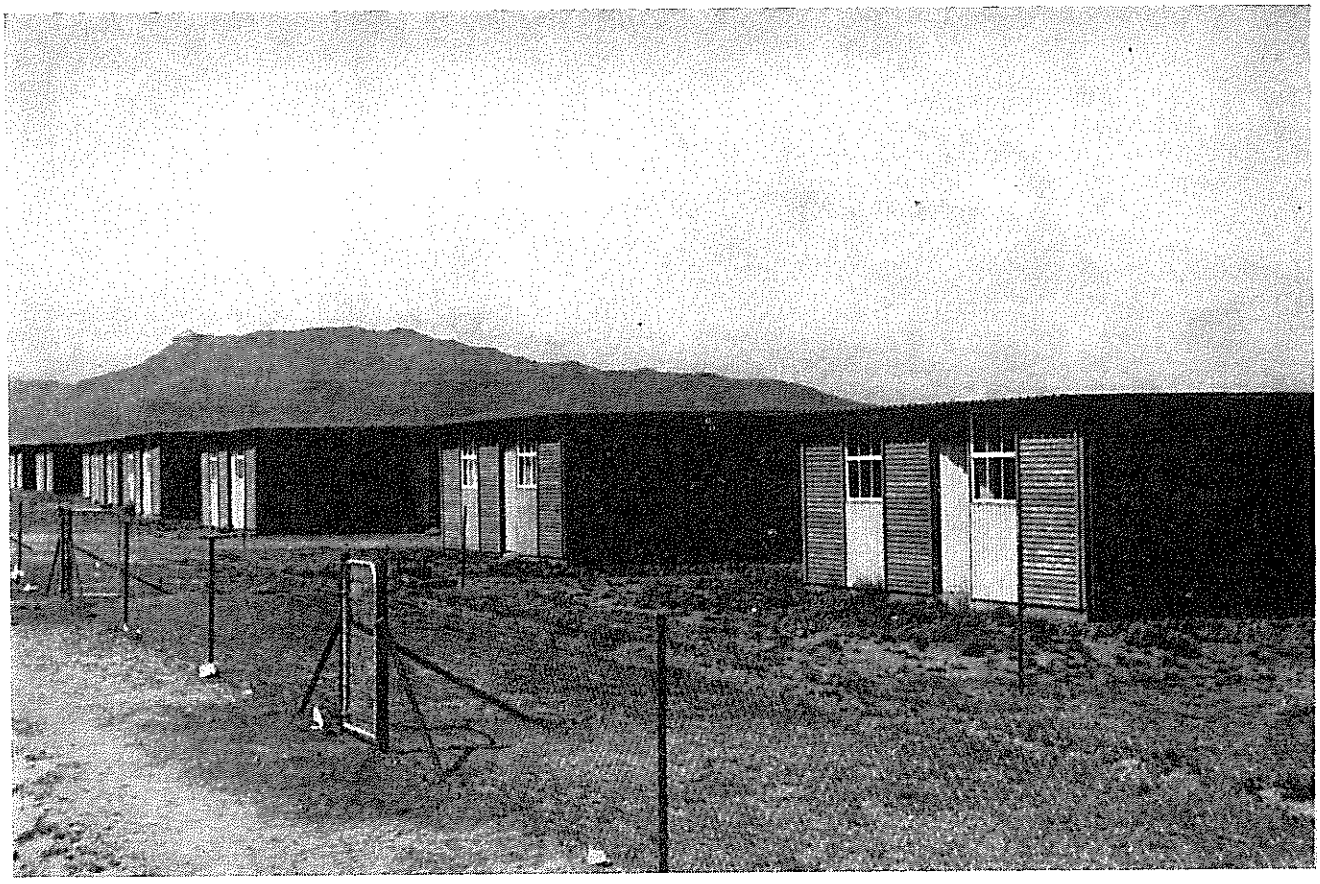
—National Building Research Institute

Low-cost timber houses

A technique for utilizing small dimension South African pine in the erection of low-cost timber houses has been developed by the C S I R. Panels are manufactured in jigs by nailing the pine boards to vertical beams. As jigs are used throughout, the process of manufacturing the wall panels and the erection of the walls can be done by unskilled labour under supervision.

This system of erecting low-cost timber houses was developed on behalf of the Department of Bantu Administration and Development, the Department of Commerce and Industry, and members of the forest products industry. A scheme of 50 such houses built at Thaba 'Nchu has provided a practical test of its efficacy. A team of twenty-four unskilled labourers from the neighbouring reserve, after having erected only fifteen houses, were able to complete two houses a day under the supervision of a trained Bantu carpenter. The basic cost of building each of these four-roomed houses (total floor area 450 sq. ft) amounted to R420.

Low-cost timber houses erected at Thaba 'Nchu.

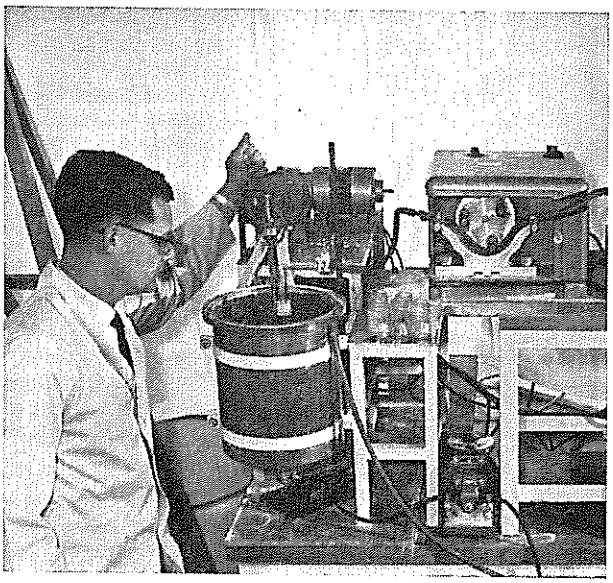


In developing the houses, the C S I R gave consideration to factors such as treatment of the timber against natural destructive agencies, thermal insulation, rodent and insect proofing and the most suitable position for windows, etc. Although no standardized rain-penetration tests have been carried out, there has been no evidence of damp in a prototype exposed to severe thunderstorms.

—Timber Unit
National Building Research Institute

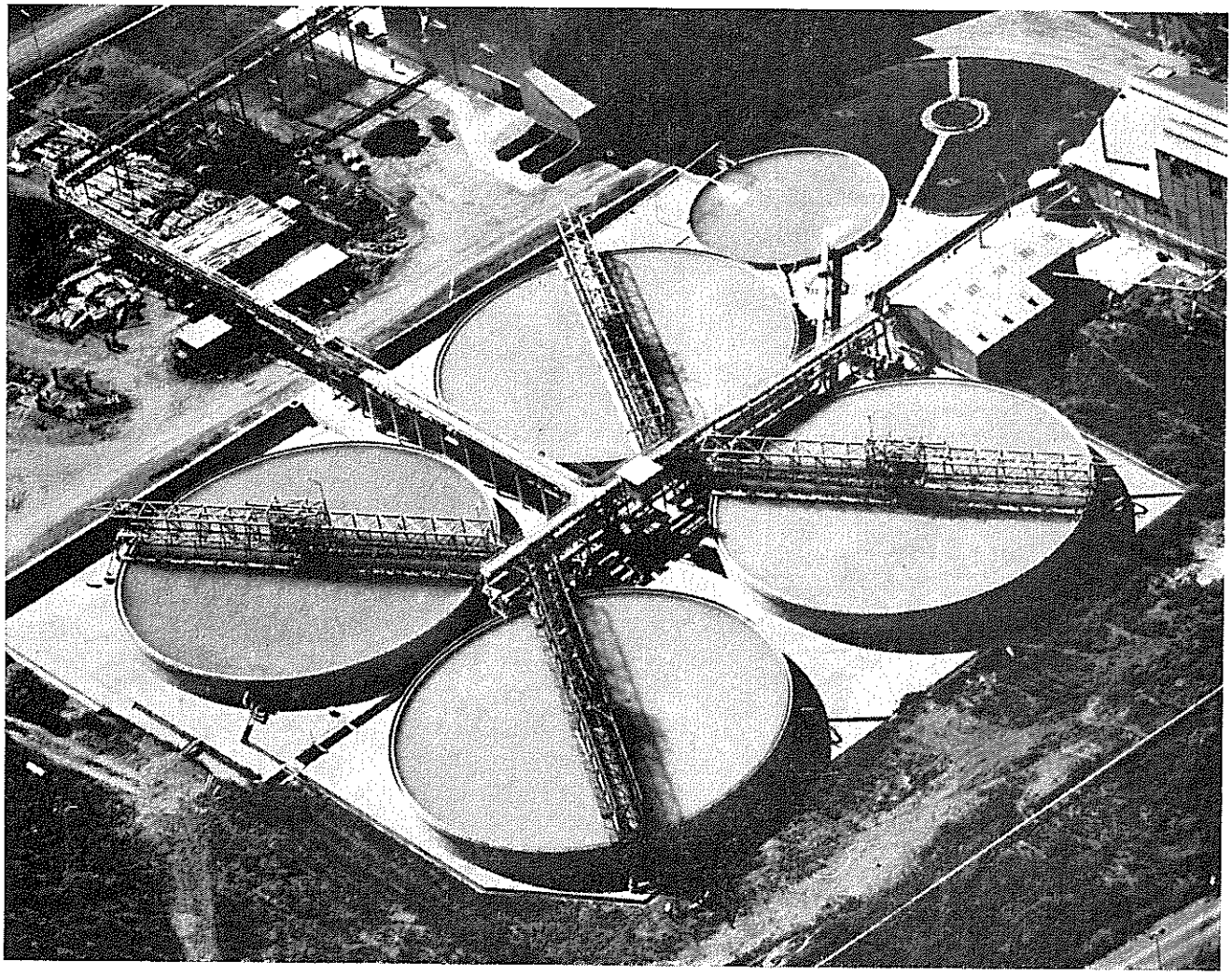
Dewatering of gold-ore mill pulps

On behalf of and in collaboration with the Transvaal and Orange Free State Chamber of Mines, the National Chemical Research Laboratory has been investigating the dewatering of mill pulps, produced by the wet milling of gold-bearing ores. The bulk of the water must be removed prior to the extraction of the gold from



Above: Laboratory scale plant was used to study the thickening of gold ore mill pulps.

Below: Thickener tanks at Bracken Mines Limited. (Photo: Gordon Douglas.)



the pulp. The fine particles are flocculated with lime or some other suitable agent and the solid matter allowed to settle out in large circular tanks (thickeners).

An analysis of the design and operation of thickeners has shown that it may be possible to reduce the size and number required for a given throughput which will result in considerable economies especially with new installations. Laboratory experiments have also shown that the settling properties of a pulp can be observed very easily in a glass cylinder and that it may be possible to apply these properties to the design of thickeners. With the collaboration of various mining groups these findings are at present being tested in practice.

Other experiments suggest the possibility of increasing the capacity of existing thickeners by relatively small changes in their design and mode of operation.

Much attention has been given to the flocculation of mill pulps, an essential preliminary to thickening. It has thus been found that in practice organic flocculants often react contrary to currently accepted theories. Again the flocs formed when fine clay-like particles are flocculated contain more water than the flocs from coarser particles of quartz. As a result there is more difficulty in thickening to a high density of solid when the proportion of clay-like materials is high. It is hoped that this can be controlled to some extent by finding a flocculant which will dewater gold ore mill pulps more effectively than those used at present.

—Chemical Engineering Group
National Chemical Research Laboratory

Modern chemical analysis

New methods for the separation and concentration of chemical elements have been developed in the National Chemical Research Laboratory (N C R L). This has resulted from a high degree of collaboration with other research groups specializing here and overseas in various aspects of instrumental analysis.

To improve the sensitivity and accuracy of chemical analysis, modern instrumental techniques have to be combined with effective methods for the separation and concentration of elements. The Analytical Section of the N C R L has carried out a systematic research into such methods as ion-exchange chromatography and solvent extraction for many years. As a result a large amount of information has been built up, making it possible to develop new procedures for the separation of elements from simple as well as from complex structures. Most of the research work was carried out in collaboration with various divisions of the National Physical Research Laboratory.

Highly sensitive and accurate methods for the separation and determination of lead, uranium and thorium in a variety of radioactive minerals have been developed. This makes it possible to estimate with great accuracy the ages of minerals and geological formations in South Africa.

A fast and accurate method for the determination of low concentrations of gold in cyanide solutions has been developed. Atomic absorption spectrometry combined with a suitable solvent extraction of gold gives a fifty-fold increase in sensitivity as compared with gold determination by atomic absorption alone. Atomic absorption spectrometry has also been combined with separation and concentration by ion-exchange chromatography for determining traces of strontium and barium in wheat flour and sorghum meal.

Thorium from very dilute solutions has been concentrated by adsorption on a cation-exchange resin and determined on the resin beads by x-ray fluorescence.

The N C R L collaborated with overseas institutes in developing a neutron activation method for the difficult determination of very low amounts of calcium.

— National Chemical Research Laboratory
National Physical Research Laboratory

Toxins in fungi

The C S I R has been carrying out research for some time into the toxins produced by certain fungal species found as moulds on cereal and legume products. A survey by the Microbiology Research Group revealed that a number of fungal species include toxigenic strains. Cultures of some of these have been cultivated and the chemical structure of their toxins determined. The influence of these mycotoxins on health is at present being studied in laboratory animals and methods are being developed for the detection and elimination of fungus-produced toxins in foodstuffs.

One fungus *Aspergillus ochraceus*, which occurs widely on agricultural crops in South Africa and which in the Far East is used in the preparation of food for human consumption, produces a very active toxin called ochratoxin. The National Chemical Research Laboratory has developed a rapid method for its determination in foodstuffs while the National Nutrition Research Institute is at present carrying out toxicological studies.

Mycotoxins are responsible for diseases like ergotism which has repeatedly occurred in epidemic proportions in Europe. Japanese research workers have found a possible connection between the metabolites of *Penicillium islandicum*, a mould which occurs on mouldy rice and the abnormally high incidence of certain types of cancer among rice eating populations.

Shortly after the C S I R started its research work on this subject it became known that great losses of turkeys in England had been traced to the use of mouldy

groundnuts as feed. The fungus responsible was *Aspergillus flavus*, certain strains of which produce mycotoxins called aflatoxins. A survey by the Microbiology Research Group showed that the same fungus sometimes occurs on South African groundnuts and other agricultural crops.

The timely isolation of aflatoxins by the C S I R and the development of methods for their detection in suspected grain enabled the South African Oilseeds Control Board to save some R2 million in 1963 when the groundnut crop from certain areas of the Republic became contaminated.

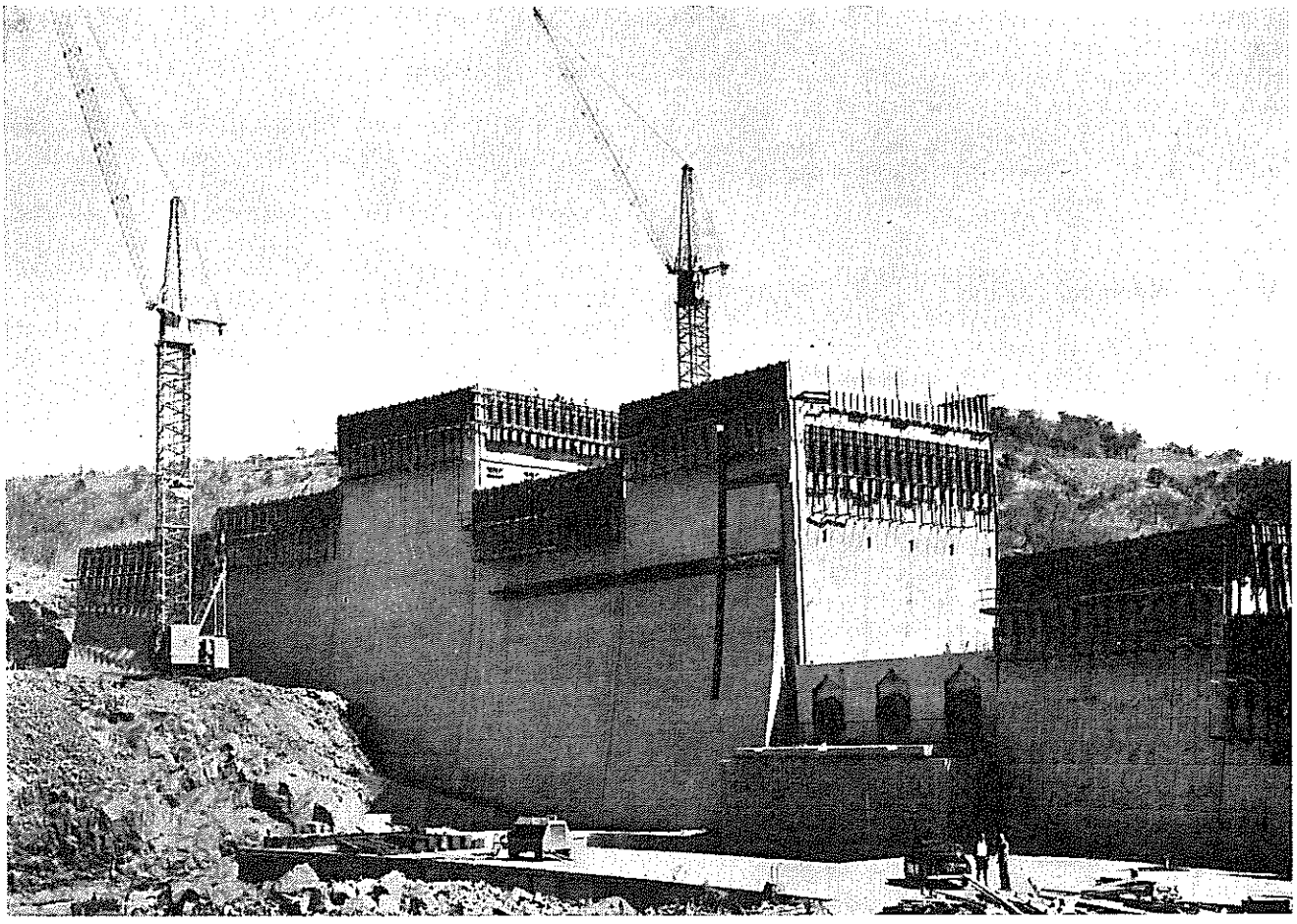
— *National Chemical Research Laboratory*
National Nutrition Research Institute
Microbiology Research Group

Rapid calculation for planning of dam walls

Considerable savings in time and money have been effected by the Department of Water Affairs as a result of assistance given by the C S I R in time-consuming calculations for the construction of the Josini Dam in Zululand and the Lubisi Dam in the Transkei.

Before casting a concrete dam wall the position of the shuttering must be calculated to an accuracy of within a fraction of an inch. In the case of an arched and concave dam wall as is the case in both these dams, the calculations are extremely lengthy.

Using an ordinary desk calculating machine it would probably take about 3,000 hours to make the calculations required for the Lubisi Dam which is 800 feet long and 200 feet high. The National Research Institute for Mathematical Sciences programmed the problems in 200 hours and completed the calculations within 3 hours on the IBM 704 electronic computer. The whole job cost the Department of Water Affairs R250.



Construction work in progress on the Josini Dam wall at Pongolapoort in Zululand. (Photo: Eric Hayne.)

Remote recording of biological data

New applications are constantly being found for electronic techniques and, among the most recent, is equipment developed by the C S I R for recording certain biological processes in sheep which are communicated by radio.

A small radio transmitter on the animal's back can send data up to two miles away where they are automatically recorded by a receiver. A miniature pressure converter which can be implanted under the skin or in the muscle tissue of the animal is at present in the development stage.

This project is being carried out for the Animal Husbandry and Dairy Research Institute of the Department of Agricultural and Technical Services.

— National Research Institute for Mathematical Sciences

Hydraulic models aid the engineer in solving harbour and river problems

In solving their problems, engineers often make use of models which simulate reality on a small scale. The National Mechanical Engineering Research Institute of the C S I R has carried out several model studies on behalf of State Departments and other bodies. The siltation problem of the Durban harbour entrance, the Durban beach erosion problem, the flood guidance works near the bridge over the Notchwan River, the effects of a new breakwater on the wave conditions in and around the fishing harbour at Gansbaai and the silting up of the estuary mouth at St Lucia Bay are a few examples of the projects studied by means of models during the past few years.

The preservation of St Lucia as one of the country's most popular holiday and angling resorts, for instance, depends on the link between the lakes and the sea. The Natal Provincial Administration has been spending about R50,000 annually on a dredging system for keeping the river estuary free of the sand which constantly threatens to silt it up and which would eventually lead to interference with fish life in the lakes.

The use of a scale model of the St Lucia lake and estuary has enabled the C S I R to design a system of breakwaters and berms in which natural forces are harnessed so that silt introduced during high tide is washed out again during ebb tide.

The solution of a problem of this kind involves firstly, an accurate simulation to scale of natural phenomena such as (in the case of St Lucia) the tides, waves, currents, wind directions and the silting up of the estuary, and secondly, the testing of various possible solutions by means of the model.

Once the recommendations for breakwaters and berms at the St Lucia estuary have been put into practice expenditure on dredging should prove unnecessary in future.

—National Mechanical Engineering Research Institute

Patterns for testing Bantu reasoning abilities

A battery of tests "The General Adaptability Test Battery" has been used successfully in the selection and classification of illiterate and semi-literate Bantu mineworkers for sixteen years.

During this time, however, there has been a gradual shift in the norms as a result of factors such as the cultural evolution of the Bantu and, in some cases, familiarity with the test material among workers who have to be re-tested.

The C S I R has been requested by the Transvaal and Orange Free State Chamber of Mines to restandardize "The General Adaptability Test Battery" and is, at present, engaged in developing a new series of tests which will complement the original battery.

One of the tests suggested for inclusion in the new battery is a non-verbal performance test which has been designed to measure the reasoning ability of illiterate and semi-literate Bantu. The person being tested is required to study an incompleted series of patterns and to select from a supply of shapes those which continue the series. No time limit is set.

The patterns become more difficult as the test progresses. There are two groups of patterns — "perceptual" where the underlying principles of the patterns are visually obvious, and "conceptual" where it is necessary to analyse the patterns before the underlying principles become apparent. The latter demands a relatively high level of abstraction.

Two experimental groups of Bantu, one from secondary industry and the other from the mines, were subjected to this test. A higher percentage of the first group were able to deal with both the perceptual and conceptual items of the test. In an endeavour to discover the factors responsible for the variations within the groups, the C S I R is at present investigating the effects of age, education, experience, tribal group and intelligence on the level of performance in this test. It is hoped that this investigation will throw more light on the intellectual abilities of the Bantu.

Instant programmes for computers

The programming of an electronic computer prior to use is usually a time and energy consuming operation. The National Institute for Personnel Research has developed a system of statistical programmes for computers from which a mathematician can select the programme relevant to his problem rapidly and effortlessly. The system handles *inter alia*, intercorrelation procedures, factor analyses and various matrix operations.

A feature of the system is that all the programmes are loaded on to a single magnetic tape under the control of a monitor. As a result, successive programmes can be called into operation by the use of control cards without the intervention of an operator.

All data are read from magnetic tape and intermediate results are written onto tape. The results of one programme are often the data for the next in the series.

As the system could be generally applied, a manual has been produced describing it and the individual programmes in detail, together with the programming conventions and routines resulting from it. The manual has been circulated to directors of C S I R institutes and to universities and research organizations throughout the country, and requests for its use have been received. The system has been handed over to the National Research Institute for Mathematical Sciences of the C S I R for general use.

Tests for recognizing scientific creativity

It may be possible to recognize the creative scientist of the future while he is still at school or university by means of tests developed by the C S I R. This would be of inestimable value to science and industry in South Africa.

The importance of the creative scientist has long been realized in the United States where research work has been carried out into the design of tests that can be used to identify the potentially creative individual at an early stage, to train him properly and to place him in work where the best use can be made of his talents. For various reasons, the American tests are not entirely suitable for South African conditions and the C S I R has designed tests for the Republic.

The validity of the tests was assessed by applying them to a number of South African research workers. The results were compared with information about each subject's creative ability as shown in his research work.

The following interesting findings and data were revealed by this study:

- A number of the tests appear to identify successfully those scientists who have proved themselves to be creative.
- Intelligence and creativity are not necessarily related. This surprising observation supports similar findings made overseas and suggests that existing I Q tests should be supplemented in such a way that they also measure creative ability.
- There appear to be considerable differences between the personalities of creative and non-creative scientists. Creative scientists appear to be more uninhibited, humorous, dominating, intellectually curious, outspoken, aggressive and radical in outlook. It is noteworthy that the creative scientist is not necessarily a "desirable" personality, and it is quite possible that many potentially creative applicants for jobs are not employed because they do not conform to the likeable, well-balanced person accepted and approved by society.
- Every individual is to some extent creative. Creativity, like intelligence, is not an all or nothing quality.

—National Institute for Personnel Research

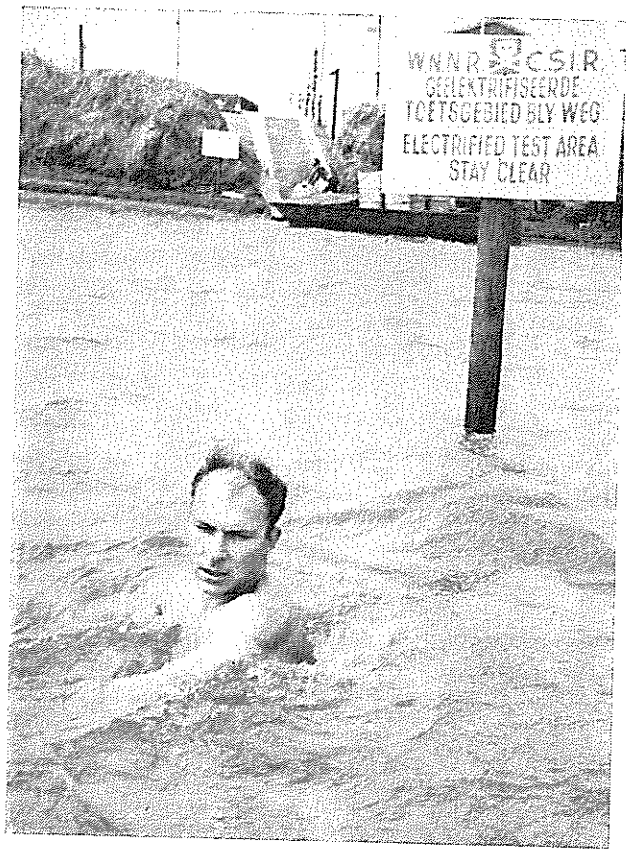
Electric shark barrier

The use of an electric current to protect bathers against shark attack has been tried out on the Natal coast and promising results have been obtained.

Laboratory tests carried out for the past two years by the C S I R and the Oceanographic Research Institute have shown that it is theoretically possible to electrify a strip of the sea which will keep sharks away from a beach and yet be harmless to humans. This is accomplished by installing an electrode system on the ocean bed parallel to the beach.

A 100-ft long experimental barrier was electrified in this way at St. Lucia Bay and its efficiency was determined by using shark nets.

To make this shark barrier effective it was necessary to have an electrode system capable of maintaining a constant field in the sea water along its entire length. Three systems were tested in a model and the best was selected. Factors taken into account were practicability, economy, resistance to corrosion, efficiency and ease of maintenance. Biological and electrolytical corrosion of the electrodes is a serious problem which still requires considerable investigation.



A scientist swims behind the electrical shark barrier, confident of his safety against attack. (Photo: Barry Jenman, Sunday Tribune.)

Other aspects of shark research such as a study of the biology and nature of sharks and a survey of the species of shark found along the Natal coast are being investigated by the Oceanographic Research Institute. The C S I R is, however, doing research on the hearing of sharks and is at present developing an apparatus to record the activity of fish in water in an experimental tank.

Hail studies

It is generally accepted that further knowledge of hailstorms and the mechanism of hail formation is required before attempts to prevent hailstorms of a damaging nature can be made with any hope of predictable results. Moreover, hailstorms are known to behave quite differently in different geographical areas.

During the past year the National Physical Research Laboratory continued its studies of hailstorms on the highveld. These were carried out in the Pretoria-Witwatersrand area where hail and thunderstorms frequently occur. Observations were made with the assistance of a dense network of voluntary observers. Important information on the movements of the storms in relation to winds in the upper levels of the atmosphere was acquired and it was also found that sustained hailstorms behave quite differently from a model that had been proposed for severe travelling storms studied elsewhere.

In addition to its field studies the N P R L also continued with laboratory studies of hailstones. Many hundreds of hailstones were examined in detail and certain generalizations about their modes of growth were made.

A further study was made of the changes in the crystal structure of poly-crystalline ice which take place with time and changes in temperature — this information is important in the interpretation of hailstone structures.

These laboratory studies also included an investigation into the mode of freezing of waterdrops. A method of determining the pressure inside freezing drops has been devised. This pressure builds up to high values and may cause the drops to shatter. Shattering of such drops is thought to be the principal cause of electrification during a thunderstorm.

New method for determining age of rocks

The geological history of South Africa is characterized by various periods of volcanicity the evidence of which is scattered throughout the stratigraphic column i.e. the succession of rock formations that occur in the earth's crust. These so-called lava horizons, represent thousands of feet of non-fossilliferous crustal rock, the most important of which are the Stormberg, Ventersdorp, Dominion Reef and Onverwacht formations.

Until recently it was impossible to do radiometric age-measurements on these rocks so that the correlation of wide-spread formations was open to speculation, particularly as, in the past, age measurements were based almost exclusively on physical features of the rock, which can be misleading.

Investigations by the National Physical Research Laboratory in co-operation with the Geological Survey have resulted in the application of improved methods for mineral separation and chemical processing, thus paving the way for the first ever radiometric age measurements of acid lavas and quartz porphyry.

This has not only provided a valuable aid in solving many stratigraphic and correlation problems but will also facilitate geological prospecting for minerals, groundwater and oil.

—National Physical Research Laboratory

Transport of abnormal loads

At the request of the Department of Transport, the C S I R is investigating problems arising from the transport of abnormal loads over existing public roads. At present, there is no fully satisfactory procedure to assist road authorities in deciding whether a permit should be issued for the passage of a load over a particular road.

Before granting permits for the transport of loads of this type by road it is necessary to consider the load carrying capacity of the road, its width, the number of bridges, and the stability of embankments or cuttings on slopes.

Loads of 200 tons or more which cannot be sent by rail, are at times transported by road in South Africa. Also industrial development makes it necessary to transport equipment of unusual dimensions because *inter alia* larger items of equipment are more economical than smaller.

The investigation, which is still in its initial stages, should be completed within two years, and is expected to provide a basis for a more rational approach to a problem affecting various organizations engaged in the development of the country.

Stabilization of sand with bituminous binders

The C S I R is assisting the South West Africa Administration with its road building problems by investigating bituminous sand stabilization methods.

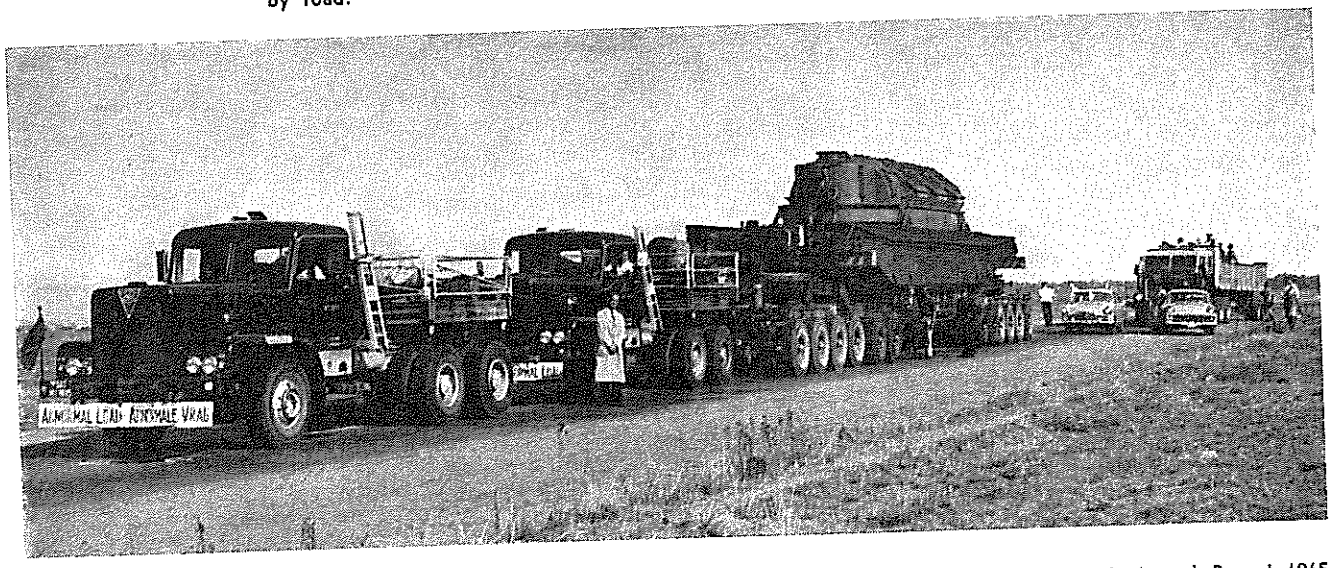
The ground in regions to the north of the territory is overlain by windblown sand, which in some places is up to several hundred feet deep. In most areas suitable aggregates for road-base construction are scarce and not within economical hauling distance so that the stabilization of the sand in these areas with bituminous binders to provide a road foundation would be particularly valuable.

During a period of preliminary experimentation the relative strengths and suitabilities of different bituminous materials mixed with sand from the areas concerned were determined in the laboratories of the National Institute for Road Research. The experiments were of particular value in that they showed that an addition of up to 15 per cent of the fine calcareous material which often occurs under the sand in Ovamboland could be used in the mixtures to improve the strength.

Techniques of mixing, aeration and compaction of bitumen sand mixes were then investigated on a larger scale at the Road Research test site at Silverton. An experimental loop road was laid in sections in which six different bituminous binders were tested, and trafficked continuously with a vehicle drawing a 14,000 lb axle load. The experiment indicated the best techniques to use and the most promising mixtures for trial in a full-scale road experiment constructed in Ovamboland in South-West Africa on the road between Tsumeb and Ondangua.

The one-mile length consists of 18 sections laid with different mixtures in different thicknesses. The performance under traffic of the different sections in this experimental length is being followed closely and the gradual increase in strength of the various sections is also being measured at intervals.

A typical example of an abnormal load being transported by road.



Motor vehicle running costs

In estimating the eventual economies expected to accrue from a road facility in comparison with the expenditure on the construction and improvement of such a road, the effect of different types of road on motor vehicle running costs is one of the important factors to be taken into consideration.

The C S I R has therefore calculated a set of running-cost tables for different types of vehicle on various types of roadway. The variables included in this table are four classes of motor vehicle — passenger cars, light delivery vans, heavy commercial vehicles and heavy articulated trucks — and also various characteristics of roads such as curves, plus and minus grades, roadway surfaces and traffic. The effect of traffic is calculated as the influence of change in speed on running costs.

A companion study in which the minimum direct costs of road accidents have been estimated, has also been completed.

— National Institute for Road Research

Improved Tellurometer

The National Institute for Telecommunications Research (NITR) has for some years been carrying out research work on the use of radio waves for the measurement of distances and it was as a direct result of this work that a prototype of the Tellurometer was developed in 1956. Since then many refinements have been incorporated in the instrument so that the new Tellurometer is much more accurate than its predecessors.

The new Tellurometer uses a shorter carrier wavelength than the earlier models, i.e. 8 mm, compared with the wavelength of 10 cm, and more recently, 3 cm, of the older models. As, in effect, Tellurometers measure distance in terms of the wavelength of a 'pattern' frequency modulated onto the carrier, the use of a shorter carrier wavelength offers a number of advantages. In practice shorter carrier wavelengths can support higher modulation frequencies; this means finer patterns and greater precision of measurement.

With the use of a shorter carrier wavelength, narrower beamwidths are possible. This affords a great deal of protection from radio interference and also reduces the interference caused in other systems by the Tellurometer. The most important advantage of the narrow beam, however, is that it makes it easier to avoid stray reflections from the ground or from obstacles close to the line of measurement, which under certain conditions have proved to be a serious limitation to the accuracy of radio distance measurement.

At ranges above about 10 km, errors due to atmospheric effects tend to predominate, and as radio waves of all frequencies are affected to much the same extent, no great advantage is expected from the 8 mm instrument in this respect. At shorter ranges, however, preliminary field trials have verified the increase in accuracy and the freedom from ground reflections that were anticipated. Where the accuracy of the distances measured with earlier Tellurometers was expressed in centimetres, that of the new instrument is expressed in millimetres. Its increased precision at short range makes the instrument extremely suitable for civil engineering and for cadastral surveying.

Distance measurement by infra-red beam

A new distance-measuring device which operates on infra-red rays is now at the laboratory testing stage. The new instrument promises to be a highly precise instrument suitable for distance measurement at ranges up to 1 km. Although, in general, such systems suffer from limited range, are more dependent on good visibility, and tend to be bulky and expensive, their accuracy is less affected by atmospheric conditions than that of the Tellurometer and they can operate with smaller clearance angles from obstacles. The NITR instrument will be relatively light and inexpensive.

The infra-red beam is generated by a gallium-arsenide diode, which is a light-emitting diode (LED). If suitably cooled, such a device operates as a laser, emitting a highly intense narrow beam of coherent radiation, but if operated at a lower level of power, and uncooled, a LED loses many of the laser properties, and becomes a relatively simple device which retains one important advantage over other light sources — the ease with which it can be modulated at high frequencies.

A laboratory model of an instrument using an uncooled gallium-arsenide diode as the source of infra-red radiation has been built. The instrument comprises the following: a LED which can be modulated at frequencies up to 75 Mc/s; optical focusing systems; a receiver which amplifies the radiation returned by a reflector at the far end of the line of measurement, and a unit which compares the phases of the transmitted and received modulation.

Preliminary tests of the instrument have shown that distances of several hundred metres can be measured readily to an accuracy of within a few millimetres. The accuracy is at present limited by the difficulty of modulating the beam at frequencies greater than 75 Mc/s. The development of better LEDs is, however, progressing rapidly, and as these become available it is expected that accuracies of within about 1 mm in distances up to 1 km will be achieved.

— National Institute for Telecommunications Research

Re-use of sewage effluent

The limited water supplies of Windhoek, and the relatively high cost of obtaining additional supplies, has led the City Council to give serious consideration to the possibility of recycling purified sewage effluent for domestic use. The C S I R was approached to investigate the problem in collaboration with the City Engineer's Department. The investigation was not only successful from the technical, but also from an economic point of view, since it was estimated that the recycled water could be delivered to consumers at 10c per 1 000 gallons less than the present supplies.

The city's sewage purification plant and the water purification plant are in close proximity, and the objective of the investigation was the further purification of the effluent by processing it through the water purification plant. The main problem was the removal of ammonia, nitrates, bacteria and viruses, algae and detergents.

These problems were successfully overcome after extensive investigations on a laboratory and pilot-plant scale and after certain adjustments had been made to the flow pattern of the sewage at the purification works. A demonstration was given at the pilot plant to city councillors and members of the Executive Committee of the Administration of South West Africa to show how class-A drinking water could be produced from sewage effluent. The City Council of Windhoek subsequently approved the incorporation of purified sewage effluent in its water supply in principle, and the design of full-scale units is now under way.

An important development during the investigation at Windhoek was a flocculation/flotation technique for the removal of algae from maturation ponds. It is foreseen that the technique will have wide application as the availability of an inexpensive way of removing algae may result in increasing use of stabilization pond systems for the purification of sewage effluent. This is also true of pond systems for the treatment of industrial effluents.

Stabilization ponds offer a relatively inexpensive and simple solution to the problems of many small communities which cannot afford conventional sewage installations. An unsatisfactory feature of stabilization pond purification systems is that algae are usually present in the effluent. The removal of algae from effluents and raw water supplies is regarded throughout the world as a problem soluble only by means of costly techniques which usually make purification processes uneconomic.

The technique is also effective for the elimination of bacteria and viruses, and considerably reduces the concentration of detergent in the water. The possibility also exists that the algae removed by this method can be used as animal feed.

Treatment of effluent from textile factories

The C S I R has been approached by various textile factories for assistance in solving their effluent problems. In the majority of cases, improvement of the effluent could be achieved by the application of certain basic principles, such as the stabilization of effluent flow and quality, and the segregation of 'organic' and 'inorganic' fractions so that these can be treated and disposed of separately.

The stage at which the C S I R is approached for assistance to a large extent determines the degree of success which can be attained. In those instances where approaches are made during the planning stage of a factory, positive recommendations can be made for the design of treatment facilities in accordance with proved and modern principles of treatment. Existing plants, however, frequently have to cope with facilities which were inadequately planned and which can only be modified or replaced at very great expense. In these cases, the improvement of effluent quality can be extremely difficult.

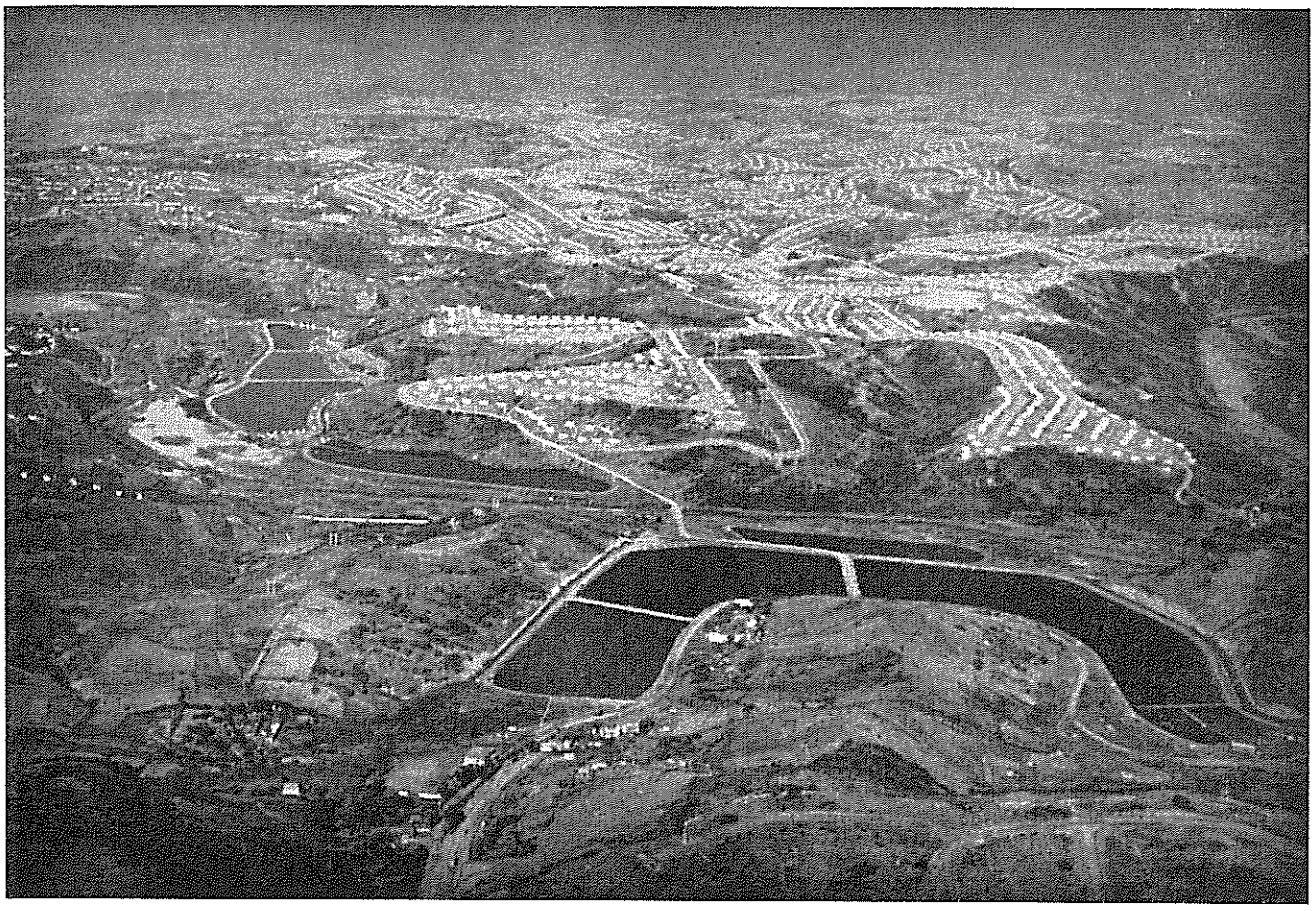
Current research on the management and purification of effluents from the textile industry which is rapidly becoming a major manufacturing industry in the Republic, has already produced valuable data. It is planned eventually to produce a manual for the treatment of textile effluents which will have particular application to South African conditions.

Sewage treatment for rapidly increasing populations

The newly established Bantu Township at Umlaas and Indian Township at Chatsworth near Durban are showing population increases of about 15,000 per annum. As the treatment of sewage from such a rapidly increasing population by conventional purification plants would have been almost impossible and most expensive, the Durban Corporation decided to employ the stabilization pond systems developed by the C S I R.

The completion of a sea pipeline which will eventually serve the townships has been delayed for nearly two years, and will now only be completed towards the middle of 1966. It is estimated that at this stage the ponds will have to treat the sewage from a population of about 135,000 people — twice that for which the ponds were designed. Extensions to the ponds are not possible on account of the topography of the area.

By using the primary pond as an anaerobic pond, and by recirculating effluent from the secondary pond, the



An aerial view of the stabilization pond systems at Chatsworth and Umlaas townships showing the topography of the surrounding countryside.

C S I R has succeeded in maintaining efficient purification with a ratio of loading to pond area which has probably never been equalled.

The capital and maintenance costs of the scheme are only about one-fifth that of a conventional scheme. The use of the pond system has enabled the Durban Corporation to implement a crash housing-programme for the Indian and Bantu population with a minimum of investment in sanitation and without disturbing the aesthetics of the environment.

— National Institute for Water Research

Water supplies from dry river beds and aquafers under sand rivers

The Kuiseb River in South West Africa forms a delta which is completely covered by sand dunes except for its northernmost channel, in which surface water flows to a point near the coast when the river is in flood. It is this water that provides the entire water supply for Walvis Bay and Swakopmund.

It is also known that a further supply of fresh water filters into the sea at a point approximately 20 miles south of Walvis Bay. This means that the other channels of the delta also contain water — a fact of the utmost importance to Walvis Bay in view of its increasing water consumption.

In the absence of any surface features to indicate the positions of the other channels or of old river beds, the only means of tracing these water sources underneath the dry sand is by seismic refraction measurements in the valleys between the dunes. The C S I R was asked to assist with this work.

The results of systematic seismic measurements were used to compile a contour plan of the bedrock above sea level, from which the position of any channel that might be obscured by the sand could be determined. At the beginning of the year the first good quality water was found in all these boreholes.

To date the seismic measurements, which were carried out with a single-channel time-interval meter and hand-operated hammer, have covered only a portion of the

vast delta. A more powerful seismic source and a multi-channel amplifier and recorder will be required for the more difficult conditions encountered deeper in the dunes. The new apparatus for which the amplifier has been built by the C S I R, is expected to be ready for use in the near future.

—National Physical Research Laboratory
National Institute for Water Research

Carding of mohair

The occurrence of kemp in mohair is detrimental to the quality and appearance of the final product because the kemp fibres are coarse and brittle and also do not dye to the same depth of shade as the normal hair. The problem of kemp removal during the processing of mohair has occupied the attention of the South African Wool Textile Research Institute (S A W T R I) in Grahamstown for a long time.

The selective removal of kemp from mohair must be carried out before the completion of top manufacture, since after combing no facilities are available for fibre removal. S A W T R I found that during carding, i.e. in the process where the scoured mohair is disentangled and converted into sliver form, the kemp fibres tend to be selectively collected by the card clothing. The mohair fibres which have a density about twice as high as kemp tend to migrate to the outside of the layer of fibres covering the revolving rollers, leaving the kemp fibres concentrated near the roller surface where they are collected by the card clothing.

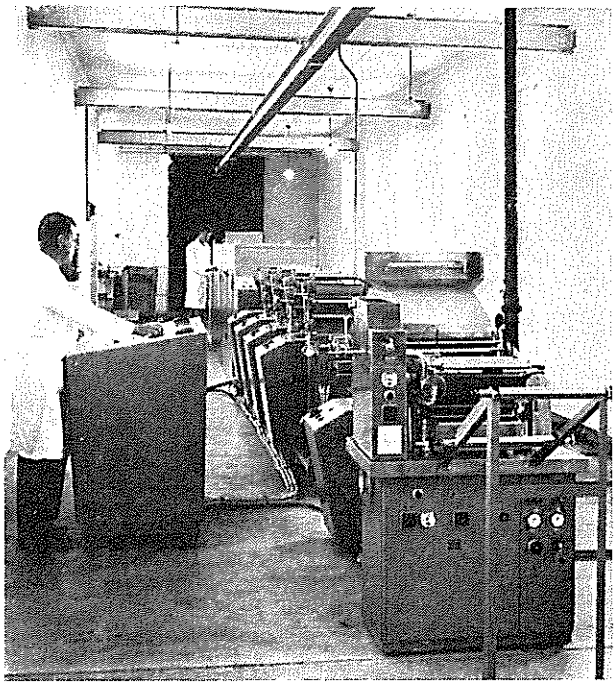
Since certain rollers have a greater kemp collecting power than others, an appreciable amount of kemp can be removed by more frequent cleaning (fettling) of these rollers.

The Institute is also studying the subsequent process of combing in order to evaluate under what conditions maximum removal of kemp occurs.

Shrinkproofing of wool

A most effective technique developed in Germany for shrinkproofing wool at any stage of processing between the combed top and the end-commodity has been pioneered in South Africa by the S A Wool Textile Research Institute. In the opinion of the International Wool Secretariat, the method, known as the Basolan DC technique, is to date the simplest and most effective process for shrinkproofing wool.

The major advantage of the Basolan DC process over other shrinkproofing techniques is that this chemical process in which chlorine, liberated by dichloroisocyanuric acid, effectively shrinkproofs the wool by oxidation while improving the resistance of the fibres to abrasion and also improving their strength, possibly through the formation of bonds between reactive groups in the wool and the isocyanuric acid residues.



The Benz plant for continuous finishing and dyeing enables S A W T R I to study modern methods of treating tops and piece goods.

S A W T R I has converted the Basolan DC technique into a continuous process for top sliver, a procedure which has been tested on a factory scale. Normally a five-bowl backwashing machine is used in factories. The first bowl is used for wetting out the wool slivers (the addition of Basolan DC to this bowl is optional). The second bowl contains the shrinkproofing Basolan DC reagent and the third sodium bisulphite, which acts as antichlorinating agent. The last two bowls are used for rinsing the top slivers which are subsequently dried.

By carrying out the shrinkproofing at the correct pH and temperature, the wool is rendered shrinkproof without causing any significant changes in the strength or colour of the wool fibres. It has also been established by S A W T R I that this method of treatment has no detrimental effect on the behaviour of the wool during spinning.

—South African Wool Textile Research Institute

Co-operative Industrial Research

Introduction

The Leather, Fishing, Sugar Milling and Paint Industries have been assisted in the development of their own autonomous research institutes through financial contributions from the C S I R equivalent in amount to the annual contributions of industrial subscribers. The operation of these industrial research institutes is reviewed annually by the Advisory Committee for the Development of Research for Industry; and the level of financial support for each institute is determined at five-yearly intervals on the basis of comprehensive reviews undertaken jointly by the C S I R and the Board of Control of the institute concerned.

A few of the projects undertaken by these industrial research institutes are briefly described below.

Varnishes on wood

The conclusion reached by the South African Paint Research Institute after an exhaustive investigation into a large number of clear finishes (varnishes) is that the maximum life to be expected is not greater than 2 years exterior exposure. It is therefore recommended that paint be used in preference.

Not only is the life of a paint much longer, about 5 years, but it shows a cost advantage since the preparation for repainting is a great deal cheaper than preparation for revarnishing.

Primers protect steel

The advantages of multi-coat primers as a means of protecting steel against rust and corrosion has been proved conclusively in the research work carried out by the S A Paint Research Institute (S A P R I) over a period of five years.

The S A P R I found that clean metal with three coats of red lead primer but with no top coat showed no sign of rusting or defects after five years. A single coat of the primer failed after two years, while two coats gave better results though these were not to be compared with the results from three layers of the primer.

Similar results were obtained with zinc chromate/epoxy resins which are to be preferred in a marine environment and with lead silico chromate which has better keeping qualities than red lead if the primer is to be stored in tins for any appreciable time.

— South African Paint Research Institute

Extraction of sugar cane juice

The unit operation of leaching is applied in raw sugar factories to the extraction of sugar from cane. The shredded cane is fed through a series of up to seven three-roller mills. Cane entering the final mill (stage) is first saturated with water which dilutes the residual juice in the cane prior to expression. The expressed juice from each stage is pumped on to the cane fed to the preceding stage. The ratio of juice to fibre (underflow) in the cane leaving each stage decreases from the first to the last stage. Hence the process may be described as multistage countercurrent leaching with variable underflow.

Such a process may be evaluated by the use of a graphical construction known as the Ponchon Savarit diagram, the main purpose of which is to determine the number of ideal stages required to achieve a given degree of extraction. (An ideal stage is one in which complete mixing occurs between residual juice in cane and the water or juice added to it.)

The Sugar Milling Research Institute has conducted detailed analyses of results from the majority of milling installations in South Africa using the above method.

It was found that the stage (mixing) efficiency of conventional equipment was only 25 to 30 per cent. A statistical analysis of the results also indicated several interesting concepts regarding the most efficient method of operation of the process. The main conclusion from this survey was that the economy of the process could be increased by an improvement in mixing efficiency thereby decreasing the number of stages. It was shown that this could be achieved by extracting about 50 per cent of the juice in one milling stage, the remainder being efficiently mixed with the water in a diffusion unit and expressed by means of a second dewatering mill.

Samplers for the sugar terminal

As the price of sugar depends on its purity and its sucrose content it is necessary to test each consignment of sugar as it reaches the sugar terminal and again before it is despatched. In the past sampling was done manually but this was unsatisfactory as often the results were not representative of the whole consignment.

In addition, the design of the sugar hoppers at the new Durban sugar terminal receiving sugar consigned by road and rail, precluded all conventional methods of sampling, and the Sugar Milling Research Institute was called in to investigate the problem.

This has resulted in the design of two types of continuous horizontal rotary samplers by means of which representative samples of each consignment can be obtained as the sugar is discharged from the hoppers.

One of the samplers consists of an arm rotating in a horizontal plane across the sugar stream which collects about an ounce of sugar on a horizontal plate. The plate is cleared by a scraper into a receiver and the sample is subsequently analysed. The other sampler is a miniature screw conveyor mounted on the side of a hopper.

After successful testing of both prototypes at a sugar factory, three samplers were installed at the Sugar Terminal, and are performing satisfactorily. The use of the horizontal type sampler at factories and refineries where hand sampling is still the rule will help to ensure that there are no discrepancies between the sampled sugar and the bulk sugar from which the sample has been withdrawn.

— Sugar Milling Research Institute

South African pilchards for export

As a result of research work carried out by the Fishing Industry Research Institute (F I R I) in collaboration with the fishing industry, fresh pilchards can now be kept in a frozen condition for more than six months and are being exported to Europe.

The fishing industry is developing new markets overseas for South African fish. One of the products for which a demand has been established is frozen pilchard fillets. Unless treated, however, this fish rapidly becomes rancid, even at a temperature of —20°F. F I R I has discovered that ascorbic acid and gelatine prevent oxidation of the fish-oil, the cause of rancidity. Moreover, this treatment extends the shelf-life of frozen pilchards by more than six months.

As a result, the potential market for South African pilchards has been considerably increased, not only through sales to overseas canners but also through local sales of fresh fish direct to the consumer.

New bags for fish meal

Fish meal tends to become rancid quickly when exposed to the atmosphere owing to oxidation of the fish oil and lipids it contains.

Unless checked the temperature may rise to levels detrimental to the protein content of the fish meal and combustion of the meal may even take place.

Research has been carried out into treatment with anti-oxidants to prevent rancidity and spontaneous heating. The Fishing Industry Research Institute has discovered an oxidant which is as effective but more economical than those generally used overseas for this purpose.

This substance is not yet being used in practice for the protection of fish meal as experiments on the packing of fish meal in hermetically sealed plastic bags are still in progress. Special filling valves have been designed and efficient filling and handling techniques developed to prevent air from entering the bags. Two successful trial shipments of fish meal in these bags have been made.

— Fishing Industry Research Institute

Assessment of leather quality

Changes in methods of shoe manufacture and the public's preference for unlined shoes have meant new requirements in regard to leather. The old methods of judging leather by quality are no longer adequate.

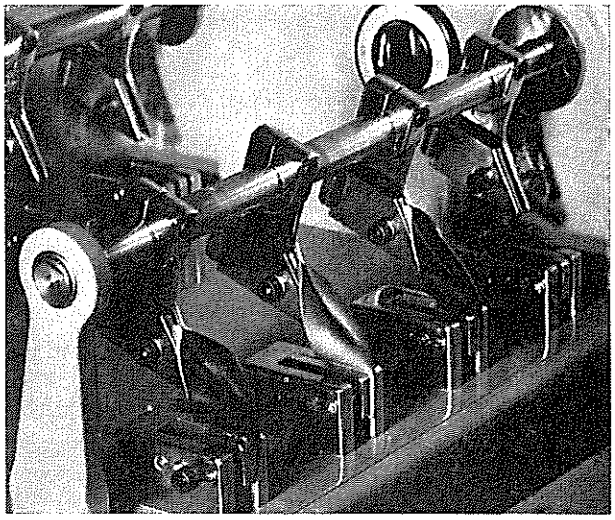
Any new tests developed by the Leather Industries Research Institute in Grahamstown must provide information on how a leather compares with synthetic material if it is to be of any value to South African footwear manufacturers. Many tanners have availed themselves of this service for assessing their products.

Particular emphasis has been given in these tests to the performance of leather under conditions corresponding to those in the various manufacturing processes.

The development of perspiration-resistant leathers, for instance, has been of major importance in maintaining the traditional markets for leather in the face of competition from synthetic materials.

Certain synthetic perspiration solutions and treatment methods have been tested on leather and several have been found unsuitable for treating many of the leathers used for the uppers of modern shoes, and new methods have been developed which have elucidated the causes and prevention of perspiration damage.

It has also been necessary to develop new tests for assessing the resistance of leather to vulcanization and moist heat setting. One of the problems has been to simulate manufacturing processes and at the same time to obtain specimens suitable for testing.



A leather flexing machine used by the Leather Industries Research Institute to study the effects of synthetic perspiration on shoe upper leathers.

Promotion of foot health in schools

Following an approach by the Leather Industries Research Institute, the Cape Education Department has approved the principle of regular inspection of the feet and footwear of school-children.

Surveys conducted among school-children in Britain and South Africa have revealed a disturbingly high incidence of foot faults and malfunctioning which in many instances are the result of badly fitting footwear. The surveys indicate the need for foot inspection in schools and for the education of parents and children regarding the selection of the correct shoe and fitting.

The Institute has designed a simple but efficient test for use in schools which has been successfully applied in a group of nursery schools in Port Elizabeth. A record is made of the length of every child's foot and the size of shoe worn as well as the size which should be worn. One copy of the data is kept in the school and a second in the Institute. A card bearing the information together with advice on shoe fitting and footcare is sent to the parents.

Initially, the checks were made by Institute staff but the plan is to extend the scheme by training school personnel to carry out routine inspections so that cases of serious foot malfunction and distortion can be referred to the official school medical inspectors.

This project is a practical application of the knowledge derived from a series of foot-shape surveys carried out by the Institute over a period of more than ten years on behalf of the South African footwear industry.

— Leather Industries Research Institute

Medical research

During 1965 the work of the medical units, groups, and *ad hoc* projects sponsored by the CSIR has progressed on a scale commensurate with available funds.

This work is reported annually in the *Annual Report on Medical Research*, which is obtainable from the Head, University and Medical Research, CSIR, P.O. Box 395, Pretoria.

The work described in the above-mentioned report represents but a fraction of the medical research potential inherent in the natural talent of the peoples of this country, much of which lies dormant because of lack of funds.

Medical research grants

The allocation of State funds to medical research for the greatest advantage of South Africa is receiving attention.

As South African universities and research organizations increase in size, gain experience, and expand in scientific contribution, their applications to the State for research grants increase annually so that sometimes it is beyond the ability of the State to provide adequate funds.

The funds spent by the CSIR between 1960 and 1964 on the recommendation of the Committee for Research in the Medical Sciences were:

1960.....	R296,252
1961.....	R285,538
1962.....	R321,103
1963.....	R346,994
1964.....	R383,311

Funds spent on long-term research projects established as units or groups increased during the years 1960 to 1964 from R248,328 to R298,570.

Over the same period funds spent from year to year on *ad hoc* projects supported on an annual basis have been as follows:

1960.....	R47,924
1961.....	R61,993
1962.....	R57,466
1963.....	R77,635
1964.....	R84,741

The tendency for applications for research grants to increase annually, shows the enthusiasm of medical scientists for research.

A list of the medical research units, groups and projects supported by the CSIR is given on page 33. The following is a brief account of some of their activities during the year under review.

Abdominal decompression during pregnancy

The CSIR has given further support for the investigation of children born by this method. It is felt that a final conclusion as to the advantages claimed for the method cannot be reached for a number of years. Performance at school may yet prove to be an important factor in arriving at a decision.

Bilharzia

Expansion of research on bilharzia has been made possible by the allocation of additional funds by the CSIR. The intention is to collect and collate all available evidence that will throw light upon the impact of bilharziasis upon public health and physical efficiency, particularly in endemic areas.

Some medical scientists in South Africa maintain that the impact of the disease is not as severe as has been alleged in numerous published articles, and a vigorous effort is being planned to establish the facts of the matter.

To obtain reliable data about bilharziasis in a country where the disease is not notifiable, is difficult. One reason, perhaps, is that the true position has never been explored and has remained a matter of allegation and denial based on opinion rather than evidence.

Pneumoconiosis Research Unit

The Pathology Division of this Unit is now housed in a new building presented by the Government. The Biochemical Section should soon be housed there as well.

Asbestosis research, a special project within the activities of the PRU, is becoming more and more important, not only in South Africa but throughout the world.

The relationship between asbestos dust and pneumoconiosis (asbestosis) is recognized and understood, and the need to reduce air pollution by this dust is accepted. There is increasing public concern about

a higher incidence of malignancy among persons exposed to asbestos dust in contrast with the normal malignancy rate among persons exposed to the silica dusts of the gold mining industry. What is not clear, however, is the exact relationship between malignancy and exposure to asbestos dust. It is imperative that research work in this field be stepped up in the interests of all concerned.

It is possible that research in the U S A and Europe may provide the answers sought here. This, however, is unlikely because mine dust problems in South Africa are not identical with those overseas. For many reasons, it may in the long run prove far more profitable to carry on with indigenous research.

Poisons derived from fungal metabolites (mycotoxins)

The part played by fungi in disease and death of livestock, fish, poultry, and perhaps of man himself has received mounting attention.

Epidemiologists and others allege repeatedly that mycotoxins, and notably aflatoxin, are probably responsible for many cases of cancer in man. This theory would explain epidemics of cancer in circumscribed localities in South Africa and abroad.

Attemps to obtain funds for expansion of researches in this field have resulted in the establishment by the Minister of Planning of a coordinating committee which consists of representatives from organizations such as the Department of Agricultural Technical Services, the Cancer Units of the South African Institute for Medical Research and the National Cancer Association, the Microbiology Section of the National Nutrition Research Institute of the C S I R, and the National Chemical Research Laboratory of the C S I R.

It is hoped that the committee will establish an organized research project.

Atherosclerosis

Atherosclerosis is a disease process characterized by an abnormal accumulation of fat, particularly cholesterol, and by extensive fibrosis in the arterial wall which impede the flow of blood. It commonly manifests itself as coronary heart disease, and other vascular diseases.

The accumulation of cholesterol in the arterial wall is believed by many to be the primary abnormality which gives rise to the disease, but the mechanism by which it accumulates is not known.

It has been demonstrated that glucose, and some other sugars, will promote the crystallization of cholesterol under certain circumstances. Preparations of blood samples from subjects with coronary heart disease have been found to show a significantly greater tendency to promote the crystallization of cholesterol than blood samples obtained from subjects without manifestations of the disease. This difference is attributed to the delayed clearing of glucose from the blood of subjects with coronary heart disease.

The crystallization of cholesterol in the arterial wall by such a mechanism could account for the accumulation of cholesterol in this tissue. Furthermore, crystalline cholesterol would act like a foreign material and has been shown to promote an extensive fibrous reaction in arterial tissue.

Studies are in progress to determine whether such a process could account for the development of this disease in man.

Gastroenteritis

The role of lactose intake in the perpetuation of diarrhoea in malnourished children is being studied. It appears that in these children, infections of the gastrointestinal tract affect the lactose-splitting enzymes. The undigested lactose then acts as an irritant and prolongs the diarrhoea attack. Good results are being obtained by treating children with lactose-free formulae.

Diabetes

Attempts are being made to find out the true frequency of diabetes in different racial groups in the region of Cape Town. So far 600 Indians and 500 Cape Malays, belonging to families selected at random, have been tested.

It is too early to give definite results, but the prevalence of diabetes among Indians of more than 25 years of age reaches the staggering figure of 12.6 per cent. Among Malays the incidence may be a little less.

Previously known diabetics amounted to 4.5 per cent, which is higher than the usual figure for whites of about one per cent. This means there are at least twice as many unknown diabetics as known ones among the Indian community.

Earlier work indicates it is likely that the incidence of diabetes (by present definition) rises with age and it is probable that nearly half the Indian population of more than 50 years of age become diabetic.

These figures tally with those found by different methods among the Indians of Natal.

Blood tests in amoebiasis

The Amoebiasis Research Unit has for some years been conducting research into the diagnosis of amoebiasis by means of blood tests, and many methods have been tried. A gel-precipitation test has proved of value, in that it indicates whether the patient's tissues have been invaded by amoebae.

In most people harbouring the parasite, the amoeba remains harmlessly in the bowel, and in such cases the blood test is negative. If, however, the amoeba invade the tissues, and cause damage, the test becomes positive and remains so for years, whether or not the patient is treated.

From the clinical angle, a negative result has value in that it precludes amoebic infection in the diagnosis of suspected liver abscess and related diseases. The test may be used as an epidemiological aid for assessing the frequency of invasion and hence the importance of the disease in any community.

A programme of international co-operation is being devised.

Alkaloids producing cirrhosis of the liver

It has long been known from the pioneer work of Professor Douw Steyn at Onderstepoort that several alkaloids from the *Senecio* species give rise to cirrhosis of the liver and cause death in cattle.

The structure of these alkaloids has been the subject of research at the University of Natal for the past 25 years. More recently, the subject has been extended to include a study of the formation of these alkaloids in the plant using carbon-14 labelled precursors.

This year the laboratory synthesis of one of the alkaloids, senecionine, labelled with carbon-14, has been accomplished in the C S I R Natural Products Research Unit, at the University of Natal, Pietermaritzburg. The work was done in collaboration with the Toxicological Research Section of the British Medical Research Council. This material will be used to follow the fate of the alkaloid in experimental animals.

CSIR research units and groups at universities and other institutions

Chromatography Research Unit, University of Pretoria.

Cosmic Rays Research Unit, University of Potchefstroom.

Geochemistry Research Unit, University of Cape Town.

Marine Research Unit, Oceanographic Research Institute, Durban.

Namib Desert Research Association, Transvaal Museum, Pretoria.

Natural Products Research Unit, University of Cape Town.

Oceanographic Research Unit, University of Cape Town.

Palynology Research Unit, University of the Orange Free State.

Solid State Physics Research Unit, University of the Witwatersrand.

Medical research units and groups

Amoebiasis Research Unit, Institute of Parasitology, Durban.

Anaesthetic Deaths Research Project, University of Pretoria.

Arthropod-borne Virus Diseases Research Unit, Poliomyelitis Research Foundation, Johannesburg.

Bacterial Genetics Research Unit, University of Pretoria.

Bilharzia Research Unit, subdivisions at Nelspruit, University of Potchefstroom, South African Institute for Medical Research, Johannesburg.

Cardio-Pulmonary Research Unit, University of the Witwatersrand.

Cardio-Vascular Pulmonary Research Group, University of Cape Town.

Clinical Nutrition Research Unit, University of Cape Town.

Degenerative Diseases Research Group, University of Stellenbosch.

Dental Research Unit, University of the Witwatersrand.

Endocrine Research Group, University of Cape Town.

Heart Research Group, University of Pretoria.

Human Biochemistry Research Unit, S A Institute for Medical Research, Johannesburg.

Iodine Metabolism Research Unit, University o Stellenbosch.

Iron and Red Cell Metabolism Research Unit, University of the Witwatersrand.

Nutritional Anaemia Research Group, University of Natal.

Nutritional and Dental Health Research Group, University of Pretoria.

Orthopaedic Development Unit, University of Cape Town.

Photobiology Research Group, University of Pretoria.

Pneumoconiosis Research Unit, Johannesburg.

Protein Research Unit, University of Cape Town.

Renal Metabolic Research Group, University of Cape Town.

Tissue Damage and Cell Metabolism Research Unit, University of Stellenbosch.

Tuberculosis Research Project, Veterinary Research Institute, Onderstepoort.

Virus Research Unit, University of Cape Town.

International conferences attended by CSIR staff during 1965

Dr F. J. Hewitt, Vice-President of the C S I R, attended the *Symposium on Electromagnetic Distance Measurement* held in Oxford, England, from 6 to 10 September.

Mr C. G. Hide, of the South African Scientific Liaison Office, London, attended a meeting of the *Intergovernmental Oceanographic Commission*, held in Paris, from 3 to 12 November.

Dr P. le R. Malherbe, of the South African Scientific Liaison Office, Cologne, attended the *3rd International Congress of the International Research Group on Refuse Disposal*, held in Trento, Italy, from 24 to 29 May.

Dr R. G. Shuttleworth, South African Scientific Attaché in Washington, D.C., attended the following international conferences during 1965:

Symposium on International Participation in Biomedical Experiments in Space, National Aeronautics and Space Administration, Houston, Texas, U S A, from 22 to 23 April.

Bicentennial Celebrations of the Smithsonian Institution, Washington, D.C., from 16 to 19 September.

1st International Symposium on Water Desalination, Washington, D.C., from 3 to 9 October.

4th Symposium on Detonation, U S Naval Ordnance Laboratory, White Oak, Silver Spring, Md., U S A, from 12 to 15 October.

Symposium on Scientific Results of Gemini III and IV Space Flights, National Aeronautics and Space Administration, Washington, D.C., from 18 to 19 October.

Mr D. G. Kingwill, Director of Information and Research Services, attended the *31st Annual Conference of the International Federation of Documentation* (*F I D*) in Washington, D.C., from 7 to 16 October. He also attended the *Annual Conference of the Association of Special Libraries and Information Bureaux* (*ASLIB*) held at the University of Keel, Staffordshire, England, from 29 September to 1 October.

Mr J. H. Visser of the Industrial Economics Division, Information and Research Services, attended the 1965 *Annual Meeting of the Forest Products Research Society*, held in New York City, U S A, from 28 June to 1 July.

Dr T. L. Webb, Director of the National Building Research Institute, attended the following conferences:

1965 Conference of Directors of Building Research of the English-speaking World held in Garston and London, England, from 16 to 20 August.

3rd Congress of the International Council for Building Research, Studies and Documentation (*CIB*) and the *5th General Assembly of CIB* held in Copenhagen, Denmark, from 23 to 31 August. A paper was read.

Meeting of CIB Commission W-25 on Windows and Indoor Climate in Tropical and Sub-Tropical Areas held in Copenhagen on 21 August.

19th Meeting of the Permanent Committee of the International Union of Testing and Research Laboratories for Materials and Structures (*RILEM*) held in Ankara and Istanbul, Turkey, from 19 to 25 September.

Meeting of the RILEM Technical Committee on Durability of Concrete and Concrete Structures to consider the subject of *Attack of concrete by aggressive agencies* held in Copenhagen, Denmark, on 1 September.

1st International Conference on Thermal Analysis — Thermal techniques and their applicability — held in Aberdeen, Scotland, from 6 to 9 September. A paper was read and the delegate served as chairman of one of the sessions.

Mr J. E. Krüger of the National Building Research Institute, also attended the *1st International Conference on Thermal Analysis* in Aberdeen, Scotland and read a paper. He also attended the *Symposium on Moisture Problems in Buildings*, organized jointly by RILEM and CIB and held in Helsinki, Finland, from 16 to 19 August.

Mr S. J. Richards of the National Building Research Institute attended the following:

International Commission for Illumination (*CIE*) *Meeting on Sunlight* held in Newcastle-upon-Tyne, England, from 5 to 9 April.

Symposium on Problems Involved in the Influence of Climate upon Building held in Vienna, Austria, from 3 to 6 May under the joint auspices of the International Council for Building Research, Studies and Documentation, the World Meteorological Organization and the International Federation for Housing and Planning.

Meeting of CIB Commission W-17 on Heating and Ventilation held in Padua, Italy, from 8 to 10 June; a paper was presented.

Dr D. M. Calderwood, of the National Building Research Institute, acting in his capacity as President-in-Chief of the Institute of South African Architects attended the *Commonwealth Association of Architects Conference* held in Malta from 23 to 29 June and also the *Union of International Architects 8th World Conference* held in Paris, France, from 30 June to 11 July.

Mr G. W. Donaldson, of the National Building Research Institute, attended the *International Research and Engineering Conference on Expansive Clay Soils* sponsored by the Commonwealth Scientific and Industrial Research Organization of Australia, the Texas Section of the American Society of Civil Engineers and the College of Engineering, Texas A and M University and held in Texas, U S A, from 30 August to 3 September. He presented six papers on expansive clays.

Mr Donaldson also attended the *6th International Conference on Soil Mechanics and Foundation Engineering* held in Montreal, Canada, from 8 to 15 September where he presented two papers.

Mr D. E. Dobson of the National Building Research Institute attended the *International Conference of Building Officials*, held in Phoenix, Arizona, U S A, from 18 to 22 October.

Members of the Timber Unit of the National Building Research Institute attended the following conferences during 1965:

Mr H. Scharfetter: *Symposium on Industrial Adhesives for Wood and Paper*, held at the University of Wisconsin, Madison, U S A, from 9 to 10 February;

Mr P. H. Muller: *International Symposium on Joints in Timber Structures* held in London from 31 March to 2 April;

Mr J. S. M. Venter: *19th General APPITA Conference* in Hobart, Australia, from 29 March to 3 April. Lectures were given and discussions held on pulp, paper and board.

Dr P. C. Carman, Director of the National Chemical Research Laboratory attended the *23rd IUPAC Conference* held in Paris from 2 to 9 July.

Other members of the National Chemical Research Laboratory staff who attended overseas conferences during 1965 were:

Dr C. E. Bird, Head of the Corrosion Group, who attended the *RILEM Symposium* on *The behaviour of concrete exposed to water*, held in Palermo, Sicily, from 24 to 26 May;

Dr P. R Enslin, who attended the *Organisch-chemisches Inst. der Universität Bonn, Summer School on ORD and CD*, in Bonn, West Germany from 24 September to 1 October; a paper was presented.

Dr F. J. Joubert, who attended two conferences in Paris, the *3rd International Wool Textile Research Conference* from 28 June to 9 July and the *23rd IUPAC Conference* from 2 to 9 July. A paper was delivered at the former conference.

Mr W. G. B. Mandersloot, of the Chemical Engineering Group, who attended the *Joint Meeting of Am. Inst. Chem. Eng. — I.Ch.E.* in London from 14 to 17 June and the *1st International Symposium on Water desalination* in Washington, D.C., U S A, from 3 to 9 October. He read a paper at the Washington symposium. He also attended the *Conference and Exhibition on Air Pollution Control* of the Association of German Engineers, held in Düsseldorf, Germany, from 5-9 April.

Dr L. Miller, who attended the *International Symposium of Solar Energy Society* in Phoenix, U S A, from 15 to 17 March;

Dr K. G. R. Pachler, who attended the Meeting of the *Gesellschaft Deutscher Chemiker* in Bonn, West Germany from 13 to 18 September and the *5th Annual Varian NMR-EPR Workshop* in Zürich, Switzerland, from 19 to 30 September.

Members of the staff of the National Research Institute for Mathematical Sciences attended the following conferences during 1965:

Mr W. W. Schroeder: *12th International Spectroscopy Colloquium*, Exeter, England, from 12 to 17 July; a paper was read.

Dr G. J. Kühn: *3rd Congress of the IFIP — International Federation for Information Processing: Computer Science and Applications*, New York, 24 to 29 May; *IFAC/IFIP — Conference 1965: Microminiaturisation in Automatic Control Equipment and in Digital Computers*, München, Germany, 21 to 23 October; *SHARE XXV Congress — IBM Computer Users Information Exchange Association*, Chicago, U S A, 16 to 20 August.

Prof. C. Jacobsz also attended the *IFIP — International Federation for Information Processing Congress* in New York in May.

Mr R. B. Anderson: *Conference International des Grandes Reseaux Electrique* — Study Committee No. 8 Lightning and Surges) and its Working Group on Lightning Flash Counters, held in Vienna, Austria, from 31 May to 4 June. A paper was presented.

The Director of the National Mechanical Engineering Research Institute, Dr H. G. Denkhaus, attended a *Meeting of the Rock Strength Group, International Bureau of Rock Mechanics*, held at LKAB, Kiruna, Sweden, from 8 to 11 June and delivered a lecture to the meeting. Dr Denkhaus also attended the 4th International Mining Congress in London from 12 to 16 July.

Mr P. S. B. Colback of the National Mechanical Engineering Research Institute attended the *3rd Canadian Symposium on Rock Mechanics* at the University of Toronto, Canada, from 15 to 16 January. He presented a paper.

Mr Z. T. Bieniawski of the National Mechanical Engineering Research Institute attended the *2nd International Congress on Experimental Mechanics* and *1965 SESA Exposition* in Washington, D.C., U S A, from 28 September to 1 October.

Dr J. P. van der Walt, of the C S I R Microbiology Research Group of the National Nutrition Research Institute attended the *56th Annual Meeting of the Oil Chemists' Society in Houston*, Texas, U S A, from 25 to 28 April and the *25th Annual Meeting of the Institute of Food Technology* in Kansas City, U S A, from 16 to 30 May. Mr L. J. Vorster of the National Nutrition Research Institute also attended these meetings.

The *3rd International Committee on Laboratory Animals Symposium — Husbandry of Laboratory Animals*, held in Dun Laoghaire, Eire, from 6 to 17 September, was attended by Mr C. J. Joubert of the National Nutrition Research Institute. He read a paper.

Dr A. Strasheim, Director of the National Physical Research Laboratory, attended the *12th International Spectroscopy Colloquium* in Exeter, England, from 12 to 17 July. He read two papers at the colloquium.

The *4th National Meeting of the Society for Applied Spectroscopy*, held in Denver, U S A, from 30 August to 3 September was attended by Dr A. Strasheim. At this meeting he read two papers.

Dr A. E. Carte of the National Physical Research Laboratory attended the following conferences:

The *First National Symposium on Hail Suppression* at Dillon, Colorado, U S A, from October 14 to 15. A paper was read.

The *244th National Meeting of the American Meteorological Society*, on "Cloud Physics and Severe Local Storms" held in Reno, Nevada, U S A, from 19 to 21 October. A paper was presented.

The National Physical Research Laboratory was also represented at conferences overseas by Dr J. F. Burger, Head of the Acoustics Division, who attended the *5th International Congress on Acoustics* in Liége, Belgium, from 7 to 13 September; Dr E. Kemeny, who attended the *Conference and Exhibition on Air Pollution Control* of the Association of German Engineers, held in Düsseldorf, Germany, from 5 to 9 April, and Dr W. L. Rautenbach, Head of the Nuclear Physics and Radioactivity Division, who attended the *Conference on Electromagnetic Isotope Separators and Related Ion Accelerators and their Application to Physics*, held in Aarhus, Denmark, from 14 to 18 June.

The Symposium on Radio Isotope Instruments in Industry and Geophysics, held in Warsaw, Poland, from 18 to 22 October, was attended by Mr W. F. Heinz of the Special Problems Division of the National Institute for Road Research. He presented a paper.

Mr R. W. Burton of the National Institute for Road Research attended the *1965 Conference of the Operational Research Society* in Shrivenham, England, from 20 to 22 September.

The Director of the National Institute for Telecommunications Research, Mr R. W. Vice, attended the *3rd IQSY Assembly* in Madrid, Spain, from 29 March to 3 April and the *COSPAR 8th Plenary Meeting and 6th International Space Science Symposium* in Buenos Aires, Argentina, from 10 to 21 May.

Other members of the National Institute for Telecommunications Research staff who attended overseas conferences were:

Mr H. D. Hölscher and Mr P. J. Cabion, who attended the *Symposium on Electromagnetic Distance Measurement* in Oxford, England, from 6 to 11 September. Mr Cabion and Mr Hölscher each presented a paper.

Dr G. J. Stander, Director of the National Institute for Water Research, attended the following conferences:

Conference of the Institute of Sewage Purification held in Harrogate, England, from 21 to 25 June.

Conference of the Water Pollution Control Federation (U S A), held in Atlantic City, U S A, from 10 to 14 October. He presented a paper.

Paper Industry Conference on Water Conservation and Stream Improvement held in Fort William, Canada, in October.

Dr Stander also attended a *Meeting of the Permanent Steering Committee of the International Conference on Water Pollution Research* in London, at which an International Association on Water Pollution Research was established.

The Congress of the *International Limnological Association*, held in Warsaw, Poland, from 23 to 30 August, was attended by Mr J. Hemens of the National Institute for Water Research. A paper was read.

The *3rd International Wool Textile Research Conference* held in Paris from 29 June to 9 July was attended by the Director of the S A Wool Textile Research Institute, Dr D. P. Veldsman, Dr O. A. Swanepoel of the Protein Chemistry Division and Mr R. I. Slinger of the Textile Physics Division of the S A Wool Textile Research Institute. Two papers were read at this conference.

Dr D. P. Veldsman also attended the *Meeting of the Research and Development Committee of the I W S* in London from 24 to 25 June, while Dr O. A. Swanepoel attended the *Annual Conference of the Textile Institute* in Manchester, England, from 22 to 23 June, where he presented a paper.

Medical and university research units

Prof. J. A. van Eeden, Head of the Snail Research Unit of the Bilharzia Research Group, attended the *2nd European Malacological Congress and Symposium on Malacology and Parasitology* held in Copenhagen, Denmark, from 9 to 14 August. A paper was read.

The Assistant Director of the Cardio-Vascular Pulmonary Research Group, Dr W. Beck, attended the *Royal College of Physicians Paediatric Conference* in London from 1 to 2 October and the *Royal College of Physicians Consultant Conference* in London from 29 November to 3 December.

Prof. J. D. L. Hansen of the Clinical Nutrition Research Unit, attended the *11th International Congress of Paediatrics* in Tokyo, Japan, from 7 to 13 November. He delivered papers in a symposium on criteria of adequate protein nutrition in infancy and childhood and at a round table discussion on kwashiorkor and chronic malnutrition.

Dr C. J. Dreyer, Director of the Dental Research Unit attended a *Symposium on the Mechanism of Tooth Support* held at Somerville College, Oxford, England, from 5 to 8 July. He read a paper.

Dr W. P. U. Jackson, Director of the Endocrine Research Group attended a *Symposium on Calcium Metabolism* in Sydney, Australia, in October. He presented two papers.

Prof C. L. de Jager, Director of the Nutrition and Dental Health Research Group attended the *Federation Dentaire Internationale* in Vienna, Austria, from 26 June to 3 July, and read a paper.

Prof. V. Pretorius of the Chromatography Research Unit, attended a *Symposium on Advances in Gas Chromatography* held in Houston, Texas, U S A, from 18 to 21 October. A paper was read.

Prof. P. H. Stoker, Director of the Cosmic Rays Research Unit, attended the following conferences: *Third IQSY Assembly* held in Madrid, Spain, from 29 March to 3 April (chief delegate to conference); *Symposium, Committee on Space Research (COSPAR VI)* in Mar del Plata, Argentina, from 11 to 19 May. At the latter conference a paper was read.

Dr J. F. de Beer, of the Cosmic Rays Research Unit, attended the *9th International Conference on Cosmic Rays*, held in London from 6 to 17 September and read two papers.

Prof. M. A. Meyer of the Cosmic Rays Research Unit also attended the *9th International Conference on Cosmic Rays*, held in London. He read two papers.

Prof. F. L. Warren, Director of the Natural Products Research Unit, attended the *International Symposium "Biochemie und Physiologie der Alkaloide"* held in Halle (Saale), East Germany, from 24 to 27 June. A paper was read.

Prof. D. H. Davies, the late Director of the Marine Research Unit, attended meetings of the *Special Committee of the International Biological Programme* as representative of the Scientific Committee on Oceanic Research (SCOR) in Rome in February. In June he attended meetings of the *Executive of the Scientific Committee on Oceanic Research* in Rome.

Prof. F. R. M. Nabarro, Director of the Solid State Physics Research Unit attended the *1st Conference on Electron Diffraction and Crystal Defects* held in Melbourne, Australia, from 16 to 21 August. He read a paper.

Dr F. R. L. Schöning of the Solid State Physics Research Unit, attended the *Summer School on Phonons in Perfect Lattices and in Lattices with point imperfections*, in Aberdeen, Scotland, in August.

Industrial research institutes

The Director of the Leather Industries Research Institute, Dr S. G. Shuttleworth, attended the *9th Congress of the International Union of Leather Chemists' Societies* in Lyons, France, from 3 to 7 September and read a paper.

Dr D. G. Roux of the Leather Industries Research Institute attended the *International Union of Forest Research Organizations conference* in Melbourne, Australia, from 4 to 15 October.

Dr K. Douwes Dekker, Director of the Sugar Milling Research Institute and Mr E. J. Buchanan of the same Institute attended the *12th Congress of the International Society of Sugar Cane Technologists* held in San Juan, Puerto Rico, from 29 March to 9 April. A paper was read.

Financial Statement and Appendix

Balance Sheet as at 31st March 1965

STATEMENT No. 1

	General Fund	Building Fund	1965	1964
	R	R	R	R
ACCUMULATED FUND			17,211,746.52	14,044,898
Balance as at 31.3.1964	7,272,001.84	6,772,895.89		
Add: Capital Receipts 1964/65:				
Parliamentary Grants:				
C.S.I.R.	690,470.00	440,000.00		
University Institutions	88,530.00	—		
Donations	450,089.89	578,244.66		
Interest	—	61,152.78		
Sale of assets written off	20,064.94	—		
Investigations and services	384,590.02	44,832.92		
Inter-fund transfers	(—)88,520.52	88,520.52		
SUB-TOTAL	8,817,226.17	7,985,646.77		
Add: Excess income 1964/65	537,094.89	—		
SUB-TOTAL	9,354,321.06	7,985,646.77		
Less: Cost of assets written off 1964/65	69,746.29	58,475.02		
	9,284,574.77*	7,927,171.75*		
GRAND TOTAL			R17,211,746.52	14,044,898

	1964/65 Additions: University Institutions	1964/65 Additions: C.S.I.R.	1964/65 Written off	1965	1964
	R	R	R	R	R
FIXED ASSETS (AT COST)					
Land and Buildings	—	894,064.13	58,475.02	7,322,717.36	6,487,128
SUB-TOTAL	—	894,064.13	58,475.02	7,322,717.36	6,487,128
Laboratory and Workshop Equipment	108,060.10	1,273,412.32	51,666.81	6,080,869.51	4,751,064
Furniture, Fittings and Office Equipment	153.60	91,357.21	4,075.88	530,743.82	443,309
Vehicles and Cycles	—	58,792.59	14,003.60	196,508.35	151,719
Books and Journals	915.69	110,457.39	—	479,062.64	367,690
Prefabricated structures	—	—	—	10,517.83	10,518
Shares in S.A. Inventions Corporation	—	—	—	100,000.00	100,000
SUB-TOTAL	109,129.39	1,534,019.51	69,746.29	7,397,702.15	5,824,300
TOTAL	109,129.39	2,428,083.64	128,221.31	14,720,419.51	12,311,428
GRAND TOTAL				R14,720,419.51	12,311,428

STATEMENT No. 1
Continued

	1965	1964			1965	1964
	R	R			R	R
CURRENT LIABILITIES			**CURRENT ASSETS**			
Advances for investigations and services	763,309.88	410,011	Stores Stock		223,750.62	211,587
Sundry creditors and credit balances	1,563,062.84	989,820	Sundry debtors and debit balances		1,635,686.52	1,182,715
			Investigations and tests in progress		135,293.71	—
			Advances and deposits:			
			Research Grants	218,523.49		185,483
			Other	413,720.39	632,243.88	43,883
			Investments		2,296,603.23	1,486,990
			Cash:			
			At S.A. Reserve Bank	(−)118,380.56		18,958
			At Standard Bank, Grahamstown	7,362.54		
			Petty Cash Imprests	5,139.79	(−)105,878.23	3,685
	R2,326,372.72	1,399,831			R4,817,699.73	3,133,301
	R19,538,119.24	15,444,729			R19,538,119.24	15,444,729

NOTES:—

* Contractual obligations against the General and Building Funds as at 31st March, 1965, was R1,149,707 and R364,143 respectively.

PRETORIA, 22 December, 1965.

N. STUTTERHEIM
Acting President

J. H. VISAGIE
Secretary/Treasurer

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 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, 12 January, 1966

Operating Account for the Year ended 31st March 1965

STATEMENT No. 2

EXPENDITURE	1964/65 University Institutions	1964/65 C.S.I.R.	1964/65 Total	1963/64	INCOME	1964/65 University Institutions	1964/65 C.S.I.R.	1964/65 Total	1963/64
	R	R	R	R		R	R	R	R
Salaries, Wages and Allowances	133,604.56	4,946,925.42	5,080,529.98	4,217,996	Parliamentary Grant	682,261.00	4,679,239.00	5,361,500.00	4,623,500
Consumable stores and services	24,849.25	2,362,741.39	2,387,590.64	1,779,876	Investigations and Services	29,428.13	3,379,703.10	3,409,131.23	2,405,161
Subsistence and Transport	12,954.72	375,954.97	388,909.69	288,811	Contributions to C.S.I.R. Projects	—	243,823.38	243,823.38	50,642
General Expenses	22,504.92	1,020,502.99	1,043,007.91	835,411	Publications	3,680.81	3,164.81	6,845.62	6,503
Subsidies: Research by Industry	—	228,432.49	228,432.49	325,941	Sundry	10.50	30,188.13	30,198.63	18,140
Grants	581,714.59	—	581,714.59	465,016	Reimbursement of cost of Capital Facilities	—	84,344.24	84,344.24(1)	99,194
SUB-TOTAL	775,628.04	8,934,557.26	9,710,185.30	7,913,051					
Less: Income for internal services	—	1,111,437.09	1,111,437.09	927,687					
SUB-TOTAL	775,628.04	7,823,120.17	8,598,748.21	6,985,364					
Balance transferred to Accumulated Fund	(−)60,258.10	597,352.99	537,094.89	217,776					
	715,369.94	8,420,473.16	9,135,843.10	7,203,140		715,380.44	8,420,462.66	9,135,843.10	7,203,140

NOTE:

(1) Cost of capital facilities (i.e. buildings, roads etc.) provided on repayment for the National Aeronautical and Space Administration, U.S.A.

PRETORIA, 22 December, 1965

N. STUTTERHEIM
Acting President

J. H. VISAGIE
Secretary/Treasurer

CSIR Budget 1965-66

STATEMENT No. 3

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 1964/65
C.S.I.R. Laboratories and Departments	R 6,396,126	R 3,959,670	R 460,630	R 397,213	R 154,337	R 1,022,552	R 1,243,351	R 11,147,177	R 4,445,955	R 6,661,222	R 40,000
Grants and Subsidies	448,479	70,483	35,590	39,870	614,806	319,526	—	1,528,754	1,469,076	59,678	—
TOTALS R	6,844,605	4,030,153	496,220	437,083	769,143	1,342,078	1,243,351	12,675,931	5,915,031	6,720,900	40,000

B. Capital Expenditure

ACTIVITIES	EXPENDITURE										
	Books/ Journals	Technical Equipment	Furniture/ Office Equipment	Vehicles			Buildings	Total			
C.S.I.R. Laboratories and Departments	44,295	1,608,983	51,400	12,065	—	—	899,900	2,616,643	1,158,700	1,457,943	—
Grants and Subsidies	100	314,469	500	—	—	—	—	315,069	315,069	—	—
TOTALS R	44,395	1,923,452	51,900	12,065	—	—	899,900	2,931,712	1,473,769	1,457,943	—
							GRAND TOTALS R	15,607,643	7,388,800	8,178,843	40,000

Members of the Council for Scientific and Industrial Research (during 1965)

S. M. NAUDÉ, M.Sc. (Stell.), Ph.D. (Berlin), D.Sc.h.c. (Potchef.), D.Sc.h.c. (Rand.) LL.D.h.c. (Cape), D.Sc.h.c. (Stell.), 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.*
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 South Africa Limited.*
F. G. HILL, B.Sc. (Eng.) (Rand.), M.A. (Juris.) (Oxon.), M.I.M.E., M.I.M.M. (Lond.), M.S.A.I.M.M.	*Manager, Technical Services, Rand Mines Limited.—*
T. F. MULLER, B.Sc. (Eng.) (Rand.), M.Sc. (Eng.) (Birmingham), M.I.M.M. (S.A.), M.I.M.M. (Lond.)	*Managing Director, General Mining and Finance Corporation 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.*
J. D. ROBERTS, B.Sc. (Eng.) (Rand.) M. (S.A.) I.C.E., A.M.I.C.E.	*Chairman, Roberts Construction Co. Ltd.*
R. L. STRASZACKER, M.Sc. (Eng.) (Rand.), Dipl. Ing. and Dr. Ing. (Berlin-Charlottenburg), M.I. Mech. E., M.S.A.I. Mech. 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. (Rhodes), LL.D.h.c. (Rand.), LL.D.h.c. (Cape), D.Com.h.c. (Stell.)	*Chairman, Industrial Development Corporation of South Africa Limited; Chairman of Munitions Production Board.*
J. N. VAN NIEKERK, M.Sc. (Cape), Ph.D. (Cape)	*President of the South African Institute of Physics; Head, Basic Research Department, Iscor.*
*F. L. WARREN, D.Sc., Ph.D. (Lond.), A.R.C.S., D.I.C., F.R.I.C., F.R.S. (S.A.)	*Head, Department of Chemistry and Chemical Technology, University of Natal.*
†E. T. WOODBURN, B.Sc. (A.I.C.) (Cape), A.M.I. Chem. E.	*Head, Department of Chemical Engineering and Dean of the Faculty of Engineering, University of Natal.*

*Council member until 31st October 1965
†Council member from 1st November 1965

MEMBERS OF THE EXECUTIVE COMMITTEE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH AS AT 31st December 1965:
Dr S. M. Naudé (Chairman), Mr F. G. Hill (Vice-Chairman), and Dr R. L. Straszacker (with Dr B. Gaigher, Prof. S. F. Oosthuizen and Dr H. J. van Eck as floating alternates to Mr Hill and Dr Straszacker).