

C S I R

EIGHTEENTH ANNUAL REPORT

(Afrikaans version obtainable separately)

1962

Council for Scientific and Industrial Research

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P.O. Box 395
PRETORIA
1 Jan., 1963

Sir,

I have pleasure in presenting to you the Eighteenth Annual Report of the Council for Scientific and Industrial Research. This Report covers the period 1 January, 1962 to 31 December, 1962.

Balance sheets and statements of income and expenditure for the financial year ended 31 March, 1962, certified by the Controller and Auditor-General, are included.

I have the honour to be,

Sir,

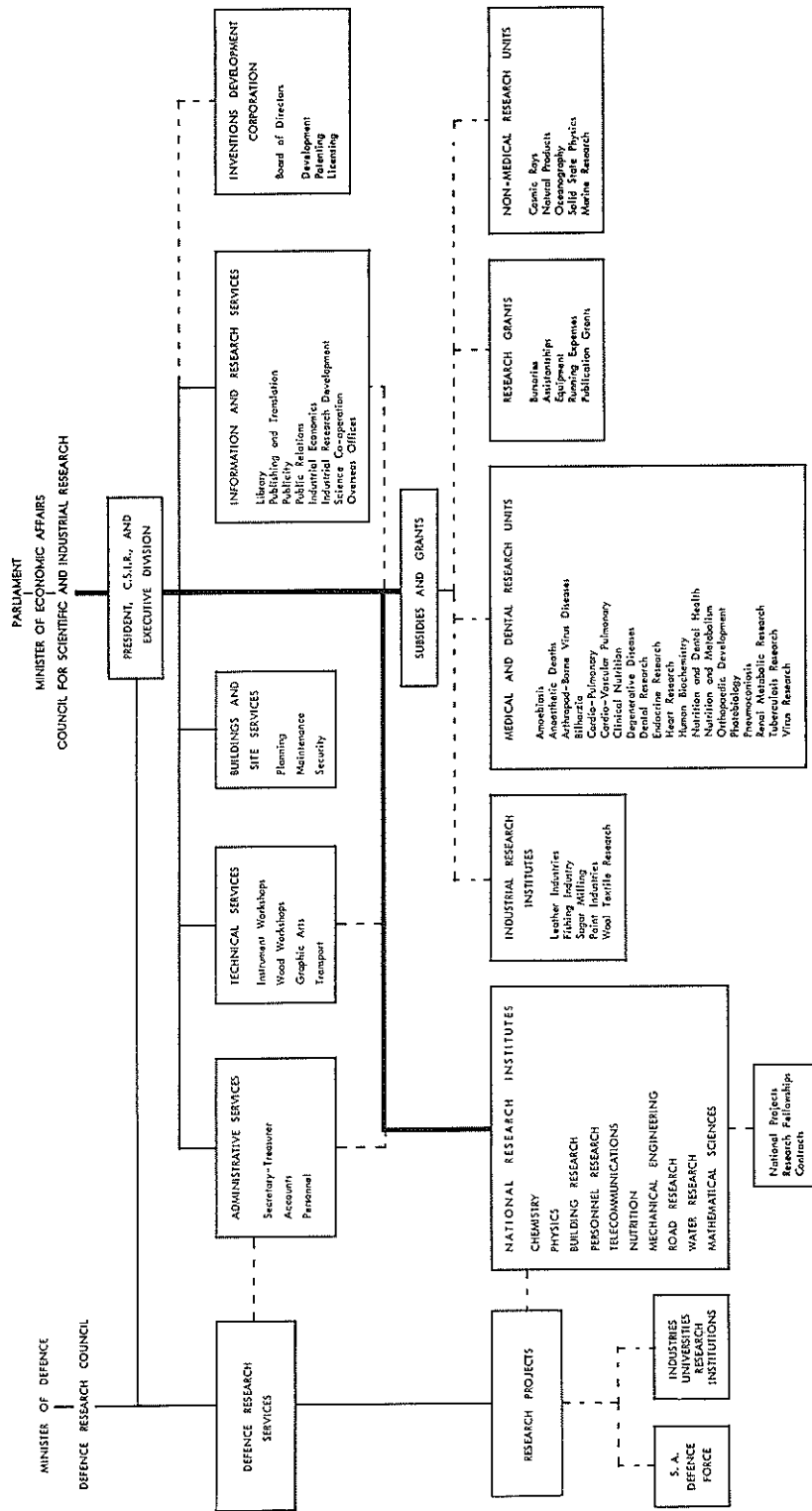
Your obedient servant,

S. M. NAUDÉ

PRESIDENT: COUNCIL FOR SCIENTIFIC
AND INDUSTRIAL RESEARCH

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

ORGANIZATION OF THE SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH



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GENERAL REVIEW

In previous years the Council was reported to be reviewing the activities of its national research laboratories and institutes. This year the Council is pleased to be able to report a greater concentration of effort on research projects undertaken for industries, local authorities, provincial administrations and government departments. The introduction of a system of project budgeting, the co-ordination of inter-laboratory projects through the creation of task groups, and the consequent reorientation of some research programmes have all contributed to this end.

At the same time, allowance has been made for basic research projects to be developed in sufficient depth to achieve real advances in fields of topical interest or special promise.

Selected research projects, described briefly in Section 2 of this report, provide examples of the work that is being undertaken in the national research laboratories and institutes, industrial research institutes, medical and other university research units.

The growth and nature of the Council's activities are illustrated in Figures 1, 2 and 3. Figure 1 shows the distribution of funds according to fields of activity. It will be seen that 80.5 per cent of the total funds made available to the C S I R from all sources is spent on activities undertaken by the C S I R. The remaining funds are disbursed by the C S I R to other organizations for medical, university and industrial research.

In Figure 2 the total income of the C S I R is shown. From this it is clear that the rate of growth of income from all sources exceeds the rate of growth of the Parliamentary Grant. Increases in income from sources other than the Parliamentary Grant have been mainly for new developments on behalf of other organizations rather than for extending existing facilities in the C S I R. Examples of such new developments have been the National Institute for Road Research, the Pneumoconiosis Research Unit and the Deep Space Instrumentation Facility which is operated on behalf of the National Aeronautics and Space Administration of the U S A. Figure 2 also shows that amount from Parliamentary Grant disbursed to non-C S I R organizations for university, medical and industrial research (Grants — funds passed on).

Figure 3, in which the running expenditure on national laboratories and services is shown, further emphasizes the increasing dependence of the C S I R on sources of income other than the Parliamentary Grant.

Distribution of total current revenue (1961-2) — R5,377,683

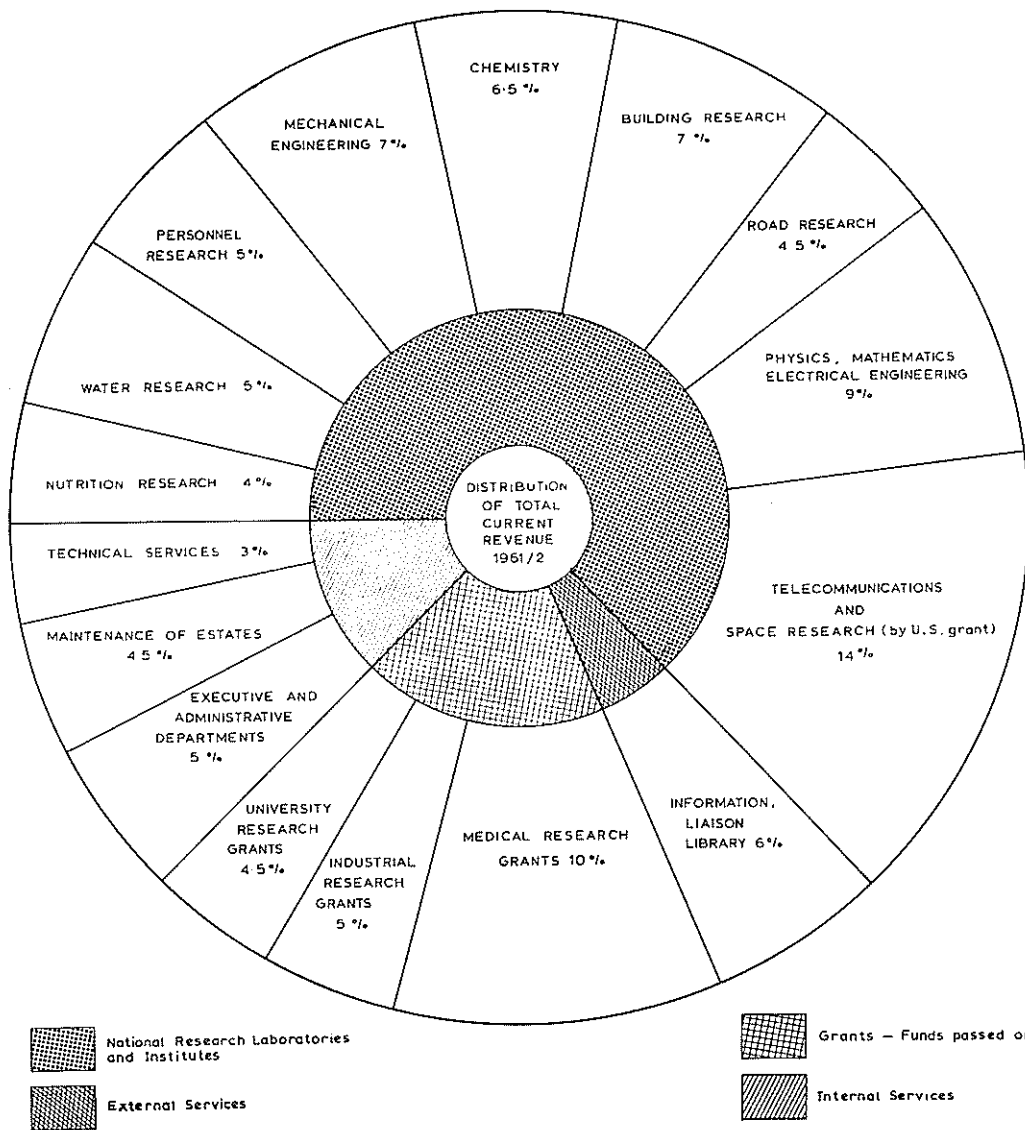


FIGURE 1. Distribution of funds (for running expenditure only) by nature and field of activity.

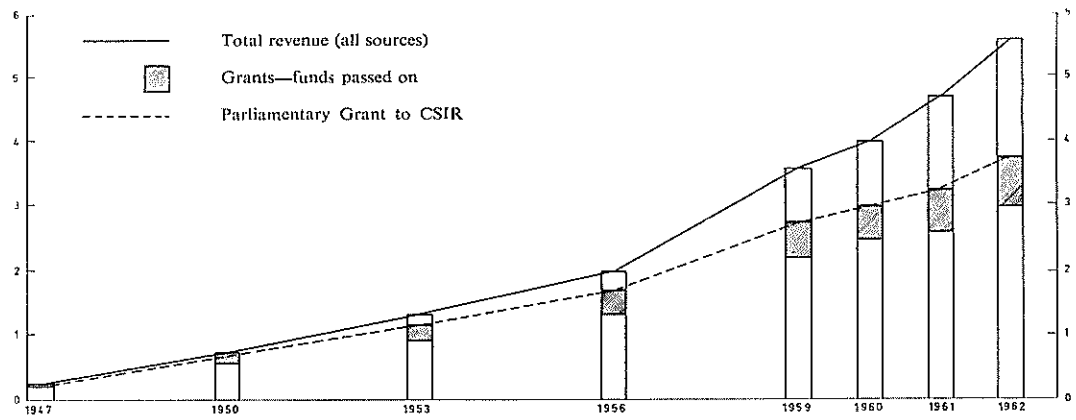


FIGURE 2. Total income (excluding income for capital purposes) for selected years during the period 1947 to 1962

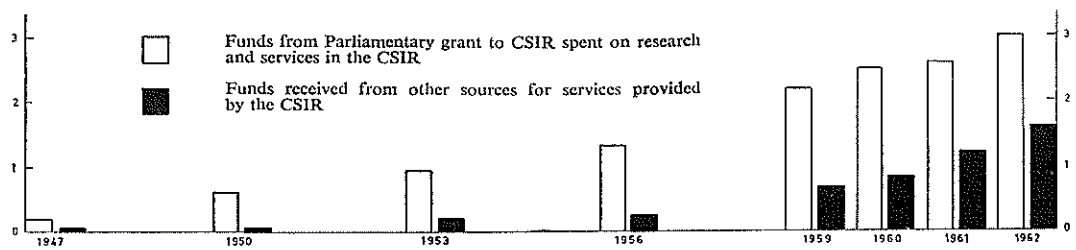


FIGURE 3. Running expenditure of CSIR National laboratories and services for selected years from 1947 to 1962 in terms of sources of income.

Dedication ceremony

The State President, Mr C. R. Swart, honoured the Council when on August 10 he unveiled a plaque dedicating Scientia, headquarters of the Council's laboratory organization, to the advancement of science. At the same ceremony, which was attended by 400 guests, the Rector of the University of Pretoria, Dr C. H. Rautenbach, unveiled a plaque commemorating the gift of the 200-acre site from the University of Pretoria to the Council.

Inventions

The activities of the Council's Inventions Development Division have been taken over by the South African Inventions Development Corporation, which was set up in terms of the Inventions Development Act (Act No. 31 of 1962). It came into operation on 8 August 1962, and the Council's existing patents have been transferred to the Corporation. The Board of Directors is constituted as follows: Dr S. M. Naudé (Chairman), Mr G. S. J. Kuschke, Mr D. Lion-Cachet, Dr P. E. Rousseau, and Dr N. Stutterheim, (alternate: Mr D. G. Kingwill).

Standardization

In accordance with the provisions of the Scientific Research Council Act (Act No. 32 of 1962), and the Standards Act (Act No. 33 of 1962), which came into force on 1 April 1962, the necessary steps were taken to separate the South African Bureau of Standards from the organization of the Council for Scientific and Industrial Research.

Defence research

The first steps have been taken towards the development of a programme of defence research in close collaboration with the South African Defence Force. This programme is co-ordinated by the Defence Research Council, of which the Honourable the Minister of Defence is Chairman, and the President of the C S I R is Vice-Chairman. The executive officer of the Defence Research Council is Professor L. J. le Roux, who was appointed as a vice-president of the C S I R in June.

New appointments

Two senior members of staff left the Council's service. Dr W. S. Rapson, Vice-President, who was appointed Director of the National Chemical Research Laboratory when it was first established in 1947 and became a Vice-President in 1958, left in February to take up an appointment as Research Adviser to the Transvaal and Orange Free State Chamber of Mines. Dr S. Biesheuvel, Director of the National Institute for Personnel Research since 1946, left in October to join the South African Breweries in the capacity of Executive Director. The Council wishes to place on record its great appreciation of the services rendered to the development of research in South Africa by Dr Rapson and Dr Biesheuvel.

The following senior appointments were made: Dr E. J. Marais (formerly Director of the National Physical Research Laboratory [N P R L]), as Vice-President; Prof L. J. le Roux (formerly Chief Chemist, Atomic Energy Board [A E B]) as Vice-President; Dr A. Strasheim (formerly Head of the Spectrochemistry Division, N P R L), as Director, N P R L; Dr D. Gouws (formerly Head of the Personnel Selection Division), as Director, National Institute for Personnel Research; Dr L. G. Walters (formerly Director of the Pneumoconiosis Bureau, Department of Mines), as Director, Pneumoconiosis Research Unit; Mr D. G. Kingwill (formerly Head of the Information and Special Services Department), as Director of Information and Research Services.

Committees

In addition to National Advisory Committees which help the Council to guide the work of its national research laboratories and institutes, a number of other committees assist the Council in the carrying out of its broader national responsibilities for the development and co-ordination of research in South Africa.

The Council wishes to take this opportunity of thanking the members of these committees and their various sub-committees, all of whom have given unstintingly of their time.

Regional activities

An Industrial Information Service that was set up at the University of Natal (on the initiative of the Natal Regional Research Committee of the CSIR and with the support of local industrial firms) has completed a trial period of three years and will be continued on a permanent basis.

A new research and technical advisory service for the Cape building and construction industry has been initiated in the Western Cape, with financial support from the National Federation of Building Trade Employers and the Portland cement industry. This service is operated through the agency of a specially appointed regional officer of the National Building Research Institute.

In addition to the existing regional units of the National Institute for Water Research at Durban and Windhoek, units are being established at Bellville, Cape (with the assistance of the Municipality of Bellville), and at Bloemfontein (with the support of the Provincial Administration of the Orange Free State).

The Midland Regional Research Committee of the CSIR, Port Elizabeth, has continued to provide valuable support for the Council's activities in the Midland and Border areas, and an excellent site for a laboratory building has been acquired from the Municipality of Port Elizabeth.

Development of border areas

Discussions have been held with senior officials of the Department of Commerce and Industries in connection with the more effective application of science, in particular of the services of the Council's national research laboratories, to the development of border areas. Effective liaison already exists between the responsible authorities and both the National Building Research Institute and the National Institute for Water Research.

Industrial research associations

The Council's Advisory Committee on the Development of Research for Industry considered reports of a sub-committee which reviewed the financing of the Paint Industries Research Institute, Durban. Despite the fact that contributions from industry are not considered adequate for the satisfactory functioning of this Institute, the Council accepted the Committee's recommendation that support for the Institute should be continued. It was noted that industrial subscribers had clearly indicated how greatly they valued the services of this Institute and had increased their contributions.

Council was pleased to receive a visit from Sir Frederick White, Chairman of the Commonwealth Scientific and Industrial Research Organization in Australia. Sir Frederick visited South Africa during March and April at the invitation of the Council and the Wool Board, to review all aspects of wool research in South Africa and to make recommendations for its further development and organization in this country. His recommendations, which were made after full discussions with representatives of the Department of Agricultural

Technical Services, the Wool Board and the C S I R, have proved most helpful. One of his main recommendations was that in his opinion, because of the international nature of wool textile research, it could be developed more satisfactorily in South Africa under the full control of the C S I R than under a research association supported by the Council, which is the present arrangement. This recommendation, which was supported by the Board of Control of the South African Wool Textile Research Institute, is still under consideration by the Council and the Wool Board.

International co-operation

Co-operation with research organizations in other countries has featured prominently in the activities of the national research laboratories and institutes. The C S I R's overseas offices in London, Washington and Cologne have continued to help South African scientists to keep abreast of scientific developments overseas, and have acted as bases for visiting South African scientists from the C S I R, the Atomic Energy Board, the South African Bureau of Standards and the universities. Information on international conferences attended by members of the Council's staff appears on page 37 of this report.

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

Dr H. R. C. Pratt, Officer-in-Charge of the Chemical Engineering Section, C S I R O, Australia
Sir Frederick White, Chairman, C S I R O, Australia
Prof. Dr P. Mariëns, Professor of Physics at the Katholieke Universiteit, Louvain, Belgium
Dr Donald H. Menzel, Director Harvard College Observatory, U S A
Sir John Baker, O B E, Head of Department of Engineering, Cambridge University
Prof. H. G. Wales, Professor of Marketing, Illinois University, U S A
Mr V. Salkind, Water Consultant, United Nations Organization
Prof. W. Nestel, Telefunken Board Member and Director responsible for Research and Development
Seven Professors of the Veterinary Faculty of the Free University of Berlin (Drs Boch, Müller, Hartwig, Ulbrich, Bronsch, Sinell and Heidrich)
Prof. G. J. Kloosterman, Professor in Obstetrics and Gynaecology at the University of Amsterdam
Dr D. Tyrrell, Medical Virologist (as the guest of the C S I R), Head of the Common Cold Group of the U K Medical Research Council
Sir Nevill Mott, Cavendish Professor, Cambridge University
Mr F. A. Lieftrinck, Chief Engineer, Netherlands Government Institute for Water Supply

International Scientific Unions

South African scientists are taking a greater interest in the activities of the International Council of Scientific Unions and the affiliated unions, on which the Council is the South African national representative. It is now possible for the national committees (set up by the C S I R to deal with matters arising out of membership of these non-governmental, international scientific organizations) to meet more frequently, and to ensure that South Africa is more adequately represented at international meetings organized under the auspices of the various unions.

Oceanography has figured prominently in international scientific co-operation in recent years. The programme of the International Indian Ocean Expedition (I I O E), in which South Africa played a prominent part, reached its climax during the year, when a very successful regional meeting of the I I O E was held in Lourenço Marques.

Documentation

There is an increasing demand for the services of the Library. Some 2,000 publications are borrowed monthly through interlibrary loan services, and the compilers of *Periodicals in*

South African Libraries (the union list of serial titles in South African libraries) answer some 300 enquiries a month about locations of periodicals in other libraries.

The Council undertook the organization of the Second National Conference on the Publication of the Results of Research, held in Pretoria on June 21 and 22, which was convened jointly with the Department of Education, Arts and Science.

The Council's Director of Information and Research Services also served on the Action Committee appointed by the South African Library Association to draw up a programme for library development in South Africa. This programme was submitted to a National Conference of Library Authorities in Pretoria on November 5 and 6.

Medical research

The Committee for Research in Medical Sciences was reconstituted to bring its membership and representation into conformity with the recommendations of the Du Toit Commission on Co-ordination of Medical Research. In addition, the Council decided to replace its system of Steering Committees for Medical research units and groups with a panel of specialist consultants, to assist Prof. S. F. Oosthuizen in his duties as Adviser to the CSIR on Medical Research. In certain special instances Steering Committees were retained where these were thought necessary.

Recognition has been given to the research work undertaken by Prof. J. E. Kench by the establishment of a CSIR Protein Research Unit under his direction at the University of Cape Town. This brings the total of CSIR medical units and groups to twenty-one.

The Council takes this opportunity of expressing its appreciation to the members of the various medical research committees for their valuable assistance and advice during the past year. In addition, the co-operation and assistance of the Department of Health, the South African Institute for Medical Research, the Division of Veterinary Services, other governmental and provincial authorities, the mining industry, universities and individuals who have collaborated in furthering medical research, are gratefully acknowledged.

Training of research workers

The Council has for some time felt the need for enlarging the scope and improving the facilities offered by its scheme of grants to universities and other institutions, so as to encourage the post-graduate training of students at South African universities.

Implementation of changes that have now been adopted in principle will depend largely on the availability of funds, as one of the main changes envisaged is an increase in the value of the bursaries.

In future overseas bursaries will be awarded only when facilities for further study are not available or are inadequate in South Africa. Candidates who are already overseas will, however, be considered for bursaries of the same value as those tenable at South African universities.

Bursaries for foreigners are to be introduced. These will be tenable at South African (non-CSIR) institutions and a definite number will be made available each year, with the possibility of renewal for a second year.

The value of Post-Doctorate Bursaries will be as follows:

Bursary.....	R2 400
Travel Grant (single).....	R350
Travel Grant (married).....	R700

Senior Bursaries will be restricted to established research workers, the terms and conditions to be settled by negotiation in each case.

Donations

Council wishes to record its appreciation of a donation of R10 000 received from Dr Erich Luebbert, which will be used to equip a laboratory for research on slag cement in the National Building Research Institute.

The Council also gratefully acknowledges the gift of a portion of ground from Messrs Jacobson and Gering, the owners of Lynnwood Township. The area of the donated ground is 56 000 square feet, and the donation therefore makes a large contribution in space as well as serving to straighten the westerly boundary on the National Road.

Staff

In some institutes, restricted staff and funds have made it necessary to limit the number of new projects initiated and to reduce slightly the fundamental work undertaken.

During the year the Honourable the Minister of Economic Affairs agreed to an improvement in the salary structure for research staff, which is expected to improve greatly the staffing position in the Council's national research laboratories and institutes. An important feature of these changes is the provision which is made for special recognition of outstanding research achievement.

Recreation Centre

The C S I R Staff Association, at its own cost and with the Council's permission, has started to develop part of the area on Scientia Hill as a recreation site. The facilities already available include tennis courts, a swimming bath and a pavilion. These developments have been made possible by donations received by the Staff Association and by funds collected by the Association over a period of more than ten years.

Buildings

Buildings for the National Mechanical Engineering Research Institute on the C S I R site at Scientia, Pretoria, were completed, and the greater part of this Institute has been transferred from its temporary accommodation in Visagie Street. New facilities include a 40 ft long test floor on which large structures can be dynamically tested using loads up to 150 tons. A start was made with the construction of a wind tunnel with a cross-sectional working area of 5 x 7 ft, suitable for aeronautic research among other things, and a supersonic blow-down tunnel.

The National Institute for Road Research (N I R R) has the only remaining laboratory in the Visagie Street premises which originally accommodated all the Council's Pretoria laboratories. Building operations on the new N I R R laboratories are, however, due to start in 1963.

Accommodation has also been provided at Scientia for the National Research Institute for Mathematical Sciences (N R I M S), the youngest of the research institutes under the C S I R, which is responsible for activities in the fields of mathematical sciences and electrical engineering. Both are fundamental to research and a considerable part of the Institute's work consists of fundamental contributions towards the projects of other institutes. In addition, the N R I M S carries out research on projects of national interest as well as research on a contract basis for industry. The Institute's new computer, the I B M 704 was installed and taken into use during the year.

PROGRESS IN RESEARCH

In the normal way, progress in research is reported in the scientific literature or in reports to the sponsors of investigations. Publications by the staffs of the national research laboratories and institutes, of research units and industrial research institutes supported by the Council, and by bursars and the recipients of *ad hoc* grants, are listed in the publication *CSIR Research Review*.

Brief descriptions of selected research projects are given, together with reviews of developments in certain of the national research laboratories and institutes, in order to present a general picture of the research that is being undertaken under the auspices of the Council. No attempt has been made to cover all the activities of the various bodies supported by the Council. More detailed information is available, on request, from the organizations concerned.

Space research

Two major radio-tracking installations which are engaged respectively in tracking near satellites, and lunar and interplanetary research vehicles are operated on behalf of the National Aeronautics and Space Administration of the U S A.

The Deep Space Station consists of an 85 ft steerable paraboloid of high precision. It is one of three such stations managed by the Jet Propulsion Laboratory for lunar and interplanetary research. Its first major operation was that of tracking the research vehicle, Mariner II, in the Venus 'fly past'.

The Minitrack, or near satellite station, comprises a highly developed radio interferometer for tracking near satellites used in the study of the earth and its immediate spatial environment.

Both stations are equipped with extensive facilities for recording telemetry signals received from the space research vehicles.

— *National Institute for
Telecommunications Research*

Cosmic rays and the Cape magnetic anomaly

Early in 1962, the South African Air Force flew a standard neutron monitor at a constant altitude over the Karoo and over the South Atlantic and Indian Oceans near Cape Town in order to measure the distribution of the intensity of cosmic rays in space. From these results the lines of cosmic rays with constant intensity were obtained and those results were compared with the lines of constant momentum per unit charge for the primary cosmic rays. As the magnetic field of the earth acts as momentum analyser of the primary rays, rays of lower energy are deflected from the equator to parts of greater latitude, i.e. to the poles.

As a first approximation the geomagnetic field of the greater part of the globe can be adequately described by assuming a magnetic dipole within the earth. The greatest deviation from this model occurs around Cape Town and the South Atlantic Ocean. In the vicinity of Cape Town the horizontal component of the earth's magnetic field has a very small value compared to the value which would be expected in terms of the dipole approach. As appears from recent observations with satellites this must have a considerable effect on cosmic rays, particularly where the anomaly in the magnetic field extends far into space.

The deviations in the effect of the earth's magnetic field on the momentum per unit charge of the cosmic rays is calculated by means of a surface theory, based on a semi-empirical approach using the surface values of the earth's magnetic field, as well as by a multipole theory, using multipoles to the sixth order in approximating the geomagnetic field. The results of our measurements show agreement with the latter theory and there is a 90 per cent probability of disagreement with other theories. However, in order to determine whether the sixth order approximation adequately describes the intensity distribution of cosmic rays in the anomalous area, it will be necessary to cover a larger area around the Cape.

Another interesting finding was that at 10 000 feet above sea level the levelling of the latitudinal intensity curve occurs at a latitude far greater than that found by the Japanese in observations at sea level. Measurements taken at other places on the globe do not show the differences between the position of levelling which were found here.

During August measurements of the neutron intensity of cosmic rays, were also carried out above the Karoo with the aid of balloons. This work was done in collaboration with the Washington University of St Louis.

— *Cosmic Ray Research Unit
Potchefstroom University*

Radar

The C S I R has been active in various fields of radar for some time. During recent years work has been concentrated on the study of the effects of weather on radar and on the development of receivers of very high sensitivity.

The weather programme is directed first at a quantitative study of the occurrence of echoes from weather on radars of various frequencies, and secondly at a quantitative study of the detailed properties of the echoes received from heavy rain. In the first part of the programme, the intensity, duration, horizontal extent, and general behaviour of weather echoes were measured with automatic equipment; the results are now being studied on a statistical basis. In the second part of the programme, work is being directed at determining the actual shape and behaviour of the individual scatterers which give rise to the complete radar echo.

Work on high sensitivity receivers has been concentrated on the application of variable capacitance semi-conductor diodes for low noise amplification, commonly known as parametric amplifiers. Most of the work has been concentrated below 1 000 Mc/s but an experimental system for laboratory use has been developed at 3 000 Mc/s.

— *National Institute for
Telecommunications Research*

Radio noise levels below 30 Mc/s

Measurements of radio noise has continued as part of a long-term programme, which is in progress on a world-wide basis and which is supervised by the Central Radio Propagation Laboratory of the United States National Bureau of Standards. Sixteen stations are engaged in this programme. On the Continent of Africa there are stations at Rabat (Morocco), Ibadan (Nigeria) and at Pretoria. The other stations in the southern hemisphere are in Brazil, Australia, and Antarctica. Thus, the station at Pretoria is of considerable importance as far as Southern Africa and the southern hemisphere are concerned.

— *National Institute for Telecommunications Research*

The propagation of radio waves

International communications systems are still based largely on the reflection of radio waves by the ionosphere. Although it is now obvious that such advanced devices as the coaxial submarine cable and the communications satellite will, in due course, replace ionospheric radio communication for many specialized purposes, there is little doubt that ionospheric communication will continue to play an important role for many years to come because of its flexibility and long established use.

Thus an important part of the large international programme in which South Africa is co-operating actively is still study of the characteristics of the ionosphere, and because of the ionosphere's reflecting properties, study of the propagation of radio waves and study of the incidence of natural radio noise levels in the frequency range concerned. This work provides the essential data for frequency allocation and planning, on the efficiency of which international communications are still largely dependent.

Recent events have greatly increased the importance of these studies as far as Southern Africa is concerned. Since the end of 1959 a number of ionospheric observing stations in Africa have closed down or are operating only spasmodically, resulting in a sparse and intermittent flow of data from areas which have a major influence on radio communications between South Africa and Europe.

National Institute for Telecommunications Research

Radio instruments for geodetic survey and similar applications

In August 1962 a symposium was arranged in London by Tellurometer U.K. Limited, to which users (mainly from Europe) of the 'Tellurometer' system of distance measurement were invited. There was a large and enthusiastic attendance.

This symposium represented a milestone in the programme of the CSIR, which was responsible for the original invention and much of the subsequent development of the Tellurometer system. The ability to measure distances directly, to the accuracy required for geodetic purposes, by using simple radio instruments, has revolutionized many aspects of surveying, from the most precise requirements to the rapid surveys required for civil engineering applications such as road construction and prospecting.

The development of the system for measuring distances has been followed by the application of related principles to systems of high precision for the direct fixing of position. In this group is Terrafix, a hyperbolic multi-user system operating in the 1.6-2.0 Mc/sec band, with many applications over land and sea, particularly when simplicity, low cost, and portability are of prime importance.

New techniques are continually making possible improved methods and systems. The CSIR is actively engaged in such work because the possible applications of radio to survey appear at this stage to be almost unlimited. Only by continued progress can South Africa maintain its position as the leading supplier of the world demand for such instruments.

*— National Institute for
Telecommunications Research*

Data processing

The extensive use of digital computers for processing and analyzing research results has made it necessary, in the case of routine observations, to record data in a form suitable for direct use in the computer. This releases the scientist for more creative work and also

eliminates the human factor — a considerable advantage in certain circumstances as when observations have to be made at sea on a small rocking boat.

An automatic weather-recording station was designed for the National Building Research Institute, to record meteorological data on a 24-hour basis at a sampling rate rapid enough to reveal short-term changes. The data recorded include temperatures, radiation, wind velocity and direction etc., with a total of 36 observations every half minute. In order to determine the influence of various environmental conditions and building features on internal conditions, these data are processed, and this can now be done by feeding them directly into a digital computer. By this means the costs of the experiment calculated on a five-year programme, will be reduced to one-fifth of what they would have been with conventional methods.

A data-recording system for oceanographic observations was recently introduced and this will play an important role in surveys being carried out for industry along the Natal South Coast. The equipment automatically records data on temperatures and depths, and on direction and speed of currents as determined by an underwater measuring unit and also determines the position of the boat in relation to the land. Simultaneously the apparatus can record meteorological data above the surface of the water, store these in a built-in 'memory' and reproduce the data on the same medium (punch tape), as required by the operator. Provision has also been made for the recording of wave data.

The major advantages of this apparatus are that no concentration on the part of the operator is required in recording the data, that particulars necessary for identification such as date, time etc. are recorded automatically on a single tape together with the measurements, and that the final checking and processing of the data can be done directly in a computer.

— *National Research Institute
for Mathematical Sciences*

Measurement of radio-active fall-out

With the resumption of nuclear tests by the major powers, it has become necessary for accurate measurements of radio-active fall-out to be taken at regular intervals. These measurements are of great importance for national security and economy, both now and in the future. A considerable amount of work has been done on fundamental standards of physical measurements for the Republic, and important contributions have been made towards determining standards for measuring radio-activity.

— *National Physical Research Laboratory*

Coastal engineering

The interaction between wind, tide, waves and sand brings about undesirable changes like the siltation of estuaries and harbour entrances and the erosion of beaches. Problems caused by siltation of the harbour entrance at Durban and erosion of the nearby beaches were investigated, while at the St Lucia estuary an attempt was made to find a reliable and cheap way of maintaining permanent access to the sea. Both field studies and tests on models of the areas were employed in these investigations.

Despite the difficulties experienced in obtaining field data, the St Lucia estuary investigation has reached the stage where the reliability of the model has been sufficiently verified for remedial schemes to be tested on it.

In conjunction with the Durban City Council and the South African Railways, intensive field observations were carried out to check the 100 x 100 ft model of a six-mile stretch of the Durban coast line. A clearer understanding of the way the sand moves was obtained, and remedial schemes are being tested in the model.

National Mechanical Engineering Research Institute.

Study of water reserves in dry river beds

Some of the rivers of South West Africa rise up-country where the rainfall is regular. When the water reaches the dry regions where the original river beds are concealed by sand, the water sinks away and filters through gradually to the sea. The residents of several towns in these areas have to rely on such dry river beds for water. At Swakopmund and Walfish Bay boreholes are simply sunk in these beds to obtain water for household and industrial purposes.

There is a danger that such water supplies may become depleted, and a study has therefore been made of the water reserves. The purpose of this study is, firstly, to determine the profiles of river beds covered by sand, and, secondly, to measure the flow rate of water in the beds.

An electrical-resistance method has proved successful for determining bottom profiles (depth of bottom at various points) of the Swakop River, for determining clay concentrations in the sand layer and for tracing brackish areas in the river.

The seismic hammer refraction method proved highly successful for bottom profile determinations down to depths of 90 ft. A pneumatic hammer capable of generating a great deal more energy than the conventional hammer is being designed for determinations at greater depths.

The magnetic method was applied in order to determine the existence of old channels under sand-dunes in the Kuiseb River. The sand is known to be magnetic to the granitic basis. Thus far three possible channels have been traced magnetically, and boreholes are shortly to be sunk.

It is now possible, by means of a new, simple technique, to measure the total underground yield of a river section fairly accurately — the new method being a great improvement on that previously employed. It is possible to measure the flow rate of a river under sand in gallons per hour.

— *National Physical Research Laboratory and
National Institute for Water Research*

Combustion

Research work on adapting gas turbines to powdered-coal firing was concentrated on overcoming the problems of coal feeding and firing, and of ash separation. The associated development of a resonant combustion chamber progressed to the stage where a valved multi-resonator combustion chamber was operated successfully on gas.

— *National Mechanical Engineering Research Institute.*

Corrosion

From the earliest years of the CSIR, the National Chemical Research Laboratory and the National Building Research Institute each maintained one or two workers to deal with the metallic corrosion problems encountered by government departments, public bodies and industry. In 1962 these and additional workers were combined into a CSIR Corrosion Unit. When operating at full strength, probably during 1963, the Unit will undertake fundamental research in addition to its anti-corrosion and consulting services.

The deterioration of reinforced concrete structures was one of the first major corrosion problems tackled. The rusting of reinforcing steel rods embedded in concrete is accompanied by an expansion in volume which causes the concrete to crack and spall off, exposing more steel to rust. Expensive damage to coastal bridges and seaside pavilions was encountered. Investigations showed that such corrosion could be prevented by taking a number of precautions during building and ensuring a good cover of dense, high quality

concrete. The use of various coatings, on both the steel and the concrete, and of various additives to the concrete, was also studied.

Corrosion-erosion damage to bronze propellers of coastal fishing vessels used to make repairs and replacements necessary every few months. After these vessels had been fitted with zinc anodes of a special composition, on recommendations from the CSIR, the propellers showed no signs of deterioration even after three years of service.

Although it is difficult to estimate the actual amounts, very substantial savings to industry and government are made possible by the sound application of anti-corrosion procedures, even in cases where corrosion losses have hitherto been accepted as inevitable.

— *Corrosion Unit*

Purity of South African gold

During the past few years there has been a demand for high-purity gold on the open market, because of its use in the construction of certain apparatus used for space research and of specialized electronic equipment such as transistors.

It became evident that a reliable method of analysis was necessary to determine the nature and concentration of impurities in fine gold.

The National Physical Research Laboratory (N P R L) and several other laboratories were asked by the Transvaal and Orange Free State Chamber of Mines to participate in an investigation of methods for the analysis of high-purity gold. The CSIR played an important role in the development of the atomic absorption and spectrographic techniques that were developed for this purpose.

At a symposium held in Johannesburg, the joint results of the laboratories were reported. It was shown that South Africa is able to produce and market fine gold with a purity of 99.998 per cent. This compares very favourably with samples of fine gold produced elsewhere, including Russian fine gold.

For the sake of its economy, South Africa must be able to test the validity of claims by other countries with regard to their high-purity gold. South Africa now has the means for determining the purity of any gold offered for sale on the world market, as well as the nature and concentration of impurities contained in this gold.

— *National Physical Research Laboratory*

Cement technology

A long-term programme of studies on ordinary local Portland cement is being pursued. An interesting aspect of this research is the quantitative determination of the mineral phases in Portland cements by X-ray techniques. Substances added to cement to improve its flow and its hardening time, and as corrosion inhibitors to reduce the corrosion of reinforcing steel in concrete have also been investigated.

Recognition of the importance of research leading to the widespread use of blast-furnace slag-cement was made by a German industrialist, Dr E. Luebbert, who donated an amount of R10 000 to the CSIR in appreciation of the work done on development of the uses of blast-furnace slag in this country. The money will be used to equip a special laboratory in the National Building Research Institute bearing Dr Luebbert's name, for further research.

Current research on slag cement includes work on the devitrification, wetting behaviour and mineralogy of blastfurnace slags. This involves X-ray, differential thermal analysis, microscope, heating microscope and chemical work on local and overseas slags. Two methods for determination of the slag content of unhydrated mixtures of granulated blast-furnace slag and Portland cement are also being investigated.

— *National Building Research Institute*

The effect of the surface on the mechanical properties of aluminium

Steady progress is being made in understanding the mechanical properties of metals and alloys. It is now well established that when a metal deforms, planes of atoms in each crystal of the metal slip over their neighbouring planes. The planes do not slip rigidly one over the other. The slip starts between the planes, in a small region of the surface, and the slip region spreads until ultimately one plane has slipped completely over the other. The boundary between the region which has slipped and the region which has not slipped is a special kind of crystal defect called a dislocation.

When, as in the case of aluminium, the surface of the metal is covered by an oxide film, the dislocations find difficulty in escaping from the surface. In 1953, C. S. Barrett showed an interesting consequence of this. An aluminium wire is twisted and then released. After release, it gradually untwists. However, the dislocations which were produced when the wire was twisted are still piled up under the surface film of oxide. If, while the wire is untwisting spontaneously, acid is poured on to dissolve the oxide film, these dislocations which were moving outwards during the original process of twisting are able to escape from the surface, and their outward movement causes the wire suddenly to twist again in the forward direction. Dr D. B. Holt working in the Solid State Physics Research Unit has shown (*Acta Metallurgica*, vol. 10, 1962, p. 1021) that this effect occurs only if the initial twist given to the wire is sufficiently large. Unexpectedly, for very small twists, the effect of pouring acid on to the wire while it is untwisting is to accelerate the untwisting. Studies made with the aid of the electron microscope of the oxide films on wires which have been twisted by varying amounts allow these results to be explained.

— *Solid State Physics Research Unit,
University of the Witwatersrand, Johannesburg.*

Anti-vibration table for precision balances

Although placing balances on foundations which are separate from those of the building is most effective in preventing vibration, this is costly and strictly limits the location of micro-balances.

The C S I R therefore devised a sprung table which could be produced economically and installed in any room. A prototype table was constructed in the central workshops of the Technical Services Department.

A one inch thick cast-aluminium table top rests on three springs. The lower ends of three tubular legs are screwed into standard flanges bolted to a platform. The screw thread may also be used to adjust the level. A concrete block weighing approximately 400 lb, which acts as a damping load, is firmly bolted to the underside of the table at the centre of gravity between the three tubular supports. Screwed to the underside of the concrete block is a steel cone which is embedded in bitumen and which stabilizes the unit within seconds after accidental disturbances.

— *Technical Services Department, and
National Physical Research Laboratory*

Factors responsible for the destruction of fresh-water fish

Whenever abnormal mortality among fish is reported, the tendency is to ascribe it to some form of pollution caused by sewage, or by industrial, or mining, or agricultural activities.

In order to see the whole problem in perspective, attention is being given to certain natural factors which may also be responsible for destruction of fish life. Results of inves-

tigations show that low temperatures in the vicinity of 10°C are probably the major cause of mortality among *Tilapia mossambica* (red-finned kurper) in the dams of the Highveld.

This work is now being carried out on a consultative basis in the laboratories of the Transvaal Provincial Administration. A start is being made with research on other natural factors. Once they are convinced that fish kills are not always attributable to pollution, fish-breeders will be able to plan their operations with due attention to the factors really responsible. The fishing industry, which is playing an increasingly important part in supplying the protein needed by the population, would benefit greatly from such research.

— *National Institute for Water Research*

Marine research

The intensive study of the sharks found off the East Coast of South Africa involves a great deal of routine work. This includes the taking of 60 different measurements for every dead shark obtained, the taking of 12 or more photographs, excision of the jaws for permanent preservation of the teeth, examination of stomach contents and reproductive organs, and so on. The work began in 1959, and so far over 500 sharks have been processed.

Considerable benefit has already been derived from these investigations. Twenty-four different species of shark have been accurately identified, and much has been learned about their biology. Perhaps the most rewarding result of these investigations has been due to the availability of accurately identified teeth in dried jaws of the Zambezi River Shark, which enabled tooth fragments found in the thigh bone of a human victim of shark attack to be positively identified.

— *Marine Research Unit,
University of Natal, Durban.*

Fish canning

Investigations related to fish canning were restricted during the year to critical studies concerning the generally used Howard mould-count for tomato purée. In the second international collaborative test organized by F I R I, there was again found to be a serious lack of agreement between laboratories, but not between individual workers in the same laboratory. This was traced to inter-laboratory differences in the recognition of mould filaments. Monthly counts of the skin flora of hake, for a period of two years, have shown a bacterial pattern similar to those obtained overseas. *Achromobacter* and *Pseudomonas* have likewise been found to predominate in hake during storage.

— *Fishing Industry Research Institute,
Cape Town.*

Hides and skins

Recent developments in these fields include the establishment of a laboratory for long-term, protein research, to keep South Africa in the forefront of work on the reconstitution of hide fibres for leather as one answer to the threat of synthetics. A new method for making low-density leather from hides by freeze-drying the unhaired hide is being developed; this revolutionary process is now in its pilot-plant phase.

— *Leather Industries Research Institute,
Grahamstown.*

Wattle tanning

The wattle industry exports what is basically an agricultural product worth R10 million a year, and it is turning increasingly to research in order to maintain its sales in the leather-making industries of the world and to find new uses for its extract. Many of the tanning

processes developed by the Leather Industries Research Unit specially for wattle are, in fact, finding wider applications overseas. The achievement of fundamental knowledge of the structure and properties of wattle tannins has been recognized in signal fashion by the award to Dr D. G. Roux of one of the largest science Fellowships ever awarded to a South African scientist. This is the United States Harvard Award of an 11,000-dollar, Bullard Fellowship for one year.

— *Leather Industries Research Institute,
Grahamstown.*

Footwear research

In research on footwear the industry is moving forward with the most advanced overseas methods in adopting the new heat-setting technique which greatly improves shape retention in shoes of all quality grades.

Advances have also taken place in research on foot health, particular attention being paid to children's footwear. Meetings with the School Medical Inspection Services will probably lead to practical application of the results of this work through regular inspection of the fitting of shoes and also through reports to parents on defective footwear and foot ailments.

— *Leather Industries Research Institute,
Grahamstown.*

Sugar milling control project

The separation of the sugar-containing juice from sugar cane takes place in tandems consisting of from 4 to 7 heavy three-roller mills, but all the factors that influence the efficiency of this process are not adequately known. This is the more so since the juice left in the bagasse after each squeeze is diluted in a counter-current process by the fairly large amounts of water added to the bagasse of the penultimate mill. The performance of the tandem is obviously of prime importance to the economy of the factory. Reducing the amount of sugar lost in the final bagasse is an urgent problem requiring special research for its solution as this loss varies from 4.5 per cent to over 7 per cent in different factories.

With the co-operation of an increasing number of factories the Sugar Milling Research Institute has initiated a careful analysis of the present performance of milling tandems. To provide the facts that have so far never been accurately known, a special instrument had to be constructed: a top-roller lift-integrating indicator. This is now functioning on most South African sugar-milling tandems and it has also aroused considerable interest in overseas sugar industries.

This whole investigation is a long term project, but it is gratifying to record that useful data have already been obtained.

— *Sugar Milling Research Institute,
Durban.*

Raw sugar quality

Factors now influencing the export market make it necessary for the utmost attention to be paid to the quality of the raw sugar exported. South Africa is in this respect possibly not as fortunate as other countries, where certain properties of the cane make it possible to produce raw material of a satisfactory quality for refining by simple, traditional techniques without any difficulty.

Improving the quality of South African raw sugar presents problems which concern nearly every department of a sugar factory, especially the juice clarification and pan boiling departments. But, to begin with, it is necessary to know more about the substances (non-

sugars) in sugar cane juice, which ultimately are responsible for the less desirable properties of the raw sugar boiled from it.

The Sugar Milling Research Institute has been studying these problems in various ways for some years and has consequently been in a position to recommend certain manufacturing methods to the Industry. These methods have undoubtedly helped to change the opinion held by certain overseas refiners, that South African raw sugar has rather poor refining qualities. It is, however, clear that much more work is required before a really satisfactory insight into our difficulties is obtained.

— *Sugar Milling Research Institute,
Durban.*

The aging of paint films

The role of the pigment in the deterioration of a paint film is not generally recognized by the public. An unsuitable pigment leads not only to premature breakdown, but also in some cases to fading of colours. The effect of different types of titanium dioxide on the fading of phthalocyanine pigments is of particular interest, since both of these materials are widely used in the manufacture of paint.

— *Paint Industries Research Institute,
Durban.*

Wattle extract in paint manufacture

Chemically modified wattle extract can be used in the manufacture of clear and pigmented finishes. Enough of this material was prepared to hand over to the Wattle Research Committee which, in turn, will distribute it to a few selected paint manufacturers for evaluation under factory conditions.

— *Paint Industries Research Institute,
Durban.*

Fungicidal paints

The influence of fungal attack on paint films, particularly in sub-tropical areas has, in the past, been underestimated. Many cases of so-called 'dirty' paint have been shown to be due to fungi, which not only render the surface unsightly but are active in destroying the paint. As a result of a lengthy programme of tests, it is possible to recommend satisfactory fungicides, and it is considered that where feasible all paints for warm and humid conditions should be so treated. It should however be noted that effective materials are toxic.

— *Paint Industries Research Institute,
Durban.*

Drying oils

A vapour-phase chromatograph has been constructed which is used in the qualitative and quantitative analysis of drying oils. It will be possible to analyse products grown in different parts of the country under the influence of different types of climate, and to compare these with imported materials.

— *Paint Industries Research Institute,
Durban.*

Washing of wool

A pilot-scale washing plant, capable of washing up to 200 lb grease-wool per hour and of simulating very well the practical conditions obtaining in normal washing mills, is being used in a study of the washing of wool, which is one of the important aspects of the local wool textile industry as one-quarter of the clip is washed in South Africa.

Details of the best methods of operation have been worked out for mechanical conditions (rate of loading, speed of the rakes and speed of the squeeze rollers), temperature, rate of replacement of dirty washliquors through a back-flow system, the effect of additions of various chemicals upon the efficiency of detergents; and the economic value of a wide range of available detergents. The information has been transmitted to local industry which is making good use of the improved methods.

— *S.A. Wool Textile Research Institute,
Grahamstown.*

Diameter/crimp ratios in merino wool

Thirty-five years ago Prof J. E. Duerden of Rhodes University showed that there exists a relationship between fibre fineness (diameter) and the number of crimps per inch in the staple of merino wool. Because of a finding that staple crimp affects the wool's tendency to felt, the South African Wool Textile Research Institute repeated Duerden's classical study, using more than 6 000 samples representative of the Republic's merino clip.

The results show that during the intervening period a change has occurred in the diameter/crimp relationship. Wools of medium to strong types show under-crimping (i.e. the wool is finer in diameter than the staple crimps would indicate), while medium to fine and super-fine wools are inclined to be over-crimped. This changed relationship is of great importance to the processing behaviour of the clip on the one hand and to breeding on the other.

— *S.A. Wool Textile Research Institute,
Grahamstown.*

Kenaf retting

This country imports over 50 000 tons of jute fibre per annum. As India and Pakistan together produce about 95 per cent of the world jute crop, there is a need for South Africa to become more independent in the fibre field. *Phormium tenax* (New Zealand hemp), although a relatively hard fibre, should replace 50 per cent of imported jute in the near future, production capacity being the only limiting factor at present. There remains the need for 25 000 tons of a fibre resembling jute more closely; officials in the Department of Agricultural Technical Services consider kenaf, derived from local 'Wilde stokroos' (*Hibiscus cannabinus*), to be best suited to filling this rôle.

The fibre is found in the bark of the plant and biological retting is necessary to produce fibre of good quality which resembles jute. As previous attempts at commercial retting were not entirely successful the C S I R was requested by the above Department to investigate the process. This was done on both laboratory and pilot plant scales and an economical method of retting was developed in which particular attention was paid to water consumption. It is intended to obtain production-cost data for this process, in order to compare its cost with the present price of imported jute.

Besides the need for retted fibre of good quality, there is a further need for cheap fibre to replace 'jute cuttings', the price of which is less than half that of long jute. There is, however, such a narrow margin between kenaf growing costs and its final value that fibre extraction methods must be severely modified. Suggestions have been put forward for achieving this difficult objective. Various processes are to be tried out during the coming season and in these trials the experience of the C S I R will be of value. Research on machines suitable for harvesting and decorticating kenaf and other fibres was carried out by the C S I R and prototype equipment, which will be tested at the next harvest, was made.

— *National Chemical Research Laboratory and
National Mechanical Engineering Research Institute*

Engineering for agriculture

The development of an evaporative cooling system for temperature control in glasshouses used by the Department of Agricultural Technical Services was successfully concluded, and several installations were put into service. Technical guidance was given to local authorities and to the Meat Control Board in the selection of quick-chilling plant that is now being introduced at several slaughter-houses in the country. The new chilling methods result in meat of a better quality.

— *National Mechanical Engineering Research Institute.*

Materials and design

The local production of many new or improved machine (and particularly automotive) components has led to increased demands by industry for the Institute's help in solving problems of materials and design. Assistance was given by performing metallurgical examinations, fatigue tests, and stress analyses of such items as car and railway springs, wheel discs, sheave wheels and large mine-ventilation fans. Long term investigations were continued into the loading conditions and strength essential for mine-shaft equipment like hoisting ropes, and buntons and guides. Application of some of the results so far obtained has led to improvements in practice.

— *National Mechanical Engineering Research Institute.*

Mining research

Research on rockbursts and control of strata movements was continued under the sponsorship of the Transvaal and Orange Free State Chamber of Mines. The emphasis of the work was upon investigations in the laboratory into the properties of rock, upon model studies, and the measurement of stress in rock. Statistical analyses of the incidence of rockbursts in mines answered some questions concerning the safest mining methods.

An extensive programme of research into problems connected with control of the ground surrounding colliery excavations is being conducted in collaboration with the S.A. Fuel Research Institute and the Geological Survey of South Africa on behalf of the Coal Owners' Association. Work already done directly for collieries involved the measurement of stress in pillars *in situ* and in models.

— *National Mechanical Engineering Research Institute*

Mine ventilation

Since the installation by a number of mines of streamlined structures in certain mine shafts, the influence of the wall in hindering the flow of air has become increasingly important. A thorough investigation into the advantages to be gained by improving wall surfaces was started.

Model and full-scale tests were both used to investigate the use of guide ropes instead of a buntton and guide system for guiding conveyances in shafts equipped for hoisting. It was shown that model tests can be used to predict performance in practice under certain conditions.

— *National Mechanical Engineering Research Institute.*

Removal of suspended solids from mine water

An investigation into the removal of suspended solids from mine water and into the associated problem of wear in the high-lift pumps used to pump the water out of the mines, was undertaken on behalf of two mining groups. The investigation concluded with a study of economic considerations. A formula was developed for determining the most economical degree of removal.

— *National Mechanical Engineering Reserch Institute.*

Bituminous surfacings for city streets

The design of premixed bituminous surfacings suitable for carrying the heavy traffic of city streets has formed the subject of a recent road experiment in Durban. Some 140 different compositions of 1½ in thick surfacing have been laid on the Umbilo Road in Durban, which carries approximately 20 000 vehicles per day. In this experiment surfacings made with bitumens from the Durban Refinery are being compared with those containing imported bitumens from Trinidad. Surfacing have been laid to two completely different types of specification, British and American, and specially designed materials containing Iscor tars have also been included.

There is a problem in designing dense premix surfacings to carry heavy traffic, as the range in bitumen content giving optimum performance is relatively narrow. If too little bitumen is used, ravelling and disintegration occur, and if the bitumen content is too high, rich mixtures are produced that become displaced under traffic. It would be extremely useful to be able to design satisfactory mixtures in the laboratory before the commencement of work and mechanical tests are sometimes used for this purpose. The Marshall Test is perhaps the most popular at present; the mixtures laid in the Durban experiment were tested by this method, which will enable a correlation between test results and performance on the road to be established later.

The work in Durban has been carried out by staff of the CSIR in collaboration with staff of the Durban City Engineer's Department, who have provided the facilities required.

— *National Institute for Road Research*

Road features and accidents

It is well known that the accident rate is not the same on all types of highway, viz. on two-lane, three-lane, four-lane or fully access-controlled freeways. There are, however, a number of road features which make travelling on different stretches of road of essentially the same type safer or more hazardous.

An attempt has been made to determine the influence of some of these road features by carrying out a comparative study of accidents and traffic conditions on two different main roads in the Reef area. Both these roads carry large volumes of traffic travelling at high speeds and one of them has a particularly bad accident record. Details of accidents which had occurred on the two roads were made available by courtesy of the South African Police and additional assistance was given by police officers who had investigated certain accidents. Plans, and data on the design of the two roads were made available by the Transvaal Provincial Roads Department.

The pattern of increase in the accident rate during the course of the day and after sunset is similar on the two roads. The road with the bad accident record, however, showed a marked peak in the accident rate at 10 p.m.

For all cases investigated it was found that the road with the higher average spot-speeds measured, and the higher 85 percentile speed (the speed which only 15 per cent of drivers exceed) had an appreciably lower accident rate (number of accidents per million vehicle miles covered on the road). This road also carries more trucks and motor cycles than the road with the bad accident record.

This finding, which is contrary to common expectation, indicates that other factors not yet fully recognized must have a pronounced influence on traffic accidents. The following road features were investigated in more detail: gradient, curve radii, road width, sight distance, traffic composition and conditions at intersections. Although more data are

needed to draw definite conclusions, it appears that gradient and sight distance are the factors influencing traffic accidents most strongly on this type of road.

From the factors investigated in this comparative study it is hoped that some basic guidance will be obtained on how to improve road safety most effectively at danger spots and on dangerous stretches of road.

— *National Institute for Road Research*

Weathering of rocks and road foundation performance

The South African road engineer is confronted with a particular materials problem, unique to the Republic and therefore unsolvable from foreign experience or research results. Generally, only 5 per cent of all igneous rocks on or near the surface of the earth are basic and their extremely wide distribution in South Africa is exceptional. In an area covering about 40 per cent of the country the engineer has little choice but to use Karoo dolerites or similar basic igneous rocks, in all stages of weathering, because other locally available materials may be even less satisfactory. Weathered basic igneous rocks are largely unstable under the climatic conditions in the eastern part of the Republic and may give trouble if they are used indiscriminately in the various layers of a road foundation. In the west, however, little trouble is experienced.

Research has been carried out into the mechanism of weathering of basic igneous rocks and into the performance on the road of materials resulting from the two principal types of weathering, viz. disintegration and decomposition. A British test, the 10 per cent Fines Aggregate Crushing Test, has been applied to determine the degree of disintegration; and a new one on the determination of the percentage of secondary materials, has been developed to define the degree of decomposition.

The determination of local climate by means of the climatic 'N-value', which indicates the potential influence of climate on weathering and the potential performance for engineering purposes of weathered basic igneous rocks, has provided a new approach to the assessment of environmental influences. The interest of foreign research workers in different fields, as well as of international organizations like the Commission for Agricultural Meteorology of the World Meteorological Organization, has been attracted by such work.

A simple method has finally been developed for use by road authorities, which combines all the above aspects in a form suitable for use in selecting the most suitable road materials.

— *National Institute for Road Research*

Electronic computer for use in road design

Designing roads to fixed standards is normally an onerous task because of the time-consuming calculations involved. After studying the nature of the area involved, the road engineer determines the provisional boundaries of the road in the horizontal plane and these are then checked for conformity with the prescribed standards by means of extensive calculations. When these requirements have been met, a vertical design is produced which is then checked in a similar manner.

The costs entailed in constructing a road depend largely on the volume of earth to be moved and the distance it has to be moved. The earth-moving necessary for each section of road is calculated and the excess of excavation or filling is determined. The result then serves as a basis for calculating the total cost of construction.

The calculations involved normally take weeks and even months, but a scheme has now been evolved whereby all calculations and checking procedures are carried out auto-

matically by the electronic computer. This makes it possible to compare a large number of designs within a short time, so that considerable savings in construction costs and manpower can be effected.

This scheme is in an advanced stage of development and should shortly be ready for application in practice.

— *National Research Institute for Mathematical Sciences*

Road-marking paints

Experimental paints were made, and tested under practical conditions with the kind co-operation of the City Engineer of Durban. Very satisfactory results were obtained.

— *Paint Industries Research Institute,
Durban.*

Acoustics

Research has shown that the acoustic behaviour of auditoria can be predicted by means of model tests. Such tests were conducted with models of two different auditoria — the one before and the other after the auditorium concerned had been built. Agreement between the 'predictions' based on model tests on the one hand and the behaviour of the auditorium itself on the other hand, was excellent. Where the acoustic design is faulty it leads to inaudibility in the auditorium so that this does not serve its purpose and a lot of money is wasted. A country is often judged by its facilities for the arts, and it can be said with pride that our latest auditoria compare favourably with the best in the world.

— *National Physical Research Laboratory*

Servantless and township houses

Further research into suitable housing for people in the low income groups in South Africa was undertaken. The possibilities of designing a house for Whites, costing approximately R1 500, were fully investigated. A study on the planning of kitchens was also started, with the aim of eliminating the necessity for servants. This particular project forms part of a much larger investigation into the planning of a 'servantless' house. The economic implications of building two- or three-storey low-cost houses for the non-White population were studied; preliminary findings indicate that the erection of such houses would be economically feasible. The houses would generally cost more per dwelling unit, but savings in the costs of services to a township — that is, of water reticulation, sanitation services, stormwater drains and roads — could justify this additional expense.

— *National Building Research Institute*

Hospital and school buildings

In connection with the long-term project of research into hospital buildings, an investigation was carried out to establish a reasonably accurate method of calculating the number of operating theatres required in general hospitals. In this the many varying factors influencing the use of theatres and the types of surgery performed are taken into account. Data were also collected on supply systems for medical gases in hospitals, with the object of establishing criteria for the efficient design of such installations. The study included examination of the relative suitability of mobile cylinders and of piped systems for oxygen and nitrous oxide.

In the investigation into school buildings a study in planning and preparing schedules of accommodation for a 1 200 pupil high school was undertaken in collaboration with the Transvaal Department of Education. This shows that suitable buildings which provide every educational facility and offer the pupil an inviting and stimulating atmosphere, can

be achieved at a reasonable cost. It appears that the best planning solution will be achieved by breaking the school complex up into age groups, so that smaller groups of children are kept together within the total number of 1 200. The necessity for this research was brought about by the need for a more comprehensive school building in which the new policy of differentiated secondary education can be fully implemented. It is expected that investigations now in progress could result in some far-reaching changes in school buildings.

— *National Building Research Institute*

Building stone

The indiscriminate use of water-proofers and so-called preservatives can often have harmful effects on sandstones and accelerate rather than retard decay. The performances of 11 commercial products of this type are being investigated as part of an investigation into treatments for building stones being carried out in collaboration with the Public Works Department.

— *National Building Research Institute*

Pre-stressed concrete

The utilization of pre-stressed (or post-stressed) concrete techniques is increasing in South Africa. Several factories are already producing pre-stressed concrete building components and it is likely that such components will be more widely used, particularly in bridges, in the near future. This is of particular significance in view of the highway development planned for some of our cities. Two important aspects of pre-stressing steel in South Africa are being investigated. One aspect is the loss of stress, technically known as 'relaxation', that takes place in a steel rod over a period of time, and the other is the possible corrosion of pre-stressing steel used in structures in a marine environment.

— *National Building Research Institute*

Structural and foundation engineering

In collaboration with the Geological Survey and the Bernard Price Institute an investigation into the effects of blasting on buildings was undertaken. Examinations of houses and walls before and after blasting operations nearby were carried out. A background of information is being built up which will permit, in the future, the expression of qualified opinions on whether cracks in a building were caused by blasting or by other phenomena.

Several soil maps were prepared during the year. The major task, still incomplete, was the mapping of the area north-west of Pretoria. Within this area, detailed maps were prepared for the Uitvalgrond Bantu township and the Rosslyn industrial area. A soil map of the Uitenhage-Despatch area was prepared to indicate areas where no foundation difficulties will be encountered and which would show areas for possible future building programmes. Soil maps were also prepared for Sophiatown and Bosmont for use by the Department of Housing in planning housing schemes.

— *National Building Research Institute*

Sanitation in mines

Underground sanitation facilities have usually been unsatisfactory because of the unpleasant smell and the inconvenience of transporting buckets.

In co-operation with a private concern, a mobile sanitation unit has been developed which makes underground treatment of excreta possible, by means of a process that renders it virtually odourless. Running on the tram tracks of the mine, the unit can be moved to any required position; as the underground face moves continually, the advantages of such an arrangement are obvious.

Preliminary experiments with prototype units have given satisfactory results. The units operate under compressed air which is freely available in a mine. Where the rate of

evaporation is high, replenishment of the water is required to maintain the correct volume in the installation. In cool places, however, it may be necessary to drain off the small quantity of effluent that is formed during disinfection and to discharge it into the regular drainage system of the mine. Similarly, sludge may need to be disposed of occasionally.

Considerable progress has been made with the development of this unit, and if it is adopted for general use it will bring about a major change in underground sanitation.

— *National Institute for Water Research*

A survey of some aspects of White manpower resources in the Republic of South Africa

This survey was conducted on a sample of White South African youths who registered for Active Citizen Force training in 1954.

The major findings that emerged from this study indicated that up to one-quarter of the male Whites in the population have no intention of proceeding beyond Std VII, or of acquiring any additional vocational qualifications above this relatively low level. In fact, the evidence showed that one-eighth to one-ninth of the male White population had not proceeded beyond Std VI.

The position at the upper end of the scale was more favourable. Youths representing one-fifth of the population were making — or intended to make — some attempt to improve their educational and vocational qualifications beyond the Std X level. More advanced education of both professional and semi-professional types was obtained by 15 per cent of the population, while 17 per cent were engaged in taking National Technical Certificates in courses I, II and III.

However, many more young men aspired to high-level occupations than were qualified by their educational status or intentions to fill such positions. Since between 22 per cent and 25 per cent of the male White population may be needed to meet the demand for people with qualifications higher than Std X, serious shortages at this level can be expected to occur.

At the bottom of the employment pyramid for Whites the survey showed that only 12 per cent wanted to enter low-level manual and supervisory services, although 25 per cent were hardly suited for anything else.

An attempt was made to assess the extent to which our young White men could improve their educational and vocational qualifications if they made a deliberate attempt to do so. It was estimated that about 25 per cent of the White male population between 17 and 20 years of age could have attained a standard of education at least 1 to 3 years higher than their present qualifications.

In view of the difficulty that is being experienced in finding jobs for Whites with low educational qualifications, and the grave shortage of high-level manpower — which is larger every year — this figure is by no means negligible. In order to salvage the educational potential that could mean so much to the nation, further investigation of this phenomenon should receive priority.

— *National Institute for Personnel Research*

Effects of heat and humidity on performance of work

In the deep gold mines of the Transvaal and Orange Free State the general performance of underground labourers is adversely affected by humidity and heat. It is necessary for the human body to get rid of the heat generated while working and this is brought about by evaporation, convection, and radiation. On behalf of the Applied Physiology Laboratory of the Transvaal and Orange Free State Chamber of Mines, instruments to study the heat exchange between a labourer and his environment and to measure the heat built up while a person works, are being developed and methods by which heat loss through *evaporation* may be measured are being investigated.

A prototype of a human calorimeter was completed and calibrated. This measures the heat gained by the human body as a result of work.

Heat loss to the air by *convection* is determined by placing the test subject between two measuring grids in an airstream. The heat lost by his body is calculated from the difference in the temperature registered by the two grids. This system of measurement has also progressed to the prototype stage.

In determination of heat loss by *radiation* from the body, the total heat radiated from a subject is measured, and, for purposes of comparison, the radiation surfaces of different mine labourers or one person in different working positions.

Measurement of heat dissipated by radiation has progressed to the stage where a radiation meter can be made to rotate continuously around a laboratory worker while he works. Steps have been taken to improve the accuracy of the measurements obtained. Very quick and accurate determination of radiation area was made possible by a method based on photometric absorption. Equipment was built by which the radiation area of any object with a surface of about 20 000 sq cm (20 sq ft) could be determined with great accuracy. The work has now been completed and the equipment tested. This research is of importance in the field of photometry, and it has created considerable interest abroad.

Data collected by all the above methods will assist materially in arriving at an economical solution to the problem of improving working conditions and performance underground.

A considerable amount of overseas interest has also been created among mine ventilation engineers and space research workers.

— *National Mechanical Engineering Research Institute*
National Physical Research Laboratory

Investigation of postal mechanization project

As the result of a request by the Postal Authorities to the C S I R, an investigation was undertaken to find out whether it would be possible to develop and manufacture letter-sorting machines locally. A preliminary study was made to establish the approximate relative costs of sorting manually as at present, and of sorting by means of certain semi-automatic machines now in use overseas. Further objects of the preliminary study were to examine letter-sorting problems generally, and to formulate these problems in more specific terms.

The preliminary study was limited to the Johannesburg Post Office. In order to make meaningful comparisons between the costs of the various sorting systems a general mathematical model of an 'optimum' manual sorting system had to be constructed. In general terms, the results of the cost comparison indicated that the costs of the present manual and the semi-automatic methods considered, are, for the Johannesburg Post Office, of the same order of magnitude and that more detailed studies of semi-automatic sorting machines are therefore warranted. It was recommended that an experimental machine be acquired by the Postal Authorities, in order to make possible more precise definition of the requirements for mechanized sorting in local postal circumstances. It was also recommended that a research and development unit be established within the Post Office organization, to keep it abreast of the rapid developments in postal mechanization overseas, to study methods for the improvement of existing manual sorting methods (which will always have to be used in conjunction with mechanized sorting), and to define mechanized sorting requirements in terms of local circumstances. The recommendation for the establishment of such a unit has been approved in principle by the Postal Authorities. The C S I R will, it is anticipated, continue to be associated with this project in order to

bring about an effective transfer of the knowledge and experience that it has acquired in this field.

This project provides a good example of how economic studies can be used to help ensure that the Council's resources are used to greatest advantage for the country.

— *Industrial Economics Division*

The rôle of motivation in heavy manual labour

Why does work capacity and efficiency differ from one person to another? In an attempt to test some of the possible explanations of this phenomenon, an extensive study was undertaken at a Rand gold mine, with the co-operation of a team of physiologists. The task selected for this purpose was lashing, i.e. the manual loading of ore with a shovel. It was possible to obtain reliable weekly records for the performance of each individual over a long period.

Physical capacity (as determined by means of physiological tests) did not vary to any marked extent between those with high and those with low production records, and it was found that a short and comparatively simple test task at the beginning of the contract period of a Bantu mineworker (e.g. doing lashing for two hours at his own spontaneous rate) gave a good indication of his subsequent performance over a period of several months.

A further interesting finding in this study was that the quality of supervision had a significant influence on production. The favourable influence on a team of a good supervisor was still evident for some time after he had been separated from the team. In addition, a team with poor performance showed a marked improvement in production soon after it had been placed under a good supervisor.

— *National Institute for Personnel Research*

Work capacity tests

In order to assist the Silicosis Bureau in the application of work capacity tests it was decided to relate maximum oxygen uptake to lung and heart area as estimated from the chest X-Ray. If this relationship is better than the physical parameters of weight, height and body surface area used at present, it will make the tests more definite. In addition, heart area and lung area increase in the majority of diseases of these organs while the maximum oxygen uptake falls, thus affecting the relationship in the direction of greater discrimination.

— *Pneumoconiosis Research Unit Johannesburg*

Training methods

The need for training in work-study methods was felt strongly during the past year. It was realized by many of those responsible for management (in various organizations) that rational decisions on the requirements for selection and training, and on the remuneration that should be offered for services rendered, were only possible if reliable information was available on the nature of the work to be done. The advantages and disadvantages of different methods of approach were investigated and further research was done on related subjects, for example, on task assessment and merit determination.

Research is being continued on methods for the training of White supervisors already employed. Research in the field of programmed instruction and teaching machines, an important new development, has progressed well and the first task in programming has already been undertaken.

— *National Institute for Personnel Research*

Bantu classification

The need for personnel selection and occupational guidance tests is growing. Tests for Bantu classification, which were conducted with great success in the mining and secondary industries, have also been conducted during the year to help employers to place Bantu labourers. Greater efficiency of farm labour is envisaged as a result of this experiment, which is being conducted on a Government experimental farm.

It was found that an experimental group of Bantu matriculants took much longer on the average to perform a routine addition test than a corresponding White group. Should this slow rate of work be manifested also in their other intellectual work, it may prove to be an important cause of the relatively poor matriculation results of Bantu pupils.

— *National Institute for Personnel Research*

Nutritional status survey among primary school pupils in Pretoria

A survey was carried out to determine the nutritional status of 24 000 White primary school pupils in Pretoria, aged between six and eleven years. The survey was the first of its kind in South Africa and one of the most extensive undertaken in any country.

The purpose of the survey was, firstly, to evaluate the various methods of investigation which were applied and secondly, to determine the present nutritional status of apparently healthy Pretoria primary school pupils.

Although a total of 360 children was considered a representative sample, it was decided to double this figure as a response of only 50 per cent was expected. The final response, however, was approximately 84 per cent and a total of 618 out of a possible 720 children participated in the survey.

In order to combine and correlate the findings, several closely related studies were carried out. These were:

1. a clinical study in which special attention was given to symptoms related to poor nutrition or to deficiencies in specific nutrients;
2. a somatometric investigation;
3. radiological examination of the hands and wrists to assess bone development;
4. biochemical examination of the blood and urine to determine the concentration of various substances which could give an indication of nutritional status; and
5. a dietary survey in which two different methods were used, viz. direct weighing of individual portions of food over a period of seven days (for this method a sub-group of 30 children was used), and a broader method which was a combination of the dietary-history method and the weighing method.

Apart from these studies, a socio-economic survey was also undertaken to study the relationship between the socio-economic status of the families and the condition of health of the children.

— *National Nutrition Research Institute*

The possible use of fish flour for the prevention of protein malnutrition

An investigation into the possible value of a South African and an American fish flour for preventing kwashiorkor was completed. The effects of these two products (included in a maize diet) were studied separately, each in a group of 15 convalescent kwashiorkor patients. The results were compared with those for a control group of 15 patients who received a diet of skimmed milk and maize porridge.

The three groups were compared for gain of weight and the changes which occurred in certain constituents of the blood serum during the experimental period of six weeks. Balance studies of nitrogen, calcium, magnesium and phosphorus were carried out in 30 cases.

All three diets were taken well and in no case was it found necessary to discontinue the diet before the end of the experimental period. The patients in all three groups showed satisfactory weight gains. Although the weight gain in the groups that received the two different types of fish flour did not differ significantly, there was an apparent contradiction in the fact that the weight gains in the group that received a supplement of South African fish flour were lower than those in the control group. The albumin content of the blood serum was satisfactorily maintained in all three groups. The differences between the various groups in the percentage absorption and retention of nitrogen, calcium, magnesium and phosphorus were not statistically significant.

The results indicate, therefore, that fish flour could probably replace skimmed milk as a source of protein in cheap baby foods. It will however be necessary to conduct experiments over considerably longer periods before the use of fish flour for this purpose can be finally approved and recommended.

National Nutrition Research Institute

Fish-meal

Using available lysine of fish-meal protein as an accepted index of protein quality, it was shown that the protein quality of South African and South West African fish-meal remains unaffected during storage, even at -5°F , where peroxides rise to exceedingly high values. As a result of research, under carefully controlled conditions, into the effect on available lysine of time and temperature during processing and storage, and of chemical 'hardening', quantitative data are now available for the guidance of industry. Research on the self-heating of fish-meal has also been continued, and though the heat generation is a function of many variables such as temperature, time, oxygen partial-pressure, moisture content, etc., it has nevertheless been possible to fit the phenomenon to mathematical laws.

Both adiabatic and isothermal calorimetry are being used to study the artificial curing of fish-meal and to evolve a prediction schedule using mathematical electronic analogue computing techniques.

Concurrently the oxidation phenomena in the oil of fish-meal are being studied, particularly peroxide formation and breakdown in relation both to spontaneous combustion and to nutritive value, as well as to the effect on vitamin A retention in chicken liver.

*— Fishing Industry Research Institute,
Cape Town.*

Fish-flour

Fish-flour investigations have continued, and a new continuous process has been applied on a pilot-plant scale. The amount of solvent needed for the extraction of a given amount of meal has in this way been reduced to one sixth of that used in the past, and the extraction time to about a third, while the protein and organoleptic qualities of the final product have been greatly improved. For instance, the residual fat content has been reduced to a quarter and the available lysine content of the protein increased by more than 10 per cent.

*— Fishing Industry Research Institute,
Cape Town.*

Dried fish products

Amongst other interesting and useful dried fish products evolved during the year may be mentioned a coarsely powdered, dehydrated fishcake-mix in which fish-fibre of hake is maintained to simulate the texture of fresh fish, and a similar dehydrated 'smoorvis'-mix.

*— Fishing Industry Research Institute,
Cape Town.*

mosomes'. As a result of certain quite simple but far-reaching modifications of technique, it is now possible to culture the lymphocytes of human peripheral blood and examine the actual chromosome complement in metaphase.

Data on the insulin-like activity of human plasma in various conditions have been collected. In 'prediabetes', early pregnancy, and mild diabetes it is usually greater than normal. From cases of chronic pancreatitis and the post-gastrectomy syndrome there are some specially interesting new data.

Certain detailed biochemical analyses and comparisons of Bantu and White urine, which were started in order to investigate the rarity of renal stone in the Bantu, were continued. It was remarkable to find that Bantu urine differed from 'White' urine in being far more dilute, in containing far less calcium, yet far *more* sodium. Perhaps the very high salt intake of the Bantu is related to their high incidence of hypertension and their low incidence of renal stone.

— *Endocrine Research Group,
University of Cape Town.*

Studies on alcohol and alcoholism

In a comparative study of the effects of Bantu beer and other alcoholic beverages on human performance, a direct relationship was found between the alpha frequency in the electroencephalogram (EEG) and the concentration of alcohol in the blood. Despite changes in alpha frequency, which suggest some interference with normal brain functioning, no significant changes were found in performance of tests of skill, or in reaction time. This conclusion holds equally for all the types of alcoholic beverage used in this investigation. Considerable individual differences were found in susceptibility to specific types of drinks. It would appear that significant changes in performance only occur when the individual reaches a stage of near-intoxication. If minor effects do occur, these seem to be compensated for by increased relaxation in the test situation.

An interesting point, from a clinical and forensic point of view, is that in some subjects with normal EEG's abnormalities in the EEG made their appearance as a result of alcohol ingestion. These abnormalities were of the kind that are found in epilepsy or that have commonly been observed in insane murderers and psychopaths. These findings confirm the clinical view that the use of alcohol is inadvisable for epileptic patients. They may also throw light on the relationship between alcoholic intoxication and the occurrence of certain types of crime. These conclusions are tentative and further investigation is desirable.

In a study of the socio-psychological aspects of Bantu drinking habits in the Witwatersrand townships, Bantu men were found to approach White drinking habits more closely as they moved up the socio-economic ladder. For many Bantu men the beerhall serves merely as a recreational centre. One-third of those who visit the beerhalls do not drink at all, while four-fifths claim that they never drink during work hours. The majority of Bantu women are opposed to the drinking habits of the male population. They feel it is a waste of money, that the men expose themselves to danger, and that they do not participate sufficiently in family life.

An intensive survey of the literature on alcoholism and the industrial effects of alcoholism has been launched, in co-operation with the South African National Council on Alcoholism.

— *National Institute for Personnel Research*

Standard artificial leg

In February 1960 the design for an artificial leg was published in *The South African Medical Journal*.

Since then this research has been pursued with a view to developing a standard artificial

Phospholipids of pilchard flesh

The phospholipids of pilchard flesh have been examined with a view to exploring their possible industrial and pharmaceutical applications. Lecithins, cephalins, sphingomyelins, inositides, cerebrosides and phospholipids of the cardiolipin type have been identified in chloroform-methanol extracts of fish tissue. Paper chromatography of the hydrolysis products from these phospholipids has revealed the presence of choline, serine, ethanalamine, sphingosine, inositol, glutamic acid, threonine and several other ninhydrin-reacting substances which are being investigated.

— *Fishing Industry Research Institute,
Cape Town.*

Vaccines and other biologically active substances

Proteins and enzymes:—

Scientists in the National Chemical Research Laboratory have specialized in the provision of facilities and development of techniques for studying proteins. In recent years, they have followed up new developments in ion-exchange chromatography, column and starch gel electrophoresis, and gel filtration. No other centre in the Republic possesses similar facilities. Many papers on protein work have been published. One of the most important of these which came out a few years ago, described the successful purification and characterization of an enzyme. Such biologically active materials are notoriously difficult to study, and the foregoing success encouraged the group to undertake other tasks of similar difficulty.

Diphtheria toxoid:—

One such project has been the purification of diphtheria toxoid, in collaboration with the Medical Research Institute. A crude toxoid was first prepared by precipitation, and then purified by column techniques. The final purity achieved was recorded as 3 170 flocculating units per milligram protein nitrogen, the units generally accepted for this toxoid. This is still probably not completely pure, but it compares favourably with the best results reported in the relevant literature, namely 3 200 units. The CSIR method was more efficient than the methods described in this literature.

Vaccine development:—

A closely allied development has been an extensive programme of work, in collaboration with the Veterinary Research Laboratories at Onderstepoort, on the isolation and purification of toxins responsible for various animal diseases. With the pure toxins it is hoped to produce single antibodies by inoculation, and these in turn will be isolated by similar techniques. At present studies are being carried out on toxins produced by the bacteria responsible for blackleg disease, for lamsiekte, and for another disease of sheep. A considerable degree of purity has been attained in each case and, in one, the next stage of preparing the pure toxin on a larger scale has been started.

— *National Chemical Research Laboratory*

The use of maize meal in bread

While the consumption of maize for human nutrition in the Republic has decreased, the consumption of bread made from wheat is increasing. It must however be noted that South Africa is producing a considerable surplus of maize, while wheat still has to be imported.

Research was therefore carried out to determine whether and to what extent maize could be used as a partial substitute for wheaten flour in bread. It was found that if minute quantities of ascorbic acid (vitamin C) are added to improve the quality, it is possible to make white baker's bread containing up to 25 per cent maize meal, and brown baker's

bread containing up to 15 per cent without detrimentally affecting the appearance, volume, texture or taste of the bread.

A large-scale experiment with white bread was also conducted in a commercial bakery. The bread produced in this experiment was submitted to a large number of persons for evaluation and with very few exceptions the bread was found most attractive. The indications are that this maize-bread would find a market, especially if it could be offered at a somewhat lower price. Thus a contribution would be made towards utilizing the maize surplus and towards savings on the importation of wheat.

— *National Nutrition Research Institute*

Clinical nutrition

In the field of protein malnutrition evidence continues to accumulate that, although calorie deficiency is uncommon among human beings in South Africa, protein malnutrition is widely prevalent and a serious cause of impaired efficiency and resistance to disease. This is particularly true of the pre-school child, as has been recognized by making kwashiorkor a notifiable disease. Protein malnutrition results from the consumption of excessively starchy diets without adequate admixture of protein-rich and protective foods. The requirements for the last two are comparatively small. Thus the Clinical Nutrition Research Unit has shown that an 18 per cent admixture of skimmed milk or a 10 per cent admixture of fish meal in a mixture of maize and cow-pea has a high nutritive value for convalescent cases of kwashiorkor.

Evidence is further accumulating that gastroenteritis in the pre-school child occurs predominantly in those children who are already suffering from protein malnutrition. The existence of this malnutrition has been shown through figures for height, weight and serum albumin. Study of the metabolic balance of albumin and globulin (in collaboration with S. Cohen of the National Medical Research Institute of Great Britain) has shown that slight hypoalbuminaemia is evidence of a severe degree of protein malnutrition. This demonstration makes it clear that whereas better feeding and improved hygiene are both required for the abolition of gastroenteritis, better feeding is the remedy most easily and quickly applied.

Study of the relationship between dietary fat and ischaemic (coronary) heart disease (I H D) by this Unit and at other centres in South Africa confirms the preventive value of 'prudent' dieting for those who may be endangered by this disease. This conclusion has now been formally accepted by the American Heart Association. It is, of course, generally recognized that I H D has multiple causation. The Unit has recently been studying some of the other contributory factors. There is increasing evidence of the contributory parts played by lack of exercise, by emotional tension and by the digestive enzymes of the gastro-intestinal tract. The Unit has contributed valuable information on this last aspect and its statistical association with the ABO blood-group system. The important role of genetic factors linked with the ABO blood-group system is being studied by a new genetics section of the Unit, with special reference to high blood pressure.

— *Clinical Nutrition Research Unit
University of Cape Town*

Endocrine research

This year the second report on the unexplained bone disorders in Coloured schoolchildren of the Kenhardt location was published. The disorders are related to the excessive amount of fluorine in the well-water used for drinking, but there are undoubtedly other factors, which we have been unable to identify, that render this type of fluorosis unique in world medicine.

After many vicissitudes, fair success has been achieved with 'growing human chro-

leg that will allow knee and ankle to bend in a natural manner while weight is being taken on it and become a free-swinging device during the period when there is no weight upon it.

Recent trials have indicated that this research is progressing towards the stage when the leg can be tested on representative groups of patients.

Should these tests prove successful, consideration will than be given to ways and means of manufacturing limbs of this kind.

— *Orthopaedic Development Research Unit,
University of Cape Town*

Air pollution

Air pollution has again caused grave concern both overseas and locally, and research in this field in co-operation with municipalities and industry has continued. The work includes determination of the present extent and composition of polluted air in our cities, in order to arrive at some criterion whereby any improvement or deterioration can be assessed immediately. The measurement of 3:4-Benzpyrene — a substance that causes cancer — and a study of oxidants which cause damage *inter alia* to plants and crops, have become matters of the utmost importance.

— *National Physical Research Laboratory*

Aluminium powder prophylaxis

Attention is being given to the possible rôle of aluminium powder in the prophylaxis of silicosis and a member of the staff will shortly be proceeding to Canada to investigate the claims of Canadian workers in this regard.

— *Pneumoconiosis Research Unit Johannesburg*

Amoebiasis

There have been several interesting developments in amoebiasis research.

It was usually believed that bacteria initiated the formation of amoebic liver abscesses and that amoebae took advantage of the lesions so caused, while the bacteria then died out. However, it has proved possible to initiate liver abscesses in the golden hamster with material containing no bacteria, and to pass amoebae from one hamster to another. In addition to throwing light on the mechanism of formation of liver abscesses, this technique now provides a laboratory source of amoebae without the contaminating organisms that confused the picture.

Emetine has, since its introduction by Sir Leonard Rogers, been the drug of choice in the treatment of liver abscesses and also for the control of symptoms in amoebic dysentery. It is extracted from plants, and unfortunately has the reputation of being somewhat toxic as it affects the heart. Now a synthetic form has been produced and this is less toxic than the natural product in laboratory animals. Preliminary tests indicate that the synthetic product is as effective in man as natural Emetine, and to date no toxic effects have been encountered.

The immunology of amoebiasis has always been confused by the complexity of antigens produced by orthodox measures and the Amoebiasis Unit has, for some time, been engaged in a study of the immune phenomenon in its cases. Several antigen-antibody systems have been encountered. Of particular interest is a non-specific antigen derived from *Clostridium welchii*, which reacts with almost all sera from cases of liver abscess.

It is proving possible to separate and isolate the various antigenic materials by using molecular filters in chromatographic columns. As this technique has been applied in this field for only some three years, its immediate successes hold great promise for the future, not only in amoebiasis and parasitology generally, but also in other fields of protein study.

— *Amoebiasis Research Unit
Durban*

Arthropod-borne virus infections in South Africa

In the course of studies on the prevalence and importance of arbor virus infections in South Africa, an immunity survey in the Vaal and Orange River valleys was recently completed. The survey revealed that several of these infections are widespread in this region in both human and animal populations. Their importance in causing disease has still to be elucidated and is engaging the attention of the team when opportunity occurs.

In May of this year, in response to an appeal from the health authorities of the Federation of Rhodesia and Nyasaland and in collaboration with the health officials of Southern Rhodesia, a study was made of an extensive outbreak of an illness in which the patients complained of severe pains in the joints and of fever, and developed a rash. The virus was isolated from one of the patients, and has recently been identified as similar to that causing chikungunya fever. (The chikungunya virus, which was first isolated in Tanganyika, causes an illness resembling dengue fever.) It was then found to have been the cause of a widespread outbreak of illness affecting visitors to the Northern Transvaal in 1956. Since then it has been shown to be widely distributed in Africa and also in some tropical and subtropical countries of Asia. In Thailand and the Philippines it is suspected of being one of the causes of haemorrhagic fever, an illness that is often severe, and sometimes fatal. Fortunately, the outbreaks in Southern Africa have, so far, been relatively mild. However, the need for continued vigilance against this infection is clear.

— *Arthropod-borne Virus Diseases Unit,
S A I M R, Johannesburg*

Bilharzia

The main project is still an investigation into the distribution of fresh-water snails in the Republic of South Africa, with special emphasis on those species which act as intermediate hosts for Bilharzia. Thus far attention has been devoted largely to the Transvaal. Here the Unit has already collected sufficient data to be able to compile a preliminary list of places where these snail hosts are found, which includes 205 rivers and streams as well as 50 more or less public dams.

The investigation has revealed that some places that are becoming increasingly popular as pleasure resorts may develop into danger spots where unsuspecting visitors may be infected with Bilharzia.

If the present distribution pattern of the fresh-water snails is correctly interpreted, it would appear that at least one criterion has been found by which it is possible to determine whether a particular Bilharzia-free area may in future become an infected area.

— *Bilharzia Research Unit
Nelspruit*

Cancer research

Cancer research in the CSIR was initiated in 1956 by two grants from the National Cancer Association. It began as a study of production of liver cancer in rats by the administration of certain dyes, in collaboration with Professor J. Gillman of the University of the Witwatersrand. The research is now financed by the CSIR alone, as the Association has not sufficient funds.

The work has led to several important discoveries. The widespread interest aroused by its publication led, during 1962, to an invitation for a member of the group to give a paper at the 8th International Congress on Cancer in Moscow, with expenses paid.

At first attention was directed to the way in which dyes attach themselves to the proteins of blood serum of the liver; and Professor Gillman studied histological changes in the

liver as cancer set in. With butter yellow and related dyes, carcinogenic activity was shown to increase with their uptake by blood serum. Trypan blue, while a useful dye in some ways, proved too complex, since its effect was found to reside in a very active impurity, itself a dye.

In present studies, attention has shifted to the changes leading to cancer which take place in liver cells. In cancerous cells, certain enzymic changes such as oxidation of isocitric acid are different from those in normal cells. These differences can be noted even in a cell which has taken up dye but is otherwise normal. Other significant changes produced by uptake of dye are an increase in the level of sulphhydryl groups, and an enhanced synthesis of protein. The last effect may well be related to the uncontrolled growth which characterizes cancerous cells.

— *National Chemical Research Laboratory*

Diffuse pleural mesothelioma

Attention is drawn to the growing number of cases of diffuse pleural mesothelioma which occur in persons who have a history of exposure to the inhalation of asbestos dust. Important work is now being done to determine the presence of carcinogenic agents in the various types of asbestos mined and processed in South Africa. Important contributions to world knowledge of this form of cancer have resulted from the surveys undertaken in the various asbestos producing areas of the Republic. An interesting observation on the general incidence of asbestosis is that a large majority of the rats (*Rattus namaquensis*) trapped by the State Department of Health in the neighbourhood of certain asbestos mills were found to show asbestos bodies and early fibrosis in the lungs. A baboon which was shot in the North Western Cape also showed asbestos bodies in its lungs.

— *Pneumoconiosis Research Unit Johannesburg*

Dust technology

Progress in the development of improved methods for the treatment of slides and dust-counting has resulted in the introduction of a procedure suitable for general use.

— *Pneumoconiosis Research Unit Johannesburg*

Effect of dust on macrophages

A noteworthy project is the experiment on the effect of dust on macrophages. Macrophages can be defined as the defence cells of the body. The dusts used were silica, mine dust, crushed quartzite, dolerite, norite and aluminium. The toxicity of varying amounts of these dusts was determined. Further work will be done to determine whether the technique used will give reproducible results.

— *Pneumoconiosis Research Unit Johannesburg*

Immunological theory

Recently considerable attention has been focused on the so-called immunological theory of silicosis. Experiments are being developed to investigate the claims of those who support this theory. Selected pairs of rats have been attached in parabiosis. In one group of animals the left twin will be injected intratracheally with 1 ml of silica suspension and the right twin with a suspension of a substance which will cause irritation of the lung but no fibrosis. In the control group only the right twin will be injected with an irritating dust suspension. If circulating antibodies play a role in the development of silicosis the injected animals attached to the silicotic animal should show a well marked degree of fibrosis.

— *Pneumoconiosis Research Unit Johannesburg*

Photobiology

Research was directed mainly to the mechanism of some light-induced reactions on the skin which are especially noteworthy in South Africa — direct pigmentation, porphyria, pellagra and geeldikkop.

Direct pigmentation is a type of immediate suntan that is seen when human skin is exposed to light. During the year a theory was proposed to explain this reaction. The essential supposition is that sunlight causes a temporary asphyxiation of skin cells and that direct pigmentation results from this reversible damage. Further, in the course of work on several drugs used in the treatment of cancer, it was discovered that these enhance the sensitivity of the skin to sunlight, possibly by a mechanism similar to that causing direct pigmentation as described above.

Pellagra is a type of nutritionally-determined sensitivity of the skin to sunlight. The mechanism of the sun's action has not been elucidated, but recent work has shown that the sun is not directly responsible for the changes in vitamin content of the skin. The proneness of pellagra cases to skin reactions caused by the sun is largely determined by some factor other than vitamin nutrition, although the latter is grossly abnormal.

Porphyria is being studied for the important relationships between sun exposure and relapses.

Geeldikkop in sheep is being investigated. A high intake of selenium from the vegetation in certain areas quite probably causes the liver damage responsible for the stock losses from this important disease.

— *Photobiology Research Group, Pretoria*

Pneumatically operated shutter for X-ray apparatus

A pneumatically operated shutter was designed and constructed by the CSIR to control the exposure time of an X-ray beam. Rapid removal of a lead disc allows the beam to pass through a collimator after which the beam is re-intercepted by the disc. The shutter is part of an apparatus especially constructed for absolute X-ray dosage measurement, and for calibration of X-ray dosage measuring equipment as used in hospitals.

— *Technical Services Department and
National Physical Research Laboratory*

Porphyria

During the past year various clinical and biochemical aspects of the porphyrias were investigated.

New methods were developed for the study of urinary and faecal porphyrins and these made possible the first detailed analysis of excreted porphyrins from South African patients.

The metabolism of glycine was studied in both experimental and human porphyria, with the aid of C¹⁴-labelled material.

Of special interest was the effect of chloroquine in acquired porphyria. This antimalarial drug has been advocated for the treatment of the skin lesions seen in certain types of porphyria. Small doses administered to patients with acquired porphyria, however, instead of being beneficial, actually produced an adverse reaction. Within days of beginning treatment the patients became ill with fever and malaise. There was a considerable, though transient, rise in urine porphyrin excretion and, coincident with this, biochemical evidence suggesting diffuse liver damage.

— *Renal Metabolic Research Group,
University of Cape Town.*

International conferences attended by CSIR Staff during 1962

The *Thirteenth Meeting of C S A* (Scientific Council for Africa south of the Sahara) held in Muguga, Nairobi, Kenya, from 13 to 22 September, was attended by Dr S. M. Naudé, President of the CSIR, and Dr P. J. du Toit, FRS, Member of the Council.

Dr S. M. Naudé was awarded a *Foreign Leader Grant* by the American State Department and visited the United States during April and May.

The *Second Consultative Meeting of Antarctic Treaty Powers*, held in Buenos Aires from 18 to 27 July, was attended by Dr E. J. Marais, Vice-President of the CSIR.

The *Sixth Meeting of S C A R* (Scientific Committee on Antarctic Research) held in Boulder, Colorado, from 20 to 24 August, was attended by Mr E. Boden, Head of the Science Co-operation Division.

The *South West Regional Meeting of S C O R* (Special Committee on Oceanographic Research), held in Lourenco Marques from 30 April to 2 May, was attended by Mr E. Boden and Mr C. G. Hide of the Science Co-operation Division.

The *Second Meeting of the Intergovernmental Oceanographic Commission (I O C)*, held in Paris from 20 to 29 September, was attended by Mr E. Boden and Mr J. A. King, Head of the Scientific Liaison Office, London, as observers.

The *Tellurometer Symposium*, which was held in London from 30 July to 3 August, was attended by Dr F. J. Hewitt, Director of the National Institute for Telecommunications Research, with Dr T. L. Wadley and Mr H. D. Hölscher of the Institute's staff.

The *Eighth International Congress for Microbiology*, held in Moscow from 22 to 28 July, was attended by Dr A. O. Hawtrey of the National Chemical Research Laboratory.

The *First European Symposium on Fresh Water from the Sea*, held in Athens on 1st June, was attended by Mr W. G. B. Mandersloot of the Process Development Division of the National Chemical Research Laboratory.

A *Physics Conference* on the subject *Spins and Phonons* was held in Bristol from 17 to 18 April and was attended by Mr J. A. van Wyk of the National Chemical Research Laboratory.

The *Fourth International Congress on Acoustics*, held at Copenhagen from 20 to 28 August, and the *Seventh Meeting of the International Standards Organization*, held at Baden-Baden, Germany from 17 to 21 September, were attended by Dr J. F. Burger of the Acoustics Division of the National Physical Research Laboratory. At the first congress Dr Burger presented a paper on *Pulse Studies of Acoustic Models*.

A *Conference on the Electromagnetic Separation Method*, which was held in Orsay, France, from 2 to 5 July, was attended by Dr W. L. Rautenbach of the Nuclear Physics Division of the National Physical Research Laboratory.

At the United States' *National Conference on Air Pollution*, held in Washington from 10 to 12 December, the Council was represented by Dr E. C. Halliday of the Air Pollution Unit of the National Physical Research Laboratory.

The *Congress of the International Research Group on Refuse Disposal* held in Essen from 22 to 26 May, was attended by Dr. G. Lenhard of the National Institute for Water Research. By special invitation, Dr B. J. Cholnoky of the Hydrobiology Division of the National Institute for Water Research visited the *New York Academy of Sciences*, New York, from 30 April to 2 May, where he acted as chairman and moderator during their conference on the Problems of Environmental Control on the Morphology of Fossils and Recent Protobionta. He presented a paper on *Cell structure and environment*. The *Philadelphia Academy of Sciences* made use of the opportunity to consult Dr Cholnoky on Hydrobiological projects and he was able to give invaluable advice at a conference which lasted from 13 to 15 May.

The *American Psychological Association's Congress on International Training in Psychology*, held at La Napoule, France, in July, was attended by Dr S. Biesheuvel, then Director of the National Institute for Personnel Research.

The *International Conference on Structural Design of Asphalt Pavements*, which was held at the University of Michigan, Ann Arbor from 20 to 24 August, was attended by Mr G. L. Dehlen of the Soil Mechanics Division of the National Institute for Road Research. At this conference Mr Dehlen presented a paper entitled *An investigation of flexure cracking on a major highway*. At the *First Australian Road Conference*, Canberra, held from 10 to 14 September, Dr P. J. Rigden, Director of the National Institute for Road Research, presented two papers: *The development of road research in South Africa*, and *Surface treatment experiments with Middle-East and Venezuelan bitumens* (which Dr Rigden wrote in collaboration with Mr R. N. Walker, Head of the Bituminous Materials Division of the National Institute for Road Research).

The *Joint European Conference of the Institution of Management Sciences and the Econometric Society*, held in Dublin from 3 to 7 September, and the *Sixth International Study Week in Traffic Engineering* held in Salzburg, Austria, from 10 to 14 September, were attended by Dr D. J. Smit of the Traffic and Safety Division of the National Institute for Road Research.

Dr T. L. Webb, Director of the National Building Research Institute, attended an *International Building Research Conference* at Cambridge. This conference, held from 6 to 11 September, was organized jointly by

the General Secretary's office of the International Council for Building Research, Studies and Documentation (CIB), and the Building Research Station, England. Dr Webb presented a paper entitled *The assessment and application of new developments in building research, with special reference to low-cost housing in Southern Africa*. Dr Webb also attended the *Sixteenth Meeting of the Permanent Commission of the International Union of Testing and Research Laboratories for Materials and Structures (RILEM)* held at Zurich, Switzerland, from 17 to 23 September.

Mr D. R. Masson, Head of the Scientific Main Office in Washington, attended the international conference of *COSPAR* in Washington from 30 April to 9 May; of the *International Rubber Study Group* in Washington from 28 May to 8 June; and the *International Spectroscopy Meeting* at College Park, Maryland, from 18 to 22 June.

Dr P. le R. Malherbe, Head of the Scientific Liaison Office in Cologne, represented the CSIR at several scientific congresses held on the Continent. By invitation, he attended the opening of the new build-

ings of the Institut für Spektrochemie und Angewandte Spektroskopie in Dortmund, with a *Symposium on Spectroscopy* on 4 and 5 February, and a *Symposium on the Fundamental Physical Units* on the occasion of the 7th Anniversary of the Physikalisch-Technische Bundesanstalt in Braunschweig on 11 and 12 April. The *Fifteenth International Conference on Water Studies*, organized by the Centre Belge d'Etude et de Documentation des Eaux at Liège, and held from 4 to 7 June, was next attended by Dr Malherbe. He also attended the *Twelfth Conference of Nobel Prize Winners* in Lindau/Bodensee by invitation from 25 to 29 June. As South African delegate, he attended the *Twenty-eighth General Assembly of the Federation Internationale de Documentation (FID)* in the Hague, on 28 and 29 September. As South African observer, he attended the *Meeting of the Board of Management of the European Translations Centre* at Delft, on 7 and 8 November.

The *Ciba Foundation Symposium on Bilharzia*, held in Cairo from 18 to 22 March, was attended by Dr R. J. Pitchford of the Bilharzia Research Unit, and Dr R. Elsdon-Dew, Director of the Amoebiasis Research Unit.

Financial Statements and Appendix

STATEMENT No. 1

Balance Sheet as at 31 March, 1962

Liabilities		Assets	
1960-61	1961-62	1960-61	1961-62
R	R	R	R
4,996,302	5,884,106.38	4,553,383	5,288,163.79*
6,043,181	6,596,031.13	5,138,751	5,686,166.86
R11,039,483	R12,480,137.51	R9,692,134	R10,974,330.65
309,284		28,482	90,464.35
371,060		530,289	746,274.33
20,000		291,283	306,686.82
252,126		1,615,462	1,843,266.02
232,585		66,888	
1,185,055		499,288.51	36,057.33
R12,224,538		20,000.00	2,467.23
		336,372.67	20,396.47
		343,316.49	
		1,539,854.69	
		R14,019,992.20	R14,019,992.20

* R5,288,163.79 for land and buildings does not include the value of the site donated by the Pretoria University to the Council, valued at R41,800 for transfer purposes.
 † Unexpended balance of grant for research projects on behalf of Government Departments to be surrendered (see also Statement No. 3).

Pretoria, 22 October, 1962

S. M. NAUDÉ
 President

A. J. MILLER-SMIT
 Secretary/Treasurer

Pretoria, 27 December, 1962.

I. T. MEYER
 Controller and Auditor-General

STATEMENT No. 2

Capital fund:
Statement of Transactions for the year ended 31 March, 1962

Details	Expenditure		Receipts		Totals as at 31 March 1962	
	Accepted Estimates	1961-62 net Expenditure	Accepted Estimates	1961-62 revenue	Totals as at 1 April 1961	Totals as at 31 March 1962
	R	R	R	R	R	R
(A) Building and Reserve Capital Fund						
Land and Buildings	800,000	734,781.26	800,000	800,000.00	4,355,200.00	5,155,200.00
Balance Unexpended..	—	153,023.21	—	—	67,619.23	67,619.23
TOTALS	R800,000	R887,804.47	R800,000	87,804.47	417,145.87	504,950.34
(B) Equipment Capital Account						
Furniture, Fittings and Office Equipment..	28,220	26,332.48	490,050	490,050.00	5,006,496.00	5,496,546.00
Laboratory and Workshop Equipment..	333,562	393,421.26	—	15,714.26	75,296.30	91,010.56
Equipment under Construction..	128,090	27,219.20	—	—	3,215.97	3,215.97
Stores on Hand..	1,300	21,960.56	39,582	34,315.90	164,079.62	198,395.52
Vehicles and Cycles..	15,060	32,703.34	12,770	12,770.00(2)	794,093.08	806,863.08
Subsidized Cars (at cost less repayments)	—	(—)2,854.94	—	—	—	—
Books and Journals..	36,170	48,633.89	12,770	—	—	—
Prefabricated Structures..	—	—	—	—	—	—
Cost of Assets..	542,402	547,415.79	542,402	542,402.00	5,006,496.00	5,496,546.00
Balance Unexpended..	—	5,434.37	—	—	75,296.30	91,010.56
TOTALS	R542,402	R552,850.16	R542,402	R552,850.16	R6,043,180.97	R6,596,031.13
TOTALS OF (A) AND (B).....	R1,342,402	R1,440,654.63	R1,342,402	R1,440,654.63	R11,039,482.88	R12,480,137.51

NOTE.—(1) R5,288,163.79 for land and buildings does not include value of site donated to the Council by Pretoria University which was valued at R41,800 for transfer purposes.
(2) R12,770 transferred with Ministerial Approval from Running Expenses Account to Capital Fund.

ALLOCATION OF UNEXPENDED FUNDS

(i) Firm commitments against Equipment Capital Fund (estimated).....	R539,155.00
(ii) Held by Universities for purchase of capital equipment.....	38,400.97
(iii) Reserved for Capitalization of equipment manufactured within the CSIR.....	54,004.71
(iv) Reserved for share capital in State Investments Development Corporation.....	50,000.00
(v) Not committed at 31 March, 1962, but earmarked pending receipt of quotations or further investigations regarding suitability of equipment.....	228,303.59
	R909,864.27

3 Pretoria, 22 October, 1962.

S. M. NAUDE
President

A. J. MILLER-SMIT
Secretary/Treasurer

Running Expenses and Appropriation Accounts for the year ended 31 March, 1962

1960-61	Details	Accepted Estimates		1961-62		1960-61		Accepted Estimates	Details	1961-62		1960-61	
		R	c	R	c	R	c			R	c		
3,859,530	Salaries, Wages and Allowances	4,358,050		4,193,452.71		4,177,400		4,675,650 ⁽¹⁾	Parliamentary Grant:—	338,600		4,672,289.00	
1,454,240	Consumable Stores and Services	1,200,075		1,644,345.33 ⁽²⁾		309,283		338,600	Statutory Objects	33,072.40 ⁽³⁾		305,527.60	
264,252	Subsistence and Transport	270,000		313,750.16					Research Projects for Govern-				
773,359	General Expenses	950,000		831,250.00					ment Departments				
340,980	Research Grants	519,000		392,107.58					<i>Less:</i> Amount Surrendered ..				
208,748	Subsidies—Industrial Research Institutes...	253,886		252,455.74									
6,901,109		7,551,011		7,627,361.32		978,471		949,232	Investigations, Tests and Services			1,346,451.18 ⁽³⁾	
855,723	<i>Less:</i> Charges for Internal Services and					178,316		151,600	Standardisation Mark Permit			183,376.02	
	Running Expenses Capitalised in					87,700		86,000	Fees			38,964.84	
	Equipment Manufactured	737,026		679,648.42 ⁽⁴⁾					Levies: Compulsory Standard				
6,045,386				6,947,712.90		17,450		17,450	Specifications			24,950.00	
484,711	Balance carried forward to Appropriation	6,813,985		679,689.16		3,000		4,600	Contributions towards:				
	Account					189,446		102,800	Preparing Specifications			108,753.40	
						17,312		14,392	Research Activities			17,661.84	
						13,771		1,720	Royalties			12,959.29	
						245,559			Publications			394,528.27 ⁽⁵⁾	
						312,389			Sundry Revenue				
									Reimbursement of Cost of Cap-				
									ital Facilities				
									Allocated from Appropriation				
									Account in terms of Section				
									14(4) of Act No. 33 of 1945				
												471,941	
R 6,530,097		R 6,813,985		R 7,627,402.06		R 6,530,097		R 6,813,985				R 7,627,402.06	
58,996	Allocation by Council to:—											232,584.76	
312,389	(a) Building and Reserve Capital Account			87,804.47		21,050			Balance brought forward from			679,689.16	
252,126	(b) Equipment Capital Account			12,770.00 ⁽⁶⁾		484,711			Running Expenses Account ..				
	(c) Running Expenses Account (1961-62)			471,940.62		291,339			Provision for firm commitments				
	(d) Provision for firm commitments at 31 March, 1962 ..			336,372.67		58,996			as at 31 March, 1961				
				908,887.76					Interest on Investments for allo-				
				343,316.49					cation to Building and Re-				
									serve Capital Account				
												87,804.47	
R 856,096	Balance for allocation by Council in terms of section 14(4)			R 1,252,204.25		R 856,096							
	of Act No. 33 of 1945												

(1) Including special grant of R8,000 for Air Pollution Research of which only R4,639 was claimed.

(2) R33,072.40 surrendered on 22.6.62.

(3) Includes the sum of R394,528.27 being the cost of Capital Facilities (i.e. buildings, roads, etc.) and R297,154.41 for operational expenses provided at Harlebeesthoek and which are, by agreement, fully recoverable from the National Aeronautic and Space Administration (U.S.A.).

(4) Includes capitalised running expenses (R16,340.54).

(5) Transferred with Ministerial Approval from Running Expenses Account to Capital Fund.

A. J. MILLER-SMIT
Secretary/Treasurer

S. M. NAUDÉ
President

Pretoria, 22 October, 1962.

CSIR Budget 1962/63

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 1961/62	
	R	R	R	R	R	R	R	R	R	R	R	
CSIR Laboratories and Departments.....	3,531,116	884,920	251,761	165,845	—	1,104,978	609,010	5,329,610	3,119,768	2,119,842	90,000	
Grants to Universities etc.....	144,742	19,018	14,750	—	431,372	—	—	609,882	582,322	27,560	—	
Subsidies to Industrial Research Institutes.....	—	—	—	—	271,910	—	—	271,910	271,910	—	—	
TOTALS.....R	3,675,858	903,938	266,511	165,845	703,282	1,104,978	609,010	6,211,402	3,974,000	2,147,402	90,000	

B. Capital Expenditure

Activities	EXPENDITURE						Total
	Books/Journals	Technical Equipment	Furniture/Office Equip.	Vehicles	Stores Stock	Buildings	
CSIR Laboratories and Departments.....	31,295	354,486	24,700	6,060	2,500	450,000	869,041
Grants to Universities, etc.....	—	79,300	—	—	—	—	79,300
TOTALS.....R	31,295	433,786	24,700	6,060	2,500	450,000	948,341
						GRAND TOTALS R	7,159,743
							4,886,900
							2,182,843
							35,441
							—
							—
							—
							90,000

(A) Members of the Council for Scientific and Industrial Research (during 1962)

- S. M. NAUDE, M.Sc., Ph.D., D.Sc., LL.D., F.R.S. (S.A.)
~~T. ALTY, Ph.D., D.Sc., LL.D., D.C.L., F.R.S.C., F.R.S.E.~~
 **~~F. J. DE VRIES, B.A., M.Sc., Ph.D., D.Sc., F.R.I.C.~~
 P. J. DU TOIT, B.A., Dr. Phil., Dr. med. vet., D.Sc., h.c., LL.D., h.c., F.R.S.
 B. GAIGHER, D.Sc.
 *~~I. GOUDRIAAN, Dr. Tech. Sc., M.B.E.~~
 F. G. HULL, B.Sc. (Eng.), B.A. (Juris.), M.M.I.M. (Lond.), M.I.Mech.E.
 ~~†H. O. MÖNNIG, B.A., Dr. Phil., B.V.Sc., D.Sc.~~
 S. F. OOSTHUIZEN, M.D., D.Sc., D.Sc. (Hons.), F.A.C.R., F.R.C.P., F.F.R.
 ~~†J. H. RAUWER, M.B., B.Ch., D.P.H., D.T.M. & Hy.~~
~~†P. E. ROUSSEAU, M.Sc., D.Sc., h.c., M.I. Chem.E., A.R.I.C.~~
 **~~G. G. SEUTLIX, M.A., D.Sc., F.R.I.C.~~
- R. L. STRASZACKER, M.Sc. (Eng.), Dipl. Ing. & Dr. Ing., M.I.Mech.E., M.S.A.I. Mech.E.
~~†W. G. SUTTON, B.A., B.Sc. (Eng.), M.I.C.E., M.Am.S.C.E.~~
 H. J. VAN ECK, M.Sc., Dr. Ing. D.Com., LL.D. h.c., M.I. Chem.E., F. L. WARREN, D.Sc., Ph.D., A.R.C.S., D.I.C., F.R.I.C., F.R.S.A.
 J. E. WORSDALE, A.R.C.S., B.Sc. (Lond.), F.R.I.C.

Secretary/Treasurer

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

MEMBERS OF THE EXECUTIVE COMMITTEE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (during 1962)

Dr S. M. Naudé (*Chairman*); Prof. H. O. Mönnig, Dr P. J. du Toit (with Mr F. G. Hill, Dr B. Gaigher and Prof. S. F. Oosthuizen as floating alternates to both Prof. Mönnig and Dr Du Toit).

** Membership terminated on 31 October

‡ Resigned on 3 December

* Resigned on 1 May

† Transferred to the Standards Council in terms of the Standards Act (1962) on 1 April

*President, CSIR.**Principal and Vice-Chancellor of Rhodes University.**Chairman: Defence Resources Board.**Adviser to the President and former President of the CSIR.**Chairman, Fuel Research Board and Chairman, Standards Council.**Director of the Institute of Management and Administration, University of Pretoria, Director of Companies.**Technical Manager and Consulting Engineer, Rand Mines Limited.**Managing Director, Agricura Laboratoria, Ltd.; Scientific Adviser to the Prime Minister.**President, S.A. Medical Council.**Formerly Surgeon General, Union Defence Force.**Chairman and Managing Director, S.A. Coal, Oil and Gas Corporation Limited.**Chairman and Managing Director, Union Whaling Co., Limited, Director, The Dundee Coal Co., Ltd., and Illovo Sugar Estates Ltd., Chairman, Natal Town and Regional Planning Commission, Director, James Brown and Hamer, Ltd.**Chairman and Consulting Engineer, Escom.**Formerly Principal, University of the Witwatersrand.**Chairman and Managing Director, Industrial Development Corporation of S. A. Ltd.**Dean of the Faculty of Science, University of Natal.**Director and Adviser, White's S.A. Portland Cement Co., Ltd.*

(B) Headquarters, Services and Regional Offices (during 1962)

CSIR	COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH		
	P.O. Box 395 Pretoria Telephone 74-6011		
	Executive Division		
President	S. M. NAUDÉ, M.Sc., Ph.D., D.Sc., LL.D., F.R.S. (S.A.)		
Vice-Presidents	N. STUTTERHEIM, D.Sc., A.M.I. (Chem.) E., Hon. M. (S.A.) I.C.E. E. J. Marais, B.Sc. D.Sc. L. J. LE ROUX, M.Sc., B.Com., D.Sc.	Secretary/Treasurer Accountant, etc. Public Relations and Publicity	see ADMINISTRATIVE SERVICES DEPARTMENT see INFORMATION AND RESEARCH SERVICES
Cape Town	CSIR regional representation Western Cape Regional Laboratory, CSIR, Liesbeek Road, Rosebank, Cape. Telephone 69-5588	Port Elizabeth	Midland Regional Research Committee, CSIR, P.O. Box 3013, Port Elizabeth. Telephone 4-4131
Durban	Natal Regional Laboratory, CSIR, P.O. Box 1, Congella, Durban. Telephone 5-1741	S W A	Regional Laboratories, P.O. Box 5035, Aussspannplatz, S W A. Telephone 4504
	Scientific Liaison Offices Overseas		
London	South African Scientific Liaison Office Chichester House, 278 High Holborn, London WC1 Telephone CHANCERY 9641 J. A. KING, B.Sc.	Cologne	South African Scientific Liaison Office c/o South African Embassy, Machabierstrasse 75/77, Cologne Telephone 7-3877 P. LE R. MALHERBE, D.Sc.
Washington	South African Scientific Liaison Office 1907 K Street N.W., Washington 6, D.C. Telephone FE 8-1800 Ext. 21 D. R. MASSON, B.Sc. (Eng.)		

2 (B) Headquarters, Services and Regional Offices

ASD	ADMINISTRATIVE SERVICES DEPARTMENT P.O. Box 395 Pretoria Telephone 74-6011	L. A. W. Skinner, B.Econ.
Secretary/Treasurer	A. J. MILLER-SMIT, B.A., M.Com.	A. E. Makin, B.Com., A.C.I.S.
Under Secretary/Treasurer	J. H. VISAGIE, B.A., B.Com.	Mrs. M. M. du Plessis
	ESTATES SECTION, CSIR P.O. Box 395 Pretoria Telephone 74-6011	W. de Beer A. Kruger P. J. Greeff
Head	D. J. J. BISSCHOFF	
TSD	TECHNICAL SERVICES DEPARTMENT P.O. Box 395 Pretoria Telephone 74-6011	J. L. Kidd S. J. Botes D. M. Seymour
Head	J. VAN DER STAAY	J. B. Kirstein
Administration	J. H. Bosch	G. O'Grady, A. de Kleyn P. J. Fourie A. B. Groenewald I. E. Badenhorst F. Kolb
		<i>Personnel Officer and General Administration</i> <i>Accountant</i> <i>Registry</i> <i>Accommodation</i> <i>Administration and security</i> <i>Mechanical and Structural Maintenance</i> <i>Design Office</i> <i>Electrician</i> <i>Glass Blowing (NCRL)</i> <i>Graphic Arts</i> <i>Instrument Makers</i> <i>Sheet Metal and Welding</i> <i>Stores</i> <i>Transport</i> <i>Woodwork</i>

The Technical Services Department also maintains specialized workshops at six laboratory buildings on the CSIR site at Scientia, as well as an engineering design office at NBR1

(C) Information and Research Services

IRS	INFORMATION AND RESEARCH SERVICES	
	P.O. Box 395 Pretoria Telephone 74-6011	
Director	D. G. KINGWILL, M.Sc.	<i>Industrial Economics</i> <i>Industrial Research Development</i> <i>Information (publishing and translating)</i> <i>Inventions Development</i>
Administration	J. SALES, C.C.S.	<i>Library</i> <i>Publicity</i> <i>Public Relations</i> <i>Research Grants</i> <i>Science Co-operation</i>
		L. A. Beard, B.Com., M.B.A. R. G. Shuttleworth, Ph.D., F.R.I.C. L. R. Dickson, B.Arch. A. M. Schady, B.Sc., B.Sc. (Eng.) J. I. Greijbe (Miss), B.A., F.S.A.L.A. A. C. Papageorge, B.A. D. R. Maude M. F. Baxter E. Boden, M.Sc., U.I.E.D.
		(i) <i>Washington</i> —D. R. Masson, B.Sc. (Eng.) (ii) <i>London</i> —J. A. King, B.Sc. (iii) <i>Cologne</i> —P. le R. Malherbe, D.Sc.

(D) National Research Laboratories and Institutes (as at 31 December, 1962)

NBRI	NATIONAL BUILDING RESEARCH INSTITUTE	
	P.O. Box 395 Pretoria Telephone 74-6011	
Director	T. L. WEBB, D.Sc.	<i>Architecture</i>
Research Application	S. J. RICHARDS, M.Sc.	<i>Civil Engineering</i>
Administration	J. H. P. J. van Rensburg	<i>Functional Efficiency</i> <i>Materials</i> <i>Soil Mechanics</i> <i>Timber Unit</i>
		D. M. Calderwood, D.Arch., Dip. Town Planning (Rand), M.I.A., A.R.I.B.A., A.M. (S.A.) T.P.I., A.M.T.P.I. V. R. Boardman, B.Sc., B.Sc. (Eng.), A.M. (S.A.) I.C.E. J. F. van Straaten, M.Sc. (Eng.) J. H. P. van Aardt, M.Sc. G. W. Donaldson, M.Sc. (Civ. Eng.), D.I.C., A.M. (S.A.) I.C.E. D. L. Bosman, M.Sc. (Mech. Eng.), M.B.A.

(D) National Research Laboratories and Institutes

NCRL	NATIONAL CHEMICAL RESEARCH LABORATORY P.O. Box 395 Pretoria Telephone 74-6011	<i>Physical, Inorganic and Analytical Chemistry</i>	H. M. Schwartz (Miss), M.Sc., Ph.D. F. J. Joubert, M.Sc., D.Sc.
Director	P. C. CARMAN, M.Sc., Ph.D.	<i>Process Development</i>	E. O. Seipold, Dr. Rer. Nat. (Acting)
Administration	H. R. Oberholzer	<i>Organic Chemistry</i>	P. R. Enslin, M.Sc., Ph.D.
		<i>Ceramics Unit</i>	E. R. Schmidt, M.Sc.
		<i>Bantu Beer Unit</i>	L. Novellie, M.Sc., Ph.D.
		<i>Corrosion Unit</i>	A. T. Morkel, M.Sc., Sc.D.
NIPR	NATIONAL INSTITUTE FOR PERSONNEL RESEARCH P.O. Box 10319 Johannesburg Telephone 835-2466	<i>Personnel Selection and Vocational Guidance</i>	H. A. Fabian, M.A. (Hons.)
Director	D. J. GOUWS, D.Phil.	<i>Psychometrics</i>	A. O. H. Roberts, M.Sc., H.E.D.
Liaison	Miss S. H. MENDELSON	<i>Applied Social Psychology</i>	F. A. Verwey, B.A. (Hons.)
Administration	H. R. OBERHOLZER	<i>Industrial Sociology & Demography</i>	Y. Glass (Mrs.), B.A. (Hons.)
Library	L. E. ANDOR (Mrs.)	<i>Neuropsychology</i>	G. K. Nelson, M.A.
		<i>Applied Experimental Psychology</i>	H. Reuning, Dr. Rer. Nat.
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