COMMITTEE OF PRIVY COUNCIL
FOR MEDICAL RESEARCH

# REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1951-1952

*Presented by the Lord President of the Council to Parliament*
*by Command of Her Majesty*
*June 1953*

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## COMMITTEE OF PRIVY COUNCIL FOR MEDICAL RESEARCH

*(Ex Officiis)*

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The Minister of Health (*Vice-Chairman*)
The Secretary of State for Scotland
The Secretary of State for Home Affairs
The Secretary of State for Commonwealth Relations
The Secretary of State for the Colonies
The Secretary of the Medical Research Council (*Secretary*)

## MEDICAL RESEARCH COUNCIL

AT DATE OF REPORT

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# REPORT OF THE

# COMMITTEE OF PRIVY COUNCIL FOR MEDICAL RESEARCH

# FOR THE YEAR 1951-1952

TO THE QUEEN'S MOST EXCELLENT MAJESTY IN COUNCIL

May it please Your Majesty,

We, the Lords of the Committee for Medical Research of Your Majesty's Privy Council, humbly submit to Your Majesty a report of our proceedings during the year from 1st October, 1951, to 30th September, 1952.

1. During the financial year 1952–53 Parliament provided for the expenditure of the Medical Research Council a grant-in-aid of £1,665,917 on the ordinary account and £232,370 on the non-recurrent account for special apparatus and buildings.

2. The estimates of the Medical Research Council for that financial year were met by our provisional allocation of funds under the following heads :—

For administration, including expenses of the Council and of the administrative offices and staff ;

For general scientific purposes, including expenses of committees, of liaison abroad, of publications and of central purchase of equipment and supplies ;

For the expenses of the National Institute for Medical Research, for the salaries of the scientific staff there and the expenses of research work done by them or by other workers temporarily attached ;

For the salaries and expenses of scientific staff working elsewhere, including those in the Research Units maintained by the Council in certain hospitals, universities and other institutions, and those engaged in work in the field of industrial health and in the Colonies ;

For temporary research grants, both for personal remuneration and for expenses, to workers engaged in investigations at universities, hospitals, and other centres in the United Kingdom, for fellowships in clinical research, and for postgraduate scholarships for training in research methods ;

For research work at the Royal Cancer Hospital, London, and for investigations into human factors in industry, and for other special projects ;

For non-recurrent expenditure on new buildings, especially those at Hammersmith for the Radiotherapeutic Research Unit and at the Christie Hospital, Manchester, for the projected Betatron Research Group, and on permanent equipment.



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3. We learnt with deep regret of the death of the Right Honourable Viscount Addison, K.G., M.D., F.R.C.P., F.R.C.S., Chairman of the Medical Research Council, on the 11th December, 1951. A tribute to his great services to the promotion of medical science was paid by the Council in their preceding report.

4. By two Orders we appointed new members of the Medical Research Council (after the required consultation with the Medical Research Council and with the President of the Royal Society in the case of members appointed in respect of their scientific qualifications) as follows :—

By an Order of the 10th January, 1952, the Right Honourable the Earl of Limerick, K.C.B., D.S.O., T.D., in the vacancy caused by the death of the Right Honourable Viscount Addison, K.G., M.D., F.R.C.P., F.R.C.S.

By an Order of the 6th September, 1952, Gordon Roy Cameron, M.B., D.Sc., F.R.C.P., F.R.S. (Professor of Morbid Anatomy in the University of London), Aubrey Julian Lewis, M.D., F.R.C.P. (Professor of Psychiatry in the University of London), Sir James Calvert Spence, M.C., M.D., F.R.C.P. (Professor of Child Health in the University of Durham), and Sir Charles Geoffrey Vickers, V.C., M.A., in place of Sir Frederic Charles Bartlett, C.B.E., M.A., F.R.S. (Professor of Experimental Psychology in the University of Cambridge), Sir Howard Walter Florey, M.D., F.R.C.P., F.R.S. (Professor of Pathology in the University of Oxford), Sir Geoffrey Jefferson, C.B.E., M.S., F.R.C.S., F.R.C.P., F.R.S. (Professor of Neuro-Surgery in the University of Manchester), and Sir George Ernest Schuster, K.C.S.I., K.C.M.G., C.B.E., M.C., retiring in accordance with the provisions of the Charter.

5. We approved the appointment by the Medical Research Council of the Right Honourable the Earl of Limerick to be Chairman of the Medical Research Council in the vacancy caused by the death of the Right Honourable Viscount Addison.

6. We have received from the Medical Research Council a report, which is submitted herewith, upon the progress of their work during the year ending 30th September, 1952. This is the thirty-eighth annual report upon the research work falling now to the duty of the Medical Research Council and formerly to their predecessors, the Medical Research Committee.

7. Scientific liaison with other parts of the Commonwealth, and with the United States of America and other countries, has been actively continued.

8. Close touch has been maintained with the Ministry of Health and the Department of Health for Scotland, and with other departments having administrative problems calling for new research work or for expert advice based on the most recent advances in knowledge. Co-operation with the Colonial Office has been continued in the organisation of research in tropical medicine. On research questions of common interest, the normal consultation with the Department of Scientific and Industrial Research and the Agricultural Research Council, acting under their respective Committees of the Privy Council, has been continued.

SALISBURY,
*Lord President*

H. P. HIMSWORTH,
*Secretary to the Committee of Privy Council for Medical Research*

28th May, 1953

# REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1951-1952

TO THE LORDS OF THE COMMITTEE OF PRIVY COUNCIL FOR MEDICAL RESEARCH

May it please Your Lordships,

The Medical Research Council beg leave to submit the following Report upon their proceedings during the period from 1st October, 1951, to 30th September, 1952.

## INTRODUCTION

### FORM OF THE REPORT

The form of this Report follows the pattern of the Council's last two Reports. The account of the work of the separate research establishments is now given in summary form instead of in full text. The fullest account of the researches promoted by the Council has always been that contained in the numerous scientific publications of the individual workers, and the references to these are collected in a single classified list.

As hitherto, the main part of the Report includes some discussion of general trends in medical research, often from a broader standpoint than that of the contribution made by work within the Council's own programme. It should be emphasised that this treatment is selective, and that it inevitably omits mention of many investigations in which the Council's workers take part. It is intended, however, that every important subject of study should be dealt with in this way once in a few years. From time to time a Report will also contain an account of some particular trend in the Council's scientific policy; on this occasion a section on the organisation of clinical research is included.

### CLINICAL RESEARCH

During the present century progress in medical research has been more rapid than at any other time in history. Beyond question this is due to the increasing application of the scientific method to the study of biological phenomena. Yet in the various branches of medical research the rate of progress has differed widely. Generally speaking, the advance has been early and rapid in those branches centred in the laboratory; slower and more delayed in those directly concerned with sick persons. In the last two or three decades, however, scientific progress in the clinical field has been gathering momentum; it is now generally extending beyond the stage of observation and description of syndromes, so fruitfully practised by the great clinicians of the nineteenth century, into a stage characterised by planned investigations of illness. The direct investigation of disease is today becoming increasingly feasible, and it may be expected to yield as rich a harvest in the future as investigations of the normal have yielded in the past. No longer need the clinical investigator be entirely dependent for his data on the chance occurrence of natural events or on discoveries suitable for clinical application being made in other fields of medical research. In view of this changing situation, and of recent administrative



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developments, discussed below, it may be timely to consider the special features of scientific clinical research in greater detail, so that a clear appreciation may be formed of its nature, limitations and needs.

Scientific studies begin with accurate observations of natural phenomena. Thereafter the observations are classified and, on this basis, generalisations are made and put to the test either by observing their compatibility with future naturally occurring events or by deliberately testing their validity in artificial but appropriate circumstances devised for the purpose. The distinction between the observational and the experimental sciences rests on this difference in the method of testing concepts. In so far as a branch of knowledge is susceptible to the devised test it can be regarded as an experimental science ; in so far as it is not susceptible to this technique and relies on future events, it is an observational science. The classical examples of these two types are respectively physics and astronomy ; and until recently clinical research was almost entirely observational.

But although the scientific method of thought is equally applicable whether one is proceeding by experiment or observation, a branch of research which is debarred from using the experimental method is heavily handicapped in the general advance of science ; for, when the validation of a concept has to wait upon natural events, progress is inevitably slower than when it can, immediately and at will, be put to a precise, experimental test. It is this differing susceptibility of the various fields of medical research to the experimental approach that largely, although not entirely, accounts for the different stages of their scientific development at the present time. Thus, for example, the devised test, in the form of animal experimentation, was early shown to be applicable to physiology. In clinical medicine, on the other hand, experimentation must obviously be limited to investigations which involve no risk to the patient and enlist his willing co-operation ; and there are some branches of clinical research, such as field studies in epidemiology, in which the object of study is a naturally occurring event and the experimental method is inapplicable. Moreover, until the normal is defined in structure and in function, its limits of variation laid down and an insight gained into the conditions for its maintenance, the study of the abnormal is necessarily retarded. For these various reasons it was inevitable that, initially, progress in the laboratory sciences of medicine should outstrip progress in the direct study of illness in human patients by scientific methods.

It may be said, therefore, that the relatively slow development in the direct application of the investigational method to the study of illness has been due, not to any inherent unsuitability of this field for scientific investigation but to practical difficulties ; in part to its dependence on the opening up of relevant fields in the pre-clinical subjects, in part, and more particularly, to the need to await the devising of accurate techniques for the investigation of illness in human patients. It is the devising of such techniques in adequate variety and with increasing speed over the last two or three decades that is putting new opportunities within our grasp. Chemical and instrumental methods are now available for accurate investigation in many types of illness, without risk to the patient. The development of statistical techniques has refined the methods of planned observation and controlled clinical trials, so that these can now be applied with far greater certainty to groups of sick persons or to whole communities. Progress in clinical knowledge need, therefore, no longer depend entirely upon the chance observation of naturally occurring events. The clinical observer can now become, in addition, a clinical investigator and, in consequence, rapid exploitation of the field of clinical research comparable to that which has already occurred in other branches of medical research is now taking place.

This sequence of developments in medical knowledge has necessarily influenced the policy of the Council. It is a matter of historical interest that when the Medical Research Committee was formed in 1913 it gave its main attention to plans for promoting work in the clinical field. But the attempt was premature and after the first world war the Committee's successor, the Medical Research Council, devoted greater effort to exploiting the many opportunities presented by the rapid development of pre-clinical studies. Nevertheless, the first research unit to be established by the Council was the Department of Clinical Research at University College Hospital Medical School, and from this decision came results of the first importance in cardiovascular medicine. In taking this step the Council took advantage of an unusual opportunity dependent upon an unusual man. Thomas Lewis was in advance of his age ; but it was largely due to him and men of his way of thinking—particularly to the professors in the new university clinical units in the medical schools—that a generation of research workers was won to clinical research and trained in the application of scientific methods to clinical problems. By the middle of the 1930's these men began to become available in adequate numbers for clinical professorships and the staffing of research units. At the same time the methods of clinical research were being elaborated. These developments were reflected in the policy of the Council. By 1939 they had established three clinical research units ; in 1948 they had eighteen. At present they are spending over £400,000 a year on investigations directly concerned with patients ; an amount which excludes support given to such closely related subjects as pathology, bacteriology, epidemiology, medical statistics and social medicine.

Clinical research being dependent upon access to patients, its organisation must be largely determined by the structure of the health services in the country. Before the passage of the National Health Service Acts in 1946 and 1947, the direct responsibility of the Ministry of Health and of the Department of Health for Scotland was limited to measures affecting the health of the community as a whole. These two departments had from the first been empowered to undertake relevant research in this field, while the Medical Research Council was established with broad terms of reference covering all branches of medical research. To define the respective spheres of research activity in England and Wales discussions took place between the Ministry and the Council and an agreement was reached. A similar agreement was reached in the case of Scotland. Thanks to understanding and mutual confidence, this agreement has operated successfully ever since, and it continues to provide a firm foundation on which to develop research into all aspects of public health.

Originally the Health Departments had no direct concern with hospitals and general practice. Arrangements for research which required access to these needed to be made directly, by separate agreements which, in the case of hospitals, were with the governing body of the voluntary hospital or the municipal authority providing hospital services. After the passage of the National Health Service Acts such piecemeal arrangements were no longer suitable. Virtually all clinical facilities then passed into the charge of the Health Departments ; and, further, the medical staff serving them all became members of a unified service.

Thus there arose two separate and unrelated reasons for examining the provision for clinical research. The first was that the growth of scientific knowledge, and the supply of trained men, had reached the stage at which clinical research could be developed, with confidence, on a scale commensurate with the need ; the second that the situation arising from the creation of a National Health Service required the devising of new arrangements to provide the necessary facilities for clinical research. It was, therefore, with great pleasure that the Council received an invitation from the Standing Medical

Advisory Committee of the Ministry of Health to enter into discussions with them to consider what new arrangements were required. A Joint Committee, which owes much of its success to the able chairmanship of Sir Henry Cohen, was formed. At the same time the Advisory Committee on Medical Research in Scotland had been concerned with the same problem. Two of the representatives of the Medical Research Council on the Joint Committee were also members of the Scottish Committee. Close liaison was thus achieved between all the bodies concerned, and by 1952 complete and unanimous agreement was reached on all points and embodied in a single report. This report was submitted to the Ministers responsible for the two Health Departments and to the Lord President of the Council. The Ministers have now accepted the recommendations in principle, and discussions are in progress with a view to their implementation.

The main recommendations for the future organisation of clinical research in this country can be summarised as follows :

(1) A central organisation for the promotion of clinical research should be established as part of the Medical Research Council. A Clinical Research Board, for the detailed supervision of centrally organised clinical research, should be appointed by the Council after consultation, and in agreement, with the Health Departments. The Medical Research Council should be the financial authority for centrally organised clinical research and should be the employing authority of the research workers engaged on its projects. The necessary additional funds should be made available to develop clinical research.

(2) Provision should be made for decentralised research at the level of Regional Hospital Boards, Boards of Governors of teaching hospitals and Hospital Management Committees. Within this field there should be the greatest possible freedom from detailed supervision. In England and Wales responsibility for the distribution of Exchequer moneys for research purposes should lie with the Regional Hospital Boards and Boards of Governors ; and each Board should set up a research committee after consultation, and in agreement, with the associated University or Medical School, to advise on the spending of the research budget. In Scotland the distribution of Exchequer Funds through Regional Hospital Boards and Boards of Management would continue to be made by the Department of Health for Scotland on the advice of the Advisory Committee on Medical Research.

(3) Careers in clinical research should be equated with careers in the National Health Service.

# SOME ASPECTS OF MEDICAL RESEARCH


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Any account of achievements in medical research is bound to be misleading unless the reader bears in mind that virtually every conspicuous advance depends on a mass of unspectacular work, all of which has been indispensable to the final result. To appraise fairly the significance of the contributions which different individuals and branches of science make to the general progress of medicine one must remember that all are not equally well placed to make those final contributions which attract public attention. The reviews that follow should be read with these considerations in mind ; a more comprehensive picture of the Council's activities can be obtained from the summarised statements in subsequent sections of the Report.

## CHROMATOGRAPHY

In November, 1952, it was announced that the Nobel Prize for Chemistry had been awarded jointly to Dr. A. J. P. Martin, of the Division of Physical Chemistry, National Institute for Medical Research, and Dr. R. L. M. Synge, of the Division of Biochemistry, Rowett Research Institute, Aberdeen, for their work on partition chromatography.

The two classical techniques for the separation of closely related molecules are crystallisation and fractional distillation. Although there is no record of the origin of either procedure, both are treated extensively in Lavoisier's Elements of Chemistry published in 1789, and the whole edifice of organic chemistry built during the 19th century depended on purification by one or other of these two methods. Thus, it is not to be wondered at that in 1906 the claim of Tswett, a Russian botanist, to have developed a new method of purification, more powerful than either of the classical methods, was treated with scepticism and attracted little attention.

Tswett's method, which he used originally to separate plant pigments, consisted in pouring a small quantity of a solution of the mixture into the top of a vertical glass tube containing a column of adsorbent powder, such as calcium carbonate ; immediately the solution had penetrated, pure solvent was poured in. Coloured bands formed down the length of the column in a sequence determined by the solubility of the individual substances in the solvent and the ability of the adsorbent to retain them. Tswett named his technique the " chromatographic method ", and the process of separating the different components of the mixture by the use of an appropriate solvent came to be called development.

Adsorption as a method of purification was not new, but the continuous development with a solvent was completely novel. However, its value was not appreciated at the time, and the method was largely forgotten until about 1930, when the interest in vitamins stimulated its reintroduction. During the ten years following the first world war the Council supported a research programme directed on the medical side towards eradication of the diseases caused by vitamin deficiencies, and on the biochemical side towards the purification of the vitamins so that their mode of action could be studied. The studies of Sir Edward Mellanby and others on vitamin A were followed in 1928 by the demonstration that certain plant pigments, the carotenoids, possessed vitamin A activity. The term " carotenoid " had been coined in 1911 by Tswett, and the renewed interest in these pigments thus refocused attention upon chromatography.

In 1931, Tswett's method was used by Dr. R. Kuhn and Dr. E. Lederer in Germany in the successful purification of $\beta$-carotene, the natural precursor of vitamin A, and during the succeeding ten years it was applied to the isolation of other vitamins and to the purification of the male and female sex hormones. Tswett himself had considered the main use of his method to be in the purification of coloured compounds, as is indicated by his choice of the name chromatography. The laws of adsorption are, however, the same for coloured and for colourless compounds, so that the method could also be used in an empirical fashion for the separation of colourless compounds. The range of suitable adsorbents was limited and the method found its chief application in the separation of water-insoluble organic compounds such as the sterols.

It was well known that, if two or more solids are dissolved in water and the water is shaken with an immiscible solvent such as chloroform, the chloroform will take up different quantities of the two substances according to whether they are more or less soluble in chloroform ; the substances are said to be " partitioned " between chloroform and water. In an attempt to develop improved methods for purifying vitamin E, Dr. Martin working in the Dunn Nutritional Laboratory, Cambridge, in 1936, designed an apparatus which automatically effected the continuous repetition of this partition process. The apparatus was used in a research project sponsored by the Council but, before all the mechanical problems involved in the use of this rather complex machine could be solved, pure vitamin E was isolated elsewhere by the classical methods of fractional crystallisation.

At about this time Dr. Synge, also working in Cambridge, began to apply partition methods to the hitherto unsolved problems of protein analysis. He found that, if a protein hydrolysate was acetylated and the resulting mixture of acetyl amino-acids shaken with a mixture of chloroform and water, the relative solubility of the different acetyl amino-acids in the two solvents was characteristic for each amino-acid. It appeared, however, that many successive treatments of this sort would be required to separate completely the more closely related compounds, and it was natural for him to join forces with Dr. Martin, whose machine would make successive batch partitions less laborious.

In 1938 they both accepted appointments with the Wool Industries Research Association and continued to develop distribution methods and later partition chromatography in the Association's Leeds laboratories. During the period 1941–5 they published together a series of papers on the theory and application of partition chromatography which are comparable in importance with the original papers of Tswett. It was during this period that they first thought of combining the principle of partition between two solvents with the chromatographic technique of Tswett. It was of course not practicable to percolate chloroform through a column of water, but the same effect could be produced by using silica powder as an inactive skeleton which held the water in its microscopic pores. The wetted silica was packed in glass tubes into columns similar to those

used by Tswett, and the organic complex, dissolved in a water-immiscible solvent, was poured on to the top of the silica. Further quantities of a water-saturated organic solvent were then added to develop the chromatogram, so that bands representing the components of the mixture moved down the column at varying speeds and could be collected at the bottom as they dripped out. In this way the limitations imposed by the adsorbent in the Tswett method were overcome and the fractionation of almost any group of water-soluble organic compounds became practicable.

Wetted silica columns were applied in the analysis of acetylated hydrolysates of several peptide antibiotics and were of value in the analysis of penicillin, which was then being studied intensively by various laboratories working in collaboration with the Council. In the analysis of proteins, however, the initial acetylation of the hydrolysate was very laborious and Dr. Martin and Dr. Synge therefore attacked the problem of separating the unmodified amino-acids. They found that cellulose pulp, or better still sheets of filter paper, made a more convenient support for the water, and that solvents such as phenol (carbolic acid) and collidine (a basic coal-tar solvent) were particularly suitable for the separation of the component parts of animal proteins. In the technique finally adopted a drop containing a few micrograms of the mixture was placed initially on one upper corner of a large sheet of filter paper ; the edge of the paper was fixed in a bath of phenol and when this solvent had percolated to the lower edge of the paper, the sheet was taken out and dried. The original mixture now formed a single line of substances along one edge of the paper, those substances which were most soluble in phenol having travelled the greatest distance. The sheet of paper was turned through a right angle and treated in the same way with collidine. The line of substances was thus moved across the paper, each substance again travelling at a characteristic speed depending upon its solubility. Finally, when dried, the paper was sprayed with a reagent which formed coloured complexes with the various substances present. In this way a pattern of coloured spots was made visible and by the shape of the pattern it was possible to determine the nature and composition of the original mixture. The whole process required about 48 hours to complete and gave information which would previously have taken over two or three years to collect.

The technique of paper chromatography, introduced in 1944, is so simple, and the applicability of the method so wide, that over the last few years it has been used throughout the world in almost every laboratory interested in the analysis of natural products. The method has been found of value not only in the analysis of proteins but in the analysis of polysaccharides, fats, nucleic acids, plant pigments, antibiotics, and indeed in the study of all the complex products of the living cell. In addition the method has been adopted by the inorganic chemist interested in rare elements and by the clinical research worker interested in the analysis of body fluids in disease.

The stimulus thus given to the study of chromatographic methods has extended far beyond paper chromatography. In 1935 Dr. B. A. Adams and Dr. E. L. Holmes at the Chemical Research Laboratory, Teddington, developed synthetic ion-exchange resins. These resins are in effect solid water-insoluble acids and bases comparable in strength with the mineral acids and the caustic alkalis. Columns packed with suitable resins can be used to fractionate mixtures of organic or inorganic ions in a fashion analogous to chromatographic columns. The ion mixture is added to the top of the column in the usual way but aqueous solutions of acid, alkali or suitable buffer are used for development instead of an organic solvent. Ion-exchange resins have been used to develop methods for the fractionation of protein hydrolysates both in this country and in the United States, and are also of great value in the study of nucleic acids and in the purification of enzymes and hormones.

The breadth and scope of chromatographic techniques are as yet by no means fully explored but the advances made during the past ten years are already so numerous that only a few examples can be mentioned here.

For many years progress in the study of pernicious anaemia has been hampered by lack of knowledge of the nature of the active component present in liver and necessary for the treatment of the disease. By the use of column and paper chromatography, Glaxo Laboratories Ltd., in England and the laboratories of Merck and Co., Inc., Rahway, New Jersey, were able to announce almost simultaneously the isolation of a new vitamin, $B_{12}$, of which a single small dose could cause complete restoration of the normal blood picture in pernicious anaemia.

The demonstration of the value of cortisone and of adrenocorticotrophic hormone (ACTH) in rheumatoid arthritis has focused attention on a group of steroid hormones occurring in the adrenal glands and upon the peptide hormones of the pituitary gland. These groups of compounds have been purified by chromatography both in Switzerland and in the United States, and the Council are supporting further research on their mode of action.

Dr. G. J. Popjak of the National Institute for Medical Research, in collaboration with Dr. S. J. Folley of the Dairy Research Institute, has been studying the formation of milk fats. Chromatographic methods have been invaluable in analysing the complex fatty acid mixtures obtained in these experiments. In the National Institute a new thyroid hormone, triiodothyronine, has been isolated by Dr. J. Gross and Mrs. R. V. Pitt-Rivers by chromatography of extracts of the thyroid gland (see p. 32). The toxin shown by Sir Edward Mellanby to be produced by bleaching flour with nitrogen trichloride (agene) was isolated by means of chromatographic methods, although it is present in the flour in extremely low concentration. Until recently the problem of protein structure was completely beyond the scope of available experimental techniques but by using chromatographic methods Dr. F. Sanger of the Council's staff has recently been able to determine the complete amino-acid sequence in the peptide chains of insulin. This investigation opens one way into a vast unexplored field, the structure and biosynthesis of proteins.

A further important extension of the chromatographic method has recently been made by Dr. Martin, namely liquid-gas partition chromatography. It seems likely that this new method will be of great value in the analysis of mixtures of volatile molecules of low molecular weight, such as occur in petroleum and similar products.

The field is still expanding and there seems no doubt that chromatography in all its aspects is likely for many years to be a most potent force in speeding progress both in general and in medical research. The award of a Nobel Prize to Dr. Martin and Dr. Synge was a fitting recognition of the fundamental importance of their work and of the value of chromatography, a technique comparable in scope with the classical methods of crystallisation and distillation.

## MENTAL DEFICIENCY

In 1948 the Council established a Research Unit in Occupational Psychiatry, under the honorary directorship of Professor Aubrey Lewis, at the Institute of Psychiatry, Maudsley Hospital, London. One purpose of the Unit was to study ways and means whereby the mentally unstable and defective could be absorbed into useful work in industry and could be retained without disharmony once this aim had been achieved. In 1951 the establishment was given the new name of the Unit for Research in Occupational Adaptation, which was considered more appropriate to its functions. An account of some of the problems it has investigated is given below.

It has been the practice for many years to house boys and girls who have been certified as mentally defective, but whose intelligence is little different from that of the duller members of the general population, in the same institutions as imbeciles and idiots. This practice was given authoritative support in 1929 by the Interdepartmental Committee on Mental Deficiency, which recommended, in its survey of the problems of mental deficiency in England and Wales, that the main institutional provision for defectives should be large central colonies of this mixed kind, which would accommodate patients of all ages and all grades of deficiency. The Committee held that these colonies should aim at being self-supporting and that the high-grade patients should be considered as the skilled workmen of the colony, who would carry out all the processes of manufacture and repair, and who would generally have a considerable measure of responsibility. Apart from the obvious practical advantages of this scheme, the Committee stressed its value in preparing the high-grade defective for work in the outside world by teaching him a trade and by accustoming him to work and live with others. The Report did, however, admit that efforts in this direction often failed, particularly when the defective person suffered from the additional handicap of temperamental instability ; such defective people, in spite of the fact that in many cases their intelligence was relatively good, failed conspicuously in ordinary life, for comparatively few of them could hold a job successfully in the general community, even after years of the stabilising influence and training of the institution.

The great authority of this Report reinforced the well-established practice of attempting to train high-grade defective boys in these large mixed institutions to work at skilled or semi-skilled trades such as carpentry, tailoring, boot-repairing and metal work. The first inquiries of the Unit for Research in Occupational Adaptation revealed, however, that in so far as this practice was intended to prepare the boys for their ultimate return to ordinary life it generally failed in its purpose : in one hospital not a single boy had succeeded in supporting himself in the outside world at the kind of work for which he had been trained in the hospital workshops. There were, however, indications that employing defectives on unskilled work would have more encouraging results. The Supervision Section of the London County Council, for instance, had found that a very high proportion of defectives, and of those who went to special schools for the backward, supported themselves in routine industrial work under the same conditions as other workers, though it should be remembered that these patients were relatively stable in personality.

Similar conclusions had been reached by investigators in other countries, who suggested that high-grade certified defectives in hospitals could be trained to earn their living by unskilled work, but the studies had on the whole been so scattered and inconclusive that the Unit set out to discover for itself how far, and in what way, this aim could be achieved. The Unit decided to take a representative group of high-grade adolescent boys in an institution and to train them from the outset not on skilled work but at the unskilled jobs which were likely in any case to be their future work. To further this end, experimental workshops of a new type were set up in Darenth Park, an institution largely intended for high-grade adult defectives of both sexes, which housed 1,100 male patients.

A representative group of high-grade male patients who had no complicating physical handicaps were tested to estimate the degree of their intelligence, their capacity for co-ordinated movement, and their emotional stability. This information was necessary to enable the Unit to study the effect of these abilities and disabilities on an individual's subsequent success or otherwise at work. The results of the tests were surprisingly encouraging, for 50 per cent. of the patients proved to have an intelligence quotient of above 75 on one test and above 70 on

another. Half of them, in short, were above the psychometric level that many authorities recognise as warranting certification. In other respects also they were found to have better capacities than certified defectives are usually credited with. For instance, at a later stage of the investigations their limited capacity to read, which obviously handicaps them both in society and in industry, was studied. A group of 25 "boys", at another hospital for defectives, with an average age of 21 years, were intensively coached both in the mechanical act of reading and in reading with comprehension : in three months their mechanical reading age improved from a nine-year to a ten-year level, and in five months their understanding of what they read was built up from that of a child of nine years five months to one of twelve years two months. These results concerning improvement in reading have yet to be confirmed but agree with at least one other study on similar patients. The test findings about intelligence and ability to learn have been given support by other studies. Taken together, the results suggested that not all certified defectives have a total cognitive defect and that not all are ineducable. In view of these findings it seemed likely that other abilities necessary for successful adjustment at work might likewise be improved by suitable training, and this proved to be the case.

The capacity of high-grade defectives to improve their reading age on certain tests was paralleled by their demonstrated capacity to make more satisfactory emotional adjustments—an important gain, for a defective boy can be handicapped as much, if not more, by emotional instability as by low intelligence. The experience of the Unit showed that about half of a group of unstable defectives were able to adjust satisfactorily to work, if given special guidance during their training period in the Unit's workshops and periodic guidance from the hospital social worker when they first went to work in a factory. A controlled experiment also showed that skilled psychiatric treatment can improve not only the behaviour of a group of delinquent defectives but also their verbal intelligence as measured by certain tests. It is too soon to say whether success at work or special treatment can help a boy to achieve lasting emotional stability, but the findings are of a kind which would justify further investigation.

After these preliminary tests had been carried out, the experimental workshops were established at Darenth Park. They were controlled by nurses from the hospital and a small number of boys were trained to do routine, repetitive work which had been sub-contracted from outside firms ; one firm supplied plastics for hand trimming and another cardboard for folding and glueing into boxes. The boys could work at their own speed providing their work passed inspection, and they were paid a trade-union piece-rate. The hospital controlled the greater part of the money but the boys were allowed a small wage, and there was a bonus for the best workers. The experiment has been popular with the staff, for the boys are looked after, trained and kept occupied for seven hours in each working day by a team of supervisors who would otherwise not be capable of managing so many ; while the boys themselves greatly prize a job in the workshops, which now occupy 140 patients.

One of the most interesting results of the experiment has been the light it has thrown on incentives and supervision—two problems on which no adequate guidance was given by any earlier studies. Money payment which was directly related to the amount of work that each boy did proved to be a far more successful incentive, judged by the comparatively high output of the boys, than the old systems of reward unrelated to performance. Less tangible gains, but no less important from an educational and social point of view, were the new values and events which became part of their lives as a result of earning money. The relative value of different methods of supervision was tested by putting the boys in charge of three supervisors, one strict, one friendly and one laissez-faire,

for periods of four weeks each. Laissez-faire supervision had the least success, for under it the boys' behaviour deteriorated both in and out of the workshops and they became considerably more aggressive than when they were under supervision of a more controlled kind.

As in many social investigations of this type, the work done at Darenth Park is at once an experiment and a therapeutic procedure which offers enough in the way of practical help to enlist the ready co-operation of those who are most affected, in this instance, the patients, the doctors and the nurses. The boys enjoy the privilege of working in the workshops ; the wages they earn there bring them closer to the conditions and pleasures of ordinary life and help them to learn the value of money. As a training proposition, the practical results of the experiment speak for themselves, for, by the end of 1951, 63 boys had been trained and tried out on daily licence in a factory : 44 of these did not need more than a first or second trial. These figures are encouraging, especially as the hospital was at the same time employing over 100 boys, selected as the most stable and physically capable in the institution, on other work out in the community. Some of these other boys worked at a building site and their wages averaged between £4 and £5 a week each. Analysis showed that their discharge rate over a six-months' period was less than that of the ordinary labourers at the same job—51 per cent. as against 58 per cent. Subsequent work has shown that even very unstable high-grade defectives may be expected to succeed in about half the cases.

The financial benefits to the boys have already been mentioned briefly, but the hospital also gains, for boys who go out to a factory earn enough to contribute to their own maintenance, while those who work in the special workshops have their pocket money, which the hospital would otherwise have to supply, paid by the firm whose work they do. For this latter reason the financial saving to the hospital in 1951, through the workshop experiment alone, was estimated to be at least £5,000, and the policy which the hospital adopted of selecting boys to go out to work in the community resulted in a monetary saving at least three times as great. Whereas in 1948 the amount of money earned by the Darenth Park patients on daily licence was £8,131, it had risen in 1951 to £30,000, and of this sum the boys paid back £16,500 to the Treasury for their board and lodging. It is gratifying that, although the percentage of boys on daily licence has nearly trebled in the course of two years, there has been no appreciable increase in the incidence of failure.

Moreover, the training scheme has other advantages from the administrative point of view, for it has shown that boys can be returned to industry who would otherwise be employed only in hospital. If provision for housing these boys in the community could be made, their beds would be freed for the long waiting list of low-grade defectives who are more in need of institutional care. Since there are about 20,000 feeble-minded patients of working age in hospitals, the freeing of even a fraction of their beds would be most valuable. The training policy would also make available a labour force which is now largely unused but which could do much socially valuable work ; on the building site mentioned earlier it is estimated that one-tenth of all construction was carried out by certified high-grade defectives.

It has also emerged that the training and rehabilitation of adolescent boys who are now sent to hospitals for defectives might be more successful if it were recognised that in many cases their biggest handicap is in their personality. To some extent such boys could receive the necessary training, support and rehabilitation while still living in the community, so that there would be less need to confine them indefinitely for a reason which they cannot understand. Such detention may be necessary for the low-grade defective and beneficial to his parents and society ; to the high-grade patient it often appears unjust, and can be

demoralising. The Unit is therefore making a study of defectives who have remained in the community. It seems probable that many high-grade adolescent defectives can best be trained in hostels housing about 30 boys, which would be situated in or near industrial areas and would serve as training centres, clubs, and living quarters, so that the young workers could acquire traditions of self-discipline and self-respect in the course of normal social and industrial contacts. No such training hostels at present exist and there are obvious practical difficulties in the way of providing them, but they would not necessarily have a higher maintenance rate than the large comprehensive institution whose main justification is economy, and their administration need not fall within the scope of the Mental Deficiency Acts.

The foregoing account has been chiefly concerned with the social findings, and with their wider application. The detailed plan of the research has, however, been a matter of controlled experiments, in which technical, psychological and psychiatric problems have been studied on matched groups of defectives. A large range of psychological tests proved necessary in order to discover the general and particular abilities—or disabilities—of the defectives. Thus it appeared that, besides having higher intelligence quotients than had been previously supposed, the high-grade male defectives were less retarded in their ability to perceive space and form relationships than they were in hand-eye co-ordination, manual dexterity, finger dexterity and the speed with which they could perform movements. The interpretation of these findings calls for further investigations, especially as it was found that patients of unstable personality were rather clumsier and more suggestible than those who were dependable and free from neurotic traits. The research has also thrown light on the effects of various types of supervision, on group relationships and group treatment, and on the relative value of different incentives and of different teaching methods in helping lower-grade defectives to learn. High-grade girls and women, and the lower-grade defectives in institutions, need further study, as do the high-grade defective boys who have not been certified or who have always lived at home. From the work already done it seems probable that in these groups of defectives, too, conclusions of considerable individual and social importance may emerge, as long as practical difficulties in the institutions or in the community do not make the necessary controlled studies hard to organise and complete.

The social and human value of the investigation must be measured not only in terms of boys trained and psychiatric problems elucidated. Account must also be taken of the happier lot of those patients who had hitherto spent their working day in the comparatively barren environment of a hospital, and who are now able, through their work, to participate in the richer and more useful life of the community. Without further evidence it would be unwise to claim too much for the findings presented, for the extent to which defectives can live unassisted in society has yet to be assessed in detail. Even so, the investigations so far carried out have shown that the feeble-minded, given training, treatment, incentive and opportunity, can achieve a degree of successful adjustment which has very often been regarded as beyond their reach.

## PREVENTIVE MEDICINE IN OBSTETRICS

During the first world war legislation was passed which opened the way for a great extension of maternity services and particularly of antenatal care. For the first time, local authorities were encouraged to build maternity hospitals, and to organise antenatal and postnatal clinics both at their own child welfare centres and at voluntary maternity hospitals. It was hoped that this extension and improvement of care would reduce the maternal mortality rate, which had been in the region of 4 per 1,000 births for many years. But maternal mortality

did not decline. It was still as high in 1932, and official inquiries into the causes revealed that in about half the cases there was a " primary avoidable factor ", that is, a departure from what was regarded as the best standard of obstetric care. The maternal mortality rate began to fall in 1936, and is now less than 1 per 1,000 births. This great improvement is probably the combined effect of many different advances in treatment, but the turning point coincided with the discovery and use of the sulphonamides, which removed most of the dangers of puerperal infection.

As the chief dangers to the life of the mother diminished, dangers to the child received increasing attention. During the 1930's the numbers of stillbirths and of deaths in the first month of life were about 40 and 30 per 1,000 births respectively, and improvement on these figures by the time of the outbreak of war in 1939 had been only slight. Although the rates are very much lower now, the loss of child life from these causes must still be regarded with great concern. Fortunately, the attitude of women, and of the community at large, has been changing and they are less willing to accept such disasters as the ineradicable accompaniments of childbirth and motherhood.

Ideally, the mother should feel well during pregnancy, have a spontaneous and easy labour, give birth to a lusty child, and be able to feed her baby successfully. In practice, this ideal is attained less commonly than is usually realised. A study of 881 consecutive first births among booked cases in the Aberdeen Maternity Hospital showed that more than half the patients had some disturbance of pregnancy, labour or the puerperium, or gave birth to an ill or dead baby. Very few of these abnormalities were due to infections or similar " accidents ", and they occurred despite a high standard of medical care. Most of them seemed to be due to failures in the physiological processes of reproduction rather than to complicating diseases. Such findings support the view that research in obstetrics should now aim primarily at prevention and should seek information about the nature of the normal reproductive processes, the conditions under which deviations from the normal are common, and the means of reducing the extent of the abnormal.

Hereditary influences which may affect the efficiency of human reproduction are very difficult to study. It is, however, reasonable to think that a woman's environment and way of life may be no less profoundly important in determining her physiological efficiency, and there are now gratifying indications that recent changes in the social environment may in fact have resulted in important improvements. For instance, the number of stillbirths and neonatal deaths due to prematurity and other ill-understood causes fell sharply during the later war years (1942–45), despite the discomforts and hardships of civilian life at that time. Observations by Dugald Baird and his colleagues suggest that two important causes of this unexpected fall were the elimination of the grosser forms of poverty and the wartime national food policy which assured supplies of cheap and nourishing foods and made available special supplements to expectant mothers.

To study childbirth in its social setting, it is necessary to use not only laboratory and clinical methods of investigation but also those of the social sciences and statistics ; teamwork becomes essential. Accordingly, collaborative studies were started in Aberdeen in 1948, under the direction of Professor Dugald Baird of the University Department of Midwifery, jointly with the Council's Social Medicine Research Unit under the direction of Dr. J. N. Morris, and with co-operation from the North-Eastern Regional Hospital Board and the Advisory Committee on Medical Research in Scotland.

One of the first and most important problems in socio-medical research is that of defining the groups of patients to be studied, so as to avoid any

distortion of results from the process which statisticians call " selection ". The patients in a particular maternity hospital may, for example, include an unduly high proportion of cases which have been sent there owing to some specific disability, or a much lower proportion of well-to-do patients than are contained in the population as a whole. Such difficulties can be overcome in Aberdeen more easily than in most cities, because the organisation of the maternity services is relatively simple. Also, the total number of births in the city (about 3,000 per annum) is small enough to allow comprehensive and accurate study, but sufficiently large to yield results from which conclusions of general application can be drawn. Since 1949, detailed and systematic records have been prepared for all births to women resident and delivered in the city, special attention being paid to first births, which form about 40 per cent. of the total and which are more often abnormal than subsequent births. About 85 per cent. of the first births take place in the Maternity Hospital, and the remaining 15 per cent. in private nursing homes or in the patient's own home. The preparation and analysis of records on such an elaborate scale involve the use of special staff and equipment, but are an essential preliminary stage in research of this kind. In this way, information has been collected about a complete urban population, and much is being learnt about the prevalence of various kinds of reproductive abnormality. The records form, in fact, a kind of " map ", which shows the relative importance of various kinds of problem, their relationships with one another, and the circumstances under which they tend to be specially frequent or infrequent.

It has been found that among first births the incidence of difficult labour and of stillbirth rises steadily as maternal age increases. The more educated sections of the population, who usually postpone marriage and childbearing until economic independence is possible, are therefore at a disadvantage compared with the poor and ill-educated, who tend to marry and start a family soon after the attainment of physical maturity. But the advantage which the poor have in terms of age is more than outweighed by their inferior physique and health. Small stature and imperfect general health are commonly associated with poverty and defective nutrition. It is only among women of small stature, especially those of inferior physique and health, that distortion of the pelvic bones, of a degree which may lead to seriously obstructed labour, is found. Women handicapped in this way experience high stillbirth and prematurity rates. Conversely, when the social background has been good, women are usually taller, and in better physical health, and have fewer reproductive abnormalities, especially when they are young. A striking finding was that in a private nursing home, taking cases from the well-to-do sections of the community, prematurity was uncommon, and death of the baby from this cause was rare.

These are examples of the kind of knowledge which can be gained from the " large-scale map." Perhaps the most important lesson is that the efficiency of a woman's reproductive processes is being influenced long before she first appears at an antenatal clinic. The best way of preventing reproductive abnormalities is to provide an environment and to inculcate a way of life which will help to ensure that women starting a family are young, healthy and well-informed. The doctor can do much to reduce the hazards and discomforts of maternity, and can limit the damage when conditions are not ideal ; but medical care cannot be expected to undo the damage of a lifetime and will not by itself result in physiologically normal motherhood. Thus, a proper understanding of the environment and way of life of mothers is an important part of research in obstetrics. A co-ordinated programme of sociological, psychological and nutritional investigations has therefore been started in Aberdeen to supplement the information obtained from the general records.

In addition to information about the prevalence of various kinds of reproductive abnormality, the records have also provided a starting point for laboratory and clinical research. Reference has already been made to the problem of contracted pelvis and obstructed labour. Another example has been an inquiry into the causes of stillbirths occurring without warning and in the absence of any obvious clinical abnormality. It was found that such deaths are more common when pregnancy has gone past term than when delivery takes place before or at term. At autopsy, the babies were usually found to have died of unexplained asphyxia. Analysis of the records showed that foetal distress during labour (indicating the onset of foetal asphyxia) occurred more frequently with " postmature " patients. Sir Joseph Barcroft showed some years ago that the supply of oxygen to the foetus is defective among postmature rabbits, and it appeared that the same thing might be occurring in the human species. Dr. J. Walker, therefore, measured the oxygen content of the maternal and foetal blood at delivery, and showed that foetal blood oxygen levels were unduly low in association with postmaturity and also with certain pathological abnormalities of pregnancy. The nature and circumstances of some at least of these hitherto mysterious deaths are now understood, and the obstetrician can plan to avoid them by inducing labour at the most favourable moment.

Abnormal uterine action is an important cause of difficult labour. The records show that it becomes more frequent as maternal age increases, but is not affected appreciably by the patient's social background, height, or health. It is much more common among first than later births and there is at present no means of predicting when it will occur. The suggestion has been made that it may be associated with psychological tensions ; many patients, however, do not appear to be anxious, and the condition is not more common among unmarried than among married mothers. Psychiatric investigations combined with clinical and physiological studies of uterine action are now in progress in the hope of reaching a better understanding of the cause of this condition.

Seventy-eight years ago William Farr wrote : " The health of an existing generation may no doubt be raised to a high standard by a hygienic regimen—complete, as Roger Bacon insists, from infancy. But a higher hygiene goes further back guided by physiology : it seeks to influence the child unborn in its aquatic life by placing the mother in favourable conditions ; and not resting there, it extends its view to the life of both parents, and to the foundation itself of families—Marriage. . . . . The first step towards it is to improve the health of the present generation ; and improvement, if as persistently pursued as it is in the cultivation of inferior species, will be felt by their children, and their childrens' children." This serves well as a statement of the point of view which should inspire modern research in obstetrics.

## THE NERVOUS CONTROL OF GLANDULAR FUNCTION

It is now well established that the activity of most of the glands of internal secretion may be affected by nervous processes. Dr. F. H. A. Marshall of Cambridge was one of the first to emphasise this fact, with particular reference to the ovaries and testes, in his Croonian Lecture in 1936. A clear example of such influence is the effect of emotional excitement on the secretory activity of the posterior pituitary gland. Professor E. B. Verney and his collaborators have demonstrated that under the influence of pain or a disturbing noise this gland will release the antidiuretic hormone which suppresses the flow of urine. Recent work at Cambridge by Dr. G. W. Harris and Mr. B. A. Cross has shown that there is also a close relationship between the central nervous system and the posterior pituitary gland during lactation. It has been found that the act of sucking by the young excites a nervous reflex in the mother which results in

posterior pituitary secretion, and that the hormone liberated is carried in the blood stream to the mammary glands and there causes ejection of milk ; this sudden flow of milk some 15 to 30 seconds after the onset of suckling has been known in agricultural and medical circles for many years as the " let-down " or the " draught ", but the mechanism by which it occurs was not previously understood. Working as a visitor in the Division of Physiology and Pharmacology at the National Institute for Medical Research, Professor H. B. van Dyke from Columbia University, New York, recently collaborated with Mr. Cross in investigating which hormone from the posterior pituitary gland was responsible for the flow of milk during suckling. They injected highly purified and potent extracts of the posterior pituitary gland, supplied by Professor V. du Vigneaud, and found that the extract containing oxytocic hormone was much the most potent in this respect. This finding throws light on the age-old clinical observation that the act of suckling aids contraction of the uterus after labour, since the oxytocic hormone evoked by suckling is also the hormone that stimulates the uterine muscle. It is likely that disturbances in lactation due to emotional stress are brought about, at least partly, through interference with this reflex excitation of the posterior pituitary gland.

The posterior pituitary gland receives a rich nerve supply from the hypothalamus in the base of the brain, and it is therefore easy to understand how its activity is brought under nervous control. But the anterior pituitary gland, ovary, testis, thyroid and adrenal cortex, which receive very few, if any, nerve fibres, are also clearly influenced by emotional factors. For many years an outstanding problem has been to discover the means by which the nervous system controls the activity of these glands and co-ordinates such activity with changes in the environment of the animal and with the activity of the other systems of the body. The embryological development of the pituitary gland seemed to provide a hint to the elucidation of this problem. Early in the development of the embryo a portion of the membrane lining the mouth cavity becomes detached, migrates through what will later become the floor of the skull, and becomes attached to the hypothalamus. This piece of tissue develops into the anterior pituitary gland. In view of this curious development, it seemed likely that some correlation might exist between the function of the hypothalamus and the activity of the gland. If that were so, the whole problem would be clarified, for the activity of the ovaries, testes, adrenal cortex and thyroid are very largely, if not exclusively, determined by the level of the different anterior pituitary hormones carried to them by the general blood stream.

With this idea in mind Dr. Harris and his collaborators, working in Cambridge with grants from the Council, have been investigating the nervous control of the anterior pituitary gland. Using a specially developed technique with experimental animals, Dr. Harris and Dr. J. de Groot found that electrical stimulation of the hypothalamus, but not of the pituitary gland itself, would cause secretion of the anterior pituitary hormones controlling the activity of the sex and adrenal glands, and work is now proceeding on similar lines with regard to the secretion of the anterior pituitary hormone controlling the thyroid gland. At the same time Dr. Harris and Dr. J. D. Green investigated the anatomical path by which the hypothalamus might excite the anterior pituitary gland. The stalk of the gland is attached to the hypothalamus, and in this stalk are nerve fibres and blood vessels. Since the nerve fibres nearly all end in the posterior pituitary gland and the blood vessels entirely in the anterior pituitary gland, it seemed likely that the hypothalamus regulates anterior pituitary activity through this vascular path. Activation of nerve fibres in the hypothalamus might, it was thought, cause the liberation into the upper end of these vessels of some substance which would then be carried to, and excite, the gland. It was found that the direction of the blood flow in these vessels is from the hypothalamus to the

anterior pituitary gland, and further work by Dr. Green has shown that these or similar vessels are present in all forms of vertebrates from fishes to man. The anatomical basis for the hypothesis described above is therefore now well established.

Many workers have investigated the effects on anterior pituitary function of cutting the pituitary stalk. The accounts given in the literature are, however, strikingly discordant, some authorities maintaining that anterior pituitary function ceases if the stalk is cut, and others that it may continue in a normal fashion. Dr. Harris found, in the rat and the monkey, that the blood vessels of the stalk re-form in a high proportion of animals after this structure is cut, and that the animals in which this vascular regeneration occurs are those in which normal activity of the anterior pituitary gland returns. To place this conclusion beyond doubt, Dr. Harris, and Dr. Dora Jacobsohn from Lund, Sweden, carried out a series of experiments, both in Cambridge and in the Physiological Department, University of Lund, in which the pituitary glands of rats were removed completely and the glands of other rats were transplanted into various sites in the body. It was found that if anterior pituitary tissue was placed directly under the hypothalamus it might become revascularised by the blood vessels of the pituitary stalk and it would then function apparently normally. If, however, the anterior pituitary tissue was placed in more remote sites of the body, it could become well vascularised by other blood vessels but always remained inactive. These results show that the faculty of activating this gland is specific to the blood in the vessels of the pituitary stalk. Unforeseen results came out of the experiments, in that anterior pituitary tissue taken from newborn rats would function in an adult fashion within a few days if placed under the hypothalamus of adult rats, and that tissue from male animals would control and regulate the female sex glands and reproductive functions if placed under the hypothalamus of female animals. This work is now being repeated in a modified form by Dr. Jacobsohn, and has obvious implications in the surgical treatment of pituitary gland disease.

Further work has been carried out by the Cambridge group on the control of corticotrophin (ACTH) secretion in the anterior pituitary gland. This hormone, which is of such clinical importance, is normally secreted in increased amounts if an animal is emotionally excited. It was found that this increased secretion was prevented by damage to various parts of the hypothalamus or by damage to the blood vessels of the pituitary stalk. These results have recently been confirmed by Dr. R. W. Porter, working in the University of California.

There are indications that adrenaline or some similar substance is concerned in the regulation of anterior pituitary activity, possibly as the hypothetical substance carried to the gland in the blood vessels of the stalk. Dr. Marthe Vogt, working with a grant from the Council, found that injection of adrenaline increased the activity of the adrenal cortex, and it is now established that this action of adrenaline is due to excitation of the anterior pituitary gland. Dr. J. E. Markee and his collaborators, in North Carolina, have produced evidence that some adrenaline-like substance is concerned in controlling the secretion of the gonadotrophic hormone from the anterior pituitary gland, and have suggested that a substance of this nature may be liberated by nerve fibres of the hypothalamus into the blood vessels of the pituitary stalk. An investigation of the chemical excitants that may possibly be carried by these vessels has been planned by Dr., now Professor Harris and his collaborators at the Maudsley Hospital, London.

## BACTERIAL FOOD POISONING

Records of food poisoning are as old as antiquity. At one time such poisoning was thought to be associated with the generation of poisons in the food itself.

Ideas on the nature of these poisons were formulated towards the end of the last century by the German chemist, Brieger, who reached the erroneous conclusion that they were formed as the result of protein decomposition and belonged to the class of toxic amines or ptomaines. This was just at the beginning of the bacteriological era. It was not long before workers in Germany, the United States of America and Great Britain began to show that many outbreaks of food poisoning were associated with the presence in the food and in the patients' faeces of an organism belonging to the *Salmonella* group of bacteria, whose first member was isolated by the American veterinarian Salmon from a pig suffering from hog cholera. Gradually, food poisoning came to be regarded by bacteriologists as essentially an infection with a disease-producing organism accidentally present in the food, rather than as an intoxication due to some poisonous substance formed by chemical breakdown of the food itself. This conception was a great advance, but it was not wholly satisfying. It did not explain why, in perhaps two-thirds of the outbreaks, salmonella organisms could not be demonstrated.

Little further progress was made till 1930, when Dack and his colleagues in Chicago reported the discovery of a toxic substance formed by a common organism known as *Staphylococcus aureus*. It is often said that a discovery cannot be made, or at any rate accepted, until people's minds are prepared for it. Dack's paper provided an excellent instance of this truth. Staphylococcal enterotoxin, as it is called, had been discovered three times before—in Belgium in 1894, in the United States in 1909, and in the Philippines in 1914. In spite of the fact that Barber in the Philippines had given the clearest demonstration of the ability of this substance to cause food poisoning, bacteriological opinion at that time was so centred on the salmonella group that little or no attention was paid to his work. Dack, however, realised its significance. He showed that the type of food poisoning caused by the *Staphylococcus* was different from that caused by *Salmonella*. *Salmonella* produces a true infection ; the organisms multiply in the gut and form their poison *in vivo*. Staphylococci, on the other hand, multiply in the food beforehand, so that when it is eaten it is already toxic, and symptoms come on after only a very short incubation period.

Even with this extra knowledge, at least half the outbreaks remained unexplained. A careful study of these revealed that the one factor common to them all was the presence in the food of an enormously large number of bacteria, belonging to types that are not ordinarily pathogenic to man. The conception, therefore, gradually grew up that many species of bacteria, although harmless when ingested in small numbers, are able when present in abundance to give rise to irritation of the stomach and intestine, with resulting symptoms of food poisoning. This view received strong support from investigations that were carried out by the Public Health Laboratory Service in the United Kingdom during and after the war. In a few outbreaks, in which a full examination could be made of the bacteriology of the food and of the patients' dejecta, certain organisms belonging to the genera *Bacillus*, *Streptococcus*, or *Bacterium*, were found under such conditions as to render their incrimination virtually complete. In some instances the evidence against them was further strengthened by experiments on human volunteers.

The latest addition to our knowledge is the recognition of another organism responsible for food poisoning. During the war Dr. R. Knox at Leicester and Dr. J. T. Duncan at Winchester, who were both then members of the Public Health Laboratory Service, isolated from meat dishes or gravy that had been cooked on the previous day an organism belonging to the group of anaerobic spore-bearers known as *Clostridium*. The outbreaks of food poisoning that they observed were all associated with the consumption of food prepared in

large quantities, as in school canteens. Several more of these outbreaks have occurred of recent years, and have been carefully investigated by Dr. Betty Hobbs of the Food Hygiene Laboratory of the Service at Colindale. The usual history is for the meat or gravy or stew to be boiled up in large saucepans, to be allowed to cool down overnight, and to be warmed up for the school dinner the following day. Symptoms of food poisoning come on about 12 hours later. Bacteriologically, the food is often seething with anaerobic spore-bearing bacilli. Indeed, on one occasion when it was brought to the laboratory, it was actually bubbling with gas produced by fermentation. It would appear that, when the meat is boiled up, all organisms except those that have spored are killed, and all oxygen is driven off. The anaerobic spores then find themselves alone in an excellent nutrient medium, containing reducing substances such as glutathione, and therefore start multiplying as the meat slowly cools down. By the next day they are present in numbers sometimes approaching hundreds of millions per gram of food.

The joint investigations of Dr. Betty Hobbs at Colindale, of Professor C. L. Oakley, then of the Wellcome Physiological Research Laboratories at Beckenham, and of Professor J. C. Cruickshank of the London School of Hygiene and Tropical Medicine, have now identified this organism as a heat-resistant variant of *Clostridium welchii* Type A. Whether the toxic substance it produces is contained in the bodies of the organisms themselves or is derived from the food as the result of bacterial enzyme action is still not known. There is no doubt, however, that *Clostridium welchii* must now be added to the list of organisms that are capable of giving rise to bacterial food poisoning. This discovery is of particular interest in view of the part played by certain other types of this organism in causing intestinal disease in animals, such as lamb dysentery, infectious enterotoxaemia, and pulpy kidney disease, although it is clear that the mechanism by which these diseases are produced is akin more to that concerned in the genesis of gas gangrene than to food poisoning in man. Botulism, it may be added, which is a form of food-poisoning caused, like that due to *Cl. welchii*, by an anaerobic, heat-resistant spore-bearing organism, is rarely seen in this country.

When the history of food poisoning during the last ten years is reviewed, it is gratifying to consider how much of the new knowledge gained can be ascribed to the Public Health Laboratory Service. The large-scale distribution of spray-dried egg by the Ministry of Food in 1942 formed the starting point of a fresh investigation into salmonella food poisoning that resulted in the discovery of a number of new types of this organism, and led to the establishment under Dr. Joan Taylor of a Salmonella Reference Laboratory which now serves most of the British Commonwealth. Similarly, during the war a method was worked out in the Oxford laboratory for distinguishing between different types of staphylococci by making use of their susceptibility to lysis by a range of bacteriophages. This method has proved remarkably useful in " finger-printing " individual organisms and relating those found in the food and the patients to those found in persons engaged in the preparation of the food and responsible for contaminating it. The Staphylococcus Reference Laboratory at Colindale, which was at first under Dr. V. D. Allison and is now under Dr. R. E. O. Williams, acts informally as the central typing laboratory for the whole world. It serves the needs not only of those engaged in food bacteriology, but of workers, such as those in the Council's Industrial Injuries and Burns Research Unit at Birmingham, who are studying the nature of cross-infection of wounds.

Many problems remain to be solved. The nature of the toxic substances produced by different food-poisoning organisms has still to be worked out. The tissues on which the toxins act and the means by which they produce their

effect are likewise unknown. The solution of these problems may well demand united efforts by the bacteriologist, the physiologist, the pharmacologist, and the biochemist.

## THE DEVELOPMENT OF DRUG RESISTANCE BY BACTERIA

That living cells can develop increased powers of resisting noxious agents has been well-known at least since the days of Mithradates, whose attempts to poison himself after his defeat by the Romans failed—so the story goes—because he had previously hardened his constitution by repeated self-administration of small doses of a variety of poisons, in order to foil the murderous plots of his enemies. The morphine addict who can withstand many times the normal fatal dose is a classic example of a general principle ; and micro-organisms are no exception.

Nearly fifty years ago, in Germany, Ehrlich himself recognised the same phenomenon in the laboratory when he found that the parasite *Trypanosoma brucei* could become resistant to the action of the dye trypan red and so survive up to 250 times the usual lethal dose. Shortly after the sulphonamide drugs came into use for the treatment of bacterial infections, their effectiveness in treating cases of gonorrhoea was noticed to be diminishing as a result of the emergence of sulphonamide-resistant gonococci ; and eleven years ago, in their first account of the almost magical effect of penicillin in the treatment of staphylococcal septicaemia, Sir Howard Florey and his associates mentioned how easy it was to train staphylococci to become resistant, by continually growing them in laboratory cultures containing the new antibiotic. In naturally occurring infections staphylococci are fortunately so far the only species of bacteria that seems readily to acquire resistance to penicillin, but these penicillin-resistant staphylococci are now a cause of much concern, since they are apparently becoming increasingly common amongst the bacterial population, particularly in large hospitals and in healthy human carriers. With streptomycin the problem is even more serious. Most bacteria—including tubercle bacilli against which streptomycin is the most important single antibacterial agent—rapidly develop high resistance after even brief contact with the drug. It is not uncommon to find strains of tubercle bacilli that have developed the ability to multiply in concentrations of streptomycin several thousand times higher than were previously enough to suppress growth. In fact, the process of acclimatisation can be so extreme that bacteria may even come to need streptomycin as a growth factor, so that, instead of inhibiting, it stimulates bacterial multiplication. Animals infected with streptomycin-requiring bacteria may be made worse by being given streptomycin ; and there is at least one case on record of a streptomycin-treated patient, infected with a strain of tubercle bacillus later found to be partially dependent on streptomycin for proper growth, whose life was ultimately saved only by withdrawing the drug. Such instances are so far fortunately very rare and bacterial resistance developed during the course of natural infection, though frequent, is not so extreme as that shown by cultures trained artificially in the laboratory. The need to discourage the indiscriminate use of antibiotics is, however, obvious, and this warning applies particularly to the dangerous practice of " preventive " dosing of healthy persons.

The situation is serious and might be worse, were it not for the existence of other drugs, such as aureomycin, chloramphenicol and terramycin, with which infections unresponsive to penicillin or streptomycin may be treated. Already, however, isolated cases are being reported where bacterial resistance has developed to these three new antibiotics also. It is unlikely that effective antibiotics will continue to be discovered as rapidly in the future, and it is

possible that some of the great advantages achieved by the introduction of chemotherapy will be lost, unless a new approach to the problem is made. Fortunately, although there are a number of exceptions, bacteria that have become resistant to one drug are usually still sensitive to others, and it is therefore common practice to combine two antibacterial agents in the treatment of infections, or to change to a second drug as soon as bacteria are found to have become resistant to the first.

In spite of the vast amount of information on the extent of bacterial resistance to various antibiotics, very little is known about the underlying basis of the process. One of the clearest needs is for more fundamental knowledge of bacterial metabolism, and it is partly for this reason that the Council have always attached so much importance to research on chemical microbiology, which is now being carried out in no fewer than five of their establishments.

A few examples may be given of the means by which resistant bacteria avoid the harmful effects of antibacterial agents. Some penicillin-resistant staphylococci produce an enzyme, penicillinase, which rapidly breaks down penicillin to the inactive penicilloic acid ; this enzyme is at present under investigation by workers in the Division of Bacterial Chemistry at the National Institute for Medical Research. Other bacteria may owe their resistance to the short-circuiting of some important metabolic reaction that is blocked by the drug. Dr. E. F. Gale, in the Council's Unit for Chemical Microbiology at Cambridge, has found, for example, that under some conditions penicillin-treated staphylococci are unable to take up an essential nutriment—glutamic acid—from the environment and this derangement may partly account for the inhibition of their growth by penicillin. If these organisms are trained to become penicillin-resistant they are then found to have acquired the ability to synthesise glutamic acid from simpler materials ; they no longer need to absorb it from the environment and the metabolic block caused by penicillin is bypassed. After Dr. D. D. Woods had shown that sulphonamide drugs inhibit the growth of bacteria by preventing their use of an essential metabolic intermediary—*p*-aminobenzoic acid—it was discovered that many resistant bacteria had developed the property of forming very large amounts of this compound, enough in fact to swamp the effect of the sulphonamide and allow normal growth. In most cases of drug resistance, however, the mechanism is not yet understood, and those just quoted are only glimpses into a field in which a great deal of research is needed.

Broadly speaking, two main theories have been put forward to explain the ability of bacteria to acquire this property of resistance. According to the first, the change to increased resistance is by one or a few successive steps that take place suddenly and spontaneously in single cells, which then pass on the character to daughter cells. Workers in the United States, such as Luria, Delbruck, Demerec and Lederberg, have shown that such " mutations " undoubtedly occur in many bacterial strains, apparently spontaneously and certainly without the organisms having been in contact with the drug. Normally, such resistant variants would not be noticed and might die out, but in the presence of the drug they have a great advantage and will outgrow the others by a process of natural selection. The second theory, one of whose leading proponents is Sir Cyril Hinshelwood, Professor of Physical Chemistry at Oxford, maintains that the transformation to resistance is often too gradual and continuous a process to be explained by sudden mutations ; it frequently appears to involve all the cells in a culture and seems to be due to a specific action of the drug by which the pattern of the cell's metabolism is gradually remoulded over a number of generations. One example of such an " adaptation " is the response of bacteria to the presence of a drug by the rapid formation of a specific enzyme to destroy it ; the effect of penicillin in stimulating penicillinase production by some bacteria is typical. It is uncertain, however, how important a role this

" enzyme adaptation " plays in the development of drug resistance generally, because it is usually a change which does not persist for long in a culture growing in the absence of the drug, and one which is not inherited.

It might be thought that it should be easy to decide between these two main hypotheses but, largely owing to the difficulty of studying single bacterial cells, the opposing ideas have led to a major scientific controversy. Fundamental to both is the need to understand how the new cell character of drug-resistance, whatever its origin, is inherited from cell to cell through many generations. It is known that a population of pathogenic bacteria in contact with a drug, either in a test-tube or in the living body, may easily grow into a population resistant to the drug, and it is essential to try to prevent this change or to reverse it as soon as possible. Reverse " mutations " from penicillin-resistance back to the normal penicillin-sensitive state are known to occur spontaneously in staphylococci, but only seldom. It it were possible to produce or to accelerate such reversions artificially the problem might be solved, and there are already some reports suggesting that chloramphenicol may be useful in combating infection with penicillin-resistant staphylococci, largely by helping to transform the bacteria back to penicillin sensitivity. The most striking and encouraging results so far are, however, those illustrated by the clinical trials on the treatment of tuberculosis with streptomycin in combination with *p*-amino-salicylic acid (PAS), which were organised during the last two years by the Council's Tuberculosis Research Unit under the direction of the Antibiotics Clinical Trials (Tuberculosis) Committee. The combination of these two drugs was shown to be more effective than either alone, and the action of PAS was found to be largely due to its ability to suppress the development of streptomycin-resistance in the tubercle bacilli. After six months' treatment, only one out of every five strains of tubercle bacillus isolated from patients treated with streptomycin alone were still sensitive to streptomycin, compared with nine out of every ten strains from those who had received both streptomycin and PAS. This success suggests that the value of many future antibacterial drugs will be judged in terms of their ability to prevent the development of resistance to other drugs.

## HAEMOPHILIA

In recent years considerable progress has been made in achieving a greater degree of accuracy in the diagnosis of haemophilia ; the results of research into methods of treatment are also less discouraging than hitherto. Workers at various centres throughout the country have interested themselves in the problems of the disease and much of the progress made has been due to their efforts. The following brief account is based on the work, both clinical and haematological, which these investigators are carrying out.

### *Aetiology*

True haemophilia is a classical example of a disease which can be handed down from generation to generation ; it is inherited as a sex-linked, recessive trait which appears to be due to a gene lying in the X sex chromosome. A woman has two of these (XX) but a man only one, the place of the other being taken by a Y chromosome which does not carry sex genes (XY). Clinical signs of haemophilia cannot be manifested in the presence of a normal X chromosome ; since this is so, a woman who has only one affected chromosome ($\otimes$ X) will not herself suffer from the disease though she will be a carrier, that is, she may pass it on to her children. Every man who carries a haemophilic gene ($\otimes$ Y) will be clinically affected, since he has no normal X chromosome to counteract its effect.

A point of obvious social importance is that all the daughters of a haemophilic man are carriers of the condition, and if a carrier daughter marries a normal man half of their sons will suffer from haemophilia and half of their daughters will be carriers. It is unfortunate that, at the moment, the daughter of a mother who is a carrier cannot know, unless a son of hers shows the clinical signs of the disease, whether she herself is a carrier or not. If some test could be devised which would make this distinction with certainty, those women who did not carry the gene could raise a family with a quiet mind, untroubled by the fear that their sons might suffer from the disease and their daughters perpetuate it.

In rare cases it is possible for a woman to suffer from clinical haemophilia if both her X chromosomes carry the trait ( ⊗⊗ ), but this can occur only if by a coincidence her father happens to be a haemophiliac and her mother a carrier. However, instances of daughters born of such a union have now been discovered and their cases have been investigated by Dr. C. Merskey at Oxford and Dr. M. C. G. Israels, Dr. H. Lempert and Dr. P. Gilbertson at Manchester. These women were affected in the same way as a male sufferer would be. In the United States haemophilia has been observed in dogs, and matings between affected males (⊗ Y) and carrier females ( ⊗X) have produced females ( ⊗⊗ ) with active manifestations of haemophilia.

*Mechanism*

Most workers now agree that the haemophilic patient's inherited tendency to uncontrolled bleeding is due to the absence or deficiency of a factor in the blood plasma known as antihaemophilic globulin. Without this factor, thromboplastin, which is an essential element in the complex mechanism of blood clotting, cannot be formed.

Dr. Rosemary Biggs and Dr. R. G. Macfarlane at Oxford have investigated the normal action of this factor, and it appears that after injury a kind of chain reaction takes place : an interaction of the blood platelets, antihaemophilic globulin, another plasma factor (called " factor VII "), and of calcium is brought about, and this interaction in its turn generates with almost explosive suddenness an extremely powerful thromboplastin in the blood. As a result the blood begins to clot a few seconds later. The particular function of antihaemophilic globulin in this series of events is that its concentration controls the time at which the explosive generation of thromboplastin takes place, so that an absence or deficiency of this globulin means that there is a prolonged delay before thromboplastin is formed and before the blood can begin to clot.

Antihaemophilic globulin is associated with the fibrinogen fraction of the plasma and it has been successfully isolated. Unfortunately, it has proved to be an unpredictably labile substance, for while in some samples of normal blood it remains relatively unaffected by storage, even at room temperature, in others it rapidly disappears. Similar unexpected losses may occur during the process of isolation.

*Diagnosis*

Although a provisional diagnosis of haemophilia can usually be made from the family history and from the characteristic clinical manifestations of the disease, supplemented by the simpler laboratory tests, increasing knowledge of the possible variations has made it clear that a fuller investigation is always advisable. The family history, for example, may be apparently negative—as was the case in 60 per cent. of the haemophilic patients seen at Manchester—or the clinical findings may not be typical. Again, Dr. Merskey, who is now working at Cape Town, has described a number of haemophilic families in which the clotting time, as measured by the usual procedures, was almost within

normal limits. In such cases, in order to establish the diagnosis, it has to be confirmed that antihaemophilic globulin is lacking. A significant hint of such a deficiency is given by the pro-thrombin consumption test, which is a more sensitive indication of the level of antihaemophilic globulin than is the time which elapses before clotting takes place. Unfortunately, an abnormal pro-thrombin consumption test is not characteristic of haemophilia alone, since the test is also abnormal in cases of numerical or functional deficiency of the blood platelets. A test for the speed and rate of thrombin generation during coagulation has been devised by Dr. Biggs and Dr. Macfarlane and has been used with some success by them at Oxford and by Dr. J. V. Dacie at the Postgraduate Medical School, London. This test can be adapted to indicate the amount of antihaemophilic globulin present in the plasma, which one needs to know not only in diagnosing haemophilia but also in controlling its treatment. A further test, which promises to be even more sensitive and specific, is the thromboplastin generation test described by Dr. Biggs, Dr. A. S. Douglas and Dr. Macfarlane. The application of these newer diagnostic tests has already shown that a number of cases previously diagnosed as true haemophilia are actually examples of clotting defects which are distinct from this disease.

The demonstration that a clotting defect is due to a deficiency of antihaemophilic globulin does not by itself, however, confirm the diagnosis of haemophilia. Such a deficiency may occur in later life as an acquired condition in both men and women, and though such cases are rare they should not be confused with hereditary haemophilia. It is only when the specific defect has existed from infancy that the hereditary condition should be diagnosed.

A most important advance in diagnosis, as has already been pointed out, would be a method for determining whether or not the daughter of a mother who is a carrier will herself pass on the abnormality. Unfortunately, as Dr. Merskey and Dr. Macfarlane found, even sensitive tests of clotting function cannot as yet differentiate the women who are carriers from those who are not. It is possible that the thromboplastin generation test may give more precise results, and may provide this information where other tests have failed.

The use of this test has recently revealed the existence of a condition, which while it is clinically indistinguishable from haemophilia, is due to the absence, not of antihaemophilic globulin but of a distinct and hitherto unrecognised clotting factor. Seven cases of this condition, which has been called " Christmas disease " after the name of the first patient in whom it was identified, have now been described. Except in the case of one patient, who was seen in Cape Town, the investigations have been carried out by workers in this country. The practical importance of differentiating this disease from haemophilia is that patients suffering from it will not respond, as will haemophilic patients, to treatment with antihaemophilic globulin.

*Treatment*

Before the results of recent research into methods of treatment are reviewed, an administrative measure which it is hoped will be of great practical value should be mentioned : with the approval of the Ministry of Health and the Department of Health for Scotland, a card is being prepared for haemophilic patients to carry, which will give useful information to doctors who may have to treat them in an emergency. The card will be issued through the Council's recently established Committee on Haemophilia under the Chairmanship of Dr. J. F. Wilkinson ; apart from its value as a guide to treatment of the individual patient, it should ultimately provide useful information for research and also some indication of the prevalence of the disease.

From time to time claims are made that an effective treatment for haemophilia has at last been found. One which has been much discussed involves the use of an egg-white derivative. At the request of the Council, trials of this material have been undertaken in various hospitals on no less than three separate occasions, with consistently unpromising results. The latest of these trials, in 1949 was carried out by Professor L. J. Witts and Dr. Merskey in Oxford and by Dr. I. A. B. Cathie at the Hospital for Sick Children, Great Ormond Street, London. Professor Witts and Dr. Merskey tried to determine not only the effect of the treatment on the clotting mechanism of a number of haemophilic patients but also its effect on bleeding following tooth extraction. In no instance was there a significant improvement in the clotting mechanism as measured by laboratory tests, and in each case the haemorrhage which followed the extraction was uncontrolled and finally had to be treated by blood transfusions and by packing the tooth socket with coagulants.

The most promising line of treatment is the administration of the missing antihaemophilic globulin. As this is present in normal blood, transfusions of fresh blood or plasma might be expected to reduce the clotting time and, in fact, for many years blood transfusion has proved useful in the treatment of haemophilic haemorrhage. Unfortunately, although such transfusion may reduce the clotting time to within normal limits as measured by laboratory tests, the patient's clinical condition may not be improved and he may still suffer from abnormal haemorrhage. It has been shown in Oxford that the more delicate tests for clotting function, such as the prothrombin consumption test and the thrombin generation and thromboplastin generation tests, reveal that a considerable underlying deficiency of antihaemophilic globulin may still exist even after transfusion and despite a normal clotting time. It is probable, therefore, that haemophilic patients require much larger doses of antihaemophilic globulin than is generally supposed. It is hoped to correlate the results of these laboratory tests with clinical findings, in order to determine to what degree the test results need to improve before haemostatic efficiency returns to normal. Treatment is further complicated by the fact that in some patients repeated transfusions may produce immunisation, apparently against the antihaemophilic globulin. These immunised patients may then become " resistant " to the effects of transfusion, though there is evidence that massive transfusions may overcome this.

A refinement of transfusion treatment is to separate from the blood plasma the active antihaemophilic principle, so that small amounts are equivalent in activity to large volumes of fresh blood. Dr. R. A. Kekwick and Miss M. E. Mackay at the Lister Institute have prepared a number of plasma fractions which are now being tested and, although for various reasons early batches showed a considerable loss of potency, it is expected that much of this loss can be avoided and that a highly active material can ultimately be prepared. It is to be hoped that the final outcome of this work will be a preparation so active that small amounts given at regular intervals will do much to reduce the haemophilic patient's tendency to bleed unduly, and to ameliorate the distress which these patients and their relatives now suffer.

## DISEASES OF THE EAR

The study of the ear and its diseases has undergone great changes within the past few years. Formerly, much time and attention were absorbed in saving life or restoring health menaced by aural suppuration. Now that such threats can so often be countered by drugs and antibiotics, more interest is being taken in auditory function and its preservation and restoration. Advances in electro-acoustics have led to the development of smaller and more efficient hearing aids

and of new techniques for exploring the auditory apparatus. Increasing attention is also being paid to the recognition of deafness in very young children and to devising the best means of mitigating their educational handicaps.

The Council have supported research in this field for many years and Dr. C. S. Hallpike, who had been a member of their staff since 1940, was in 1944 appointed director of an Otological Research Unit, which was established by arrangement with the National Hospital for Nervous Diseases, London. The staff of the Unit were responsible for much of the early work on the Medresco hearing aid and they are at present engaged in fundamental studies of the normal functions of hearing and equilibrium and their derangement by diseases of the ear and its central nervous connexions. Coupled as they have been with parallel studies of the pathological anatomy of ear diseases, these investigations have led to a number of important advances in early diagnosis and treatment.

In addition to supporting work on ear diseases from their own funds, the Council in 1948 accepted responsibility for administering a special grant made by the Alexander Pigott Wernher Memorial Trustees ; part of the grant was to be used for research on the prevention and cure of deafness, and in 1949 the Wernher Research Unit on Deafness was established under the direction of Dr. T. S. Littler at the Institute of Laryngology and Otology, in association with the Royal National Throat, Nose and Ear Hospitals in London.

*Hearing Aids*

In 1943 the Council appointed three committees to consider problems of hearing and deafness. The Electro-Acoustics Committee, which was responsible for the design of the Medresco hearing aid, has kept the development of air-conduction hearing aids under continuous review. The original Medresco aid has been modified three times and an improved model incorporating modifications such as " peak clipping " or automatic volume control will shortly be available for trial. Since the Medresco aid was introduced in 1948 the Ministry of Health has supplied over 250,000 persons with this apparatus, and a survey of users undertaken in 1950 by the Social Survey revealed that more than 80 per cent. of those interviewed found the aid satisfactory and used it regularly. It may be said that the technical advances incorporated in the Medresco aid, and the fact that it has been freely available to all deaf persons, have changed the public attitude to hearing aids and increased the possibility of normal life for thousands incapacitated by deafness.

The air-conduction type of hearing aid is coupled to the external auditory canal by a fitted plastic ear-mould and delivers sound to the inner ear by the normal pathway. A few deaf people, probably not more than 5 per cent., are not helped by this type of aid, either because they have chronic ear discharge or some other abnormality of the external auditory canal, or because they can hear speech better by bone conduction. These people require a bone-conduction aid, in which the receiver makes contact with the mastoid bone behind the ear, so that sound vibrations are transmitted directly through the bone to the inner ear. Certain physical difficulties limit the performance of bone conduction aids ; for instance, bones and skin vary in density and elasticity and therefore in ability to transmit sound, and it is also difficult to obtain good delivery of certain ranges of sound by bone conduction. A bone-conduction Medresco aid, designed at the Post Office Research Station, is, however, now being issued by the Ministry of Health. Further studies on the problems of hearing speech by bone conduction are in progress at Kings College Hospital and in the Wernher Research Unit on Deafness at the Royal National Ear, Nose and Throat Hospital, using a complex speech transmission system designed at the Post Office Research Station. This system enables the various frequency components of speech to be isolated and studied separately.

It is by the imitation of sounds heard in infancy and early childhood that the foundations of speech are laid. If a child is born deaf or acquires a serious impairment of hearing before the fourth or fifth year, the way is closed to the easy and natural process of learning to speak, and speech comes only by the imitation of lip and tongue movements, a process which few parents are able to teach unaided. Furthermore, deaf children who have never heard speech require special training before they can comprehend the meaning of the words that they are taught to use. It is therefore of the greatest importance that the hearing of small children should be tested by reliable methods, so that deafness may be treated in its earliest stages and a decision taken on the type of educational treatment each individual child requires. The investigation of these problems has been the main concern of the Council's Committee on the Educational Treatment of Deafness.

Severe deafness occurring in early infancy is nowadays most often due to a defect in the perception of sound rather than in its conduction through the auditory apparatus. In some cases the condition is acquired as a result of meningitis or some other general infectious illness ; the majority of cases, however, are congenital and, while some may be related to maternal infection with rubella during pregnancy, the causative factors are otherwise unknown. It is hoped that future work may throw some light on the possibility of preventing the occurrence of these cases. In previous generations deafness in children of all ages was frequently caused by infection of the middle ear, but such infections are less common today and can be successfully treated when they do occur. Nevertheless many cases of conductive deafness are still produced in this way, and this form of deafness also may severely limit or delay a child's educational progress and prevent him from leading a normal social life.

Pioneer work in this field, which has been aided by grants from the Council, has been carried out for many years by Professor A. W. G. Ewing and Dr. Irene Ewing in the Department of Education of the Deaf, Manchester University. Professor Ewing and his colleagues are investigating techniques for the diagnosis of defective hearing from earliest infancy onwards, and they have been able to ascertain the degree of both severe and partial deafness in children under three years of age. The problems involved in providing educational guidance and treatment for deaf and partially deaf children according to age, abilities, capacity to hear, linguistic development and educational achievement are also being explored in Manchester, and a survey of the abilities of pupils in schools for the deaf is in progress. Another investigation is concerned with advising parents on methods of pre-school training for deaf infants.

It was at one time thought that children under five could not benefit from the use of hearing aids, but Dr. Littler, of the Wernher Research Unit on Deafness, and others have shown that where residual hearing is present a modern hearing aid can have a striking effect on the development of speech and speech comprehension. In many schools for the deaf even the youngest children will be found wearing a Medresco hearing aid. For such children a more compact aid with smaller batteries would clearly be advantageous. It is hoped to introduce, also, a device by means of which unpleasant over-stimulation of the ear by very loud sounds will be avoided.

In many cases of deafness it is useful to have evidence on the child's capacity to hear pure tones. The understanding of speech depends upon the ability to hear sounds in the frequency band 250 to 3,000 cycles per second. A partially deaf child may respond quite briskly to low frequency sounds, such as those of motor engines, and also to the low frequency components of the human voice, and may in fact appear to hear a great deal of what is said to him ; yet he may comprehend

little and his own speech may be grossly defective. The true situation is at once fully elucidated by a pure-tone audiogram, which may show only a slight loss below 500 cycles, but a very severe loss for the speech frequency range above this point.

The conventional techniques of audiometry as used for older children and adults are, however, often difficult to apply to very young deaf children. It is practically impossible to explain the test procedure to them and, in addition, the pure tone stimuli are quite outside their experience, have no significance for them and fail to arouse their interest. To overcome these difficulties Dr. Hallpike and his colleague, Dr. Margaret Dix, have evolved the " Peepshow " technique, in which the child first responds to combined auditory and visual stimuli by pressing a button and is rewarded by the appearance of a brightly illuminated picture. The light stimulus is then discontinued and the test proceeds with the sound stimulus alone, being thus converted into a test of hearing. The effectiveness of the procedure depends upon the significance given by the picture display to the otherwise meaningless pure tone stimuli, and on the fact that it requires no verbal explanation.

Dr. Littler is studying the value of another test of hearing which has the advantage of being quite independent of co-operation from the patient. This is the psychogalvanic skin test, first developed at Baltimore by Dr. J. E. Bordley and Dr. W. G. Hardy, which also depends on a conditioned response to a stimulus, the fall in electrical resistance produced in the body being recorded.

A comparative study of a number of techniques for measuring children's capacity to hear pure tones and speech at different ages is being made in the Department of Education of the Deaf at Manchester ; in particular, those suitable for schoolchildren are being investigated. Even a mild degree of deafness may be mistaken for mental backwardness, and its early diagnosis and treatment are therefore of great importance for the child's educational progress. For ascertaining deafness in primary schoolchildren, as a preliminary to medical or educational treatment, a method known as the " sweep frequency test " has been found more reliable than the test by gramophone audiometer. It demonstrates early signs of high frequency deafness better than the gramophone test, and also has the advantage of eliminating the need for interpreting material written by the children, so that it can be used for all age groups.

*Other Problems in Otology*

Apart from the two subjects discussed above, there are a number of problems in otology which have received attention by the Council's Committee on the Medical and Surgical Problems of Deafness or have been investigated in the Council's Units ; a few examples may be mentioned here. Dr. C. M. Johnston, with a grant from the Council, recently studied the hearing of workers in certain noisy engineering factories. He found that a continuous noise level of less than 105 phons was unlikely to cause any permanent impairment of hearing except in a few particularly susceptible individuals. Where the noise could not be reduced below this level, protective devices were concluded to be a safeguard, and Dr. Johnston favours the use of ear pads or " muffs " to enclose the ear, which are worn on a headband or attached to a cap ; they are considered preferable to plugs inserted into the aural canal, as these are liable to cause irritation, particularly in hot and dusty trades.

The commonest cause of progressive deafness in active adult life is otosclerosis, and until recently nothing could be done to alleviate this form of deafness or even to arrest its progress. The cause of the deafness is the sealing up by new otosclerotic bone of the oval window in the bony labyrinth through which sounds have to pass to reach the end organ of hearing. By making a new window in the bony labyrinth, hearing can be restored to a useful level in the majority of cases.

For reasons which are still obscure this procedure, known as fenestration, is not always followed by a satisfactory result, and the explanation of the occasional failures is at present being sought.

A number of complex fundamental physiological investigations on the function of the cochlea and the semi-circular canals have been carried out by Dr. Hallpike and his colleagues in the Otological Research Unit. The loudness recruitment phenomenon, first described by Dr. E. P. Fowler of New York, was regarded as an accompaniment of nerve or perceptive deafness. It has now been shown by the Council's workers to be characteristic of hair cell disease in the organ of Corti, and to be absent in degeneration of the cochlear nerve fibres due to a tumour of the auditory nerve. It has thus become a useful clinical sign for differentiating between these two conditions.

Other studies in the Otological Research Unit have been concerned with the vestibular apparatus in the internal ear and its central connexions in health and disease. Modifications of existing tests have been evolved and their use has thrown new light on the difficult subject of vertigo. It has been shown in the course of work undertaken in collaboration with Dr. E. A. Carmichael, Director of the Council's Neurological Research Unit, that organic lesions in certain parts of the cerebral hemispheres, in particular the temporal lobes, give rise to characteristic abnormalities in the results obtained with these new tests ; the tests therefore may have important diagnostic value in cases of cerebral disease.

Our knowledge of the pathology of many forms of ear disease has been retarded by the technical difficulties of studying the inner ear, embedded as it is in the temporal bone of the skull. Work undertaken by the Otological Research Unit, in co-operation with the National Physical Laboratory and certain industrial firms, has led to the improvement of instruments and techniques which have already made possible detailed demonstrations of the fine changes produced in the inner ear and labyrinth by disease processes.

## THE THYROID GLAND

The general pattern of the function and metabolism of the thyroid gland appeared to be largely understood before that of any of the other endocrine glands. The interest in the thyroid gland arose from the recognition of distinctive clinical disorders associated with thyroid deficiency or overactivity, and it was not until much later that the role played by the element iodine was recognised. More recently still the nature of the iodine-containing active principle of the gland has come under study.

### *The Thyroid Hormone*

The work of Sir Charles Harington 25 years ago established that the physiologically active compound first isolated from the thyroid gland by Kendall in the United States was the iodine-containing amino-acid, thyroxine. Thyroxine produces in the animal body the same physiological effects as whole thyroid tissue and, until recently, it was thought to be the thyroid hormone itself. Studies by Sir Charles Harington and Mrs. R. V. Pitt-Rivers at the National Institute for Medical Research, and by von Mutzenbecher in Germany, have led to the view that the formation of thyroxine in the thyroid gland occurs in four stages : (1) iodide, circulating in the blood, is taken up and concentrated by the gland ; (2) iodide in the gland is oxidised by an unidentified enzyme system to iodine ; (3) iodine reacts with tyrosine in the thyroid protein, forming di-iodotyrosine ; (4) two molecules of diiodotyrosine are oxidatively coupled to form thyroxine. Confirmation of this theory has been provided principally by the work of Chaikoff in the United States and of Leblond in Canada. Research on this subject has been greatly facilitated by the use of the radio-active isotope of iodine, $^{131}I$, which became generally available to research laboratories about

ten years ago. The use of $^{131}I$ has enabled investigators to detect much smaller quantities of iodine and to measure the rates with which they are metabolised, and thus to trace the course and speed of the biochemical reactions that take place.

Although thyroxine was known to produce the same physiological effects as whole thyroid gland, there remained an element of doubt whether the thyroid hormone circulating in the body was thyroxine itself or a complex or derivative of it ; this question continued to provoke thought for many years, until cumulative evidence, particularly the demonstration by Chaikoff and his colleagues that most of the organic iodine of the blood is present as thyroxine, appeared to establish with certainty that thyroxine was indeed the circulating hormone. Within the last year, however, the discovery, in Great Britain, of another iodine-containing amino-acid in the thyroid gland and in the blood plasma has re-opened the question. Dr. J. Gross and Mrs. Pitt-Rivers, working at the National Institute, have established that this new amino-acid, which is present in the body in only minute amounts, is triiodothyronine, that is, thyroxine in which one iodine atom has been replaced by hydrogen. Triiodothyronine possesses greater activity than thyroxine in preventing the hypothyroid symptoms normally induced in rats by antithyroid drugs. Moreover, preliminary clinical trials, made in collaboration with Dr. W. R. Trotter at University College Hospital, have shown that it is also highly active in the treatment of myxoedema, the form of hypothyroid disease found in adult human beings. These and other results suggest that triiodothyronine itself may be the active principle of the thyroid gland and that thyroxine is its precursor, but not enough is known at present to establish this point with certainty.

*Substances Modifying Thyroid Function*

The discovery of the antithyroid drugs, made in the United States simultaneously by the Mackenzies and by Astwood, has contributed greatly not only to our knowledge of normal thyroid function but also to the treatment of hyperthyroid disease. The antithyroid drugs are sulphur-containing compounds belonging principally to the thiocarbamide group. The thiocarbamides are substances which are able to reverse the oxidation of iodide to iodine. In the body, they prevent the incorporation of iodine in the thyroid tissue and so inhibit the formation of the active principle of the thyroid gland. It is not yet known at what stage in the body's synthesis of the thyroid secretion this inhibitory action occurs : whether the enzyme system which oxidises iodide to iodine is inactivated, whether iodine, if formed, is reduced back to iodide by the drugs, or whether the conversion of diiodotyrosine to thyroxine is prevented. At the National Institute, Mrs. Pitt-Rivers has shown that this last reaction can be suppressed *in vitro* by several antithyroid drugs, but it may well be that in the body the process is more complicated.

Since the discovery of these antithyroid drugs, certain other agents have been found to inhibit thyroid function, though they are not suitable for use in the treatment of thyroid disease. One of the most interesting of these is resorcinol, which was shown in 1950 by Dr. Russell Fraser and his associates, at the Postgraduate Medical School of London, to have caused myxoedema in two patients with leg ulcers that had been treated by an ointment containing it.

The activity of the thyroid is maintained by a hormone produced by the anterior pituitary gland ; the output of this hormone is itself regulated by the amount of thyroxine in the blood, so that there exists a reciprocal control between the two glands. Thyroxine thus has two distinct activities : through the reciprocal control it regulates its own rate of production, and by direct action in the tissues it stimulates metabolism. A compound possessing the first but not the second of these activities would clearly be valuable in treating

hyperthyroidism. With this in mind, Sir Charles Harington synthesised the thio-ether analogue of thyroxine, which, together with thyroxine analogues containing bromine or chlorine instead of iodine, has been examined by Dr. J. Lerman in the Thyroid Clinic of the Massachusetts General Hospital.

A general and important conception which has emerged in recent years is that of the biological antagonism of closely related compounds ; the most familiar example is probably the antagonism between sulphonamide drugs and *p*-aminobenzoic acid. Thinking on these lines, Dr. D. W. Woolley and others in America, and Professor N. F. Maclagan in Great Britain, have examined numerous compounds chemically related to thyroxine, in the hope of finding one that would antagonise the action of the hormone in the tissues.

Neither of these lines of research has yet attained its object ; in the first the compounds so far examined have been too active in stimulating metabolism, whilst a really effective direct thyroxine antagonist still remains to be found. Nevertheless the importance of the subject warrants its further development and its extension to a search for antagonists of triiodothyronine.

*The Use of Radioactive Iodine in Clinical Medicine*

Much time and ingenuity have been devoted to evolving and improving methods of using tracer doses of radio-iodine for the assessment of human thyroid function in general and the diagnosis of hyperthyroidism in particular. Many of these techniques were first used in the United States, but several have been evolved in the Department of Clinical Research at University College Hospital Medical School. Here, Dr. E. E. Pochin and his co-workers, using a Geiger counter placed opposite the neck of the patient, have estimated the rate at which radio-iodine is entering the thyroid. Simultaneous measurement of the level of radioactivity in the blood enables a " clearance rate " to be deduced. This technique avoids certain errors due to variations in the distribution and excretion of radio-iodine, and gives an absolute measure of the iodine-accumulating function of the thyroid. There are, however, other possible parameters. The idea of measuring the rate at which the radio-iodine leaves the thyroid, in hormonal form, appears attractive but is difficult to carry into effect owing to complications caused by the release of iodide as the hormone disintegrates. More useful in practice is the measure of thyroid activity obtained by estimating the amount of protein-bound radioactivity in the plasma 48 hours after giving a tracer dose of radio-iodine. This technique was favoured by Professor E. J. Wayne and his colleagues at Sheffield after a detailed comparison with other methods. Another quite different approach, in use at Bristol and at Birmingham, is to precede the radio-iodine by a single large dose of an anti-thyroid drug ; the radio-iodine is then accumulated in its inorganic state, and the capacity of the gland to concentrate inorganic iodide is measured by a Geiger counter external to the body. Among the merits of this method is the brief stay of the radioactive atoms in the thyroid tissue.

These methods, in one form or another, supplement and may displace older methods of diagnosing hyperthyroidism. If they do so, it will be as much for their convenience as for their reliability. Indeed the present danger is that a method whose interpretation is by no means always clear will come into routine clinical use while still in the research stage ; the results are then likely to be misleading rather than helpful. More information is still required on the variability of radio-iodine tests, and on the meaning of the high uptake rates often found in patients with non-toxic goitres and also in those who have recovered from hyperthyroidism.

American experience with radio-iodine as a therapeutic agent, both for hyperthyroidism and for cancer of the thyroid, has been repeated in several centres in this country, without, so far, the addition of any essentially new

knowledge. It is clear enough that this type of irradiation can always be made effective in the hyperthyroid patients, and that some thyroid cancers will also show a response. It is not, however, always the treatment of choice ; detailed knowledge of the factors making for success or failure is still lacking, and is being sought by workers at a number of centres, including two of the Council's Units, the Department of Clinical Research at University College Hospital Medical School and the Radiotherapeutic Research Unit at Hammersmith Hospital.

## POLIOMYELITIS

Research on poliomyelitis (commonly known as infantile paralysis, though the disease is by no means confined to infants) has for many years formed part of the Council's programme, and the scope of the studies has been greatly extended since the first large-scale epidemic of the infection occurred in this country in 1947. Until recently the only way of identifying the virus in the laboratory was to inoculate infective material from human cases into the brains of monkeys ; the difficulties in maintaining large numbers of these animals for the purpose, particularly under the climatic conditions of the United Kingdom, naturally impeded progress, though much valuable information about the occurrence and distribution of different strains of the virus was obtained in the limited tests that were practicable. The adaptation of one strain of the virus to rodents, after the primary isolation in monkeys, was of material assistance to the experimental work and has made it possible to organise tests of potential chemotherapeutic agents against the infection, although, in common with other small-sized viruses, that of poliomyelitis has so far resisted all attempts to attack it by drugs.

Fortunately the outlook for the laboratory study of the disease has been transformed in the last two years through the development by Enders and his colleagues in America of a satisfactory technique for growing the virus in tissue culture without the use of living animals. This has already led to the introduction of new tests which assist the speedy identification of the strain of virus, and at the same time make it easier to decide whether a patient is in fact suffering from poliomyelitis or from one of the other infections of the nervous system which may simulate it. A member of the staff of the Public Health Laboratory Service, which the Council direct for the Ministry of Health in England and Wales, has had the opportunity to work with Dr. Enders at Boston and Dr. Melnick at New Haven, Connecticut, so as to study the use of the tissue culture technique, which is now being vigorously exploited in the United Kingdom as well as in the United States. A still more important recent development from the practical point of view, has been the application of methods of passive immunisation with gamma globulin, and of active immunisation with killed or attenuated virus vaccines, to the prevention of paralytic poliomyelitis. In the large-scale controlled tests of gamma globulin prophylaxis reported from America by Hammon and his colleagues it seems clear that the gamma globulin used gave substantial protection for a period from the end of the first week to the end of the fifth week after injection, but the real value of this method cannot be decided until it has been shown for certain that administration of the globulin, which at best can itself protect for only a short time, does not interfere with the development of active (and lasting) immunity in persons exposed to the infection. In any event, the short duration of the protection given by gamma globulin, and the enormous quantities of blood required to provide enough gamma globulin for practical use (about one pint per dose), make it unlikely that the ultimate solution to the problem of preventing paralytic poliomyelitis will be found to lie in this direction.

Much more hopeful are the attempts which are being made to develop methods of active immunisation (vaccination) against the disease. A British worker, now a member of the Council's staff, has collaborated with one of several groups in America who are trying to develop a virus vaccine that is both safe and effective. The technique of tissue culture in monkey testis, as devised by Enders, provides one possible method of attenuating the virus to the point of safety, while the success achieved by the Lederle Laboratories group in cultivating the virus in eggs points the way to another. These studies in the development of vaccines against poliomyelitis are still at a very early stage and formidable difficulties remain to be overcome, but the results to date provide a powerful incentive to persevere.

Meanwhile the principal studies of other aspects of the disease that are in progress in the United Kingdom can be summarised under the following headings :

*Epidemiology*

It is fundamental in all research on infectious disease to know the prevalence of the infecting agent in different localities in epidemic and inter-epidemic periods ; in the case of poliomyelitis one of the unsolved puzzles has been the question of what happens to the virus between outbreaks of the disease. Since the virus is known to be excreted by the intestine, a large-scale survey has been organised to determine its local distribution in the sewage from different areas. In planning and carrying out this study, the staff of the Virus Reference Laboratory at the Central Public Health Laboratory, Colindale, has had the co-operation of the Ministry of Health epidemiological team, and of the Medical Officers of Health in 96 urban and rural communities, as well as of the area laboratories of the Public Health Laboratory Service. So far, the virus has been isolated from two localities in which there had been no clinical evidence of poliomyelitis in the previous year ; this is the first evidence from this country that the virus may survive in a latent condition apart from epidemics. In connexion with this investigation an attempt is being made—by the new tissue culture process—to identify the strain of virus from cases which occur in different English counties and to see whether the same strain persists after a period in which no cases have been reported. To ascertain whether the virus is present in the blood in the incubation period of the disease—another outstanding question—specimens of blood from the family contacts of a series of notified cases are being examined.

*Pathology*

It is known that among those contracting infection with the poliomyelitis virus the proportion of patients developing paralysis is, fortunately, relatively small. Work is in progress at a number of centres in this country to decide what makes the nervous system susceptible to invasion and attack by the virus and localises the subsequent paralysis. This problem is being tackled both by clinical observations and by experimental work in the laboratory. Dr. Ritchie Russell has shown in Great Britain that the risk of severe paralysis developing in a patient with the infection is increased by fatiguing exercise in the pre-paralytic stage and particularly after the onset of meningeal symptoms ; this finding has had an important bearing on the successful management of the disease. In the last few years suggestive evidence has been forthcoming, especially from the United Kingdom and Australia, that paralysis occurs more often than can be explained by chance in a limb which has recently been injected with diphtheria prophylactic or whooping cough vaccine, when such injections are given during epidemics of poliomyelitis. A special Committee of the Council is at present investigating this question. Medical Officers of Health

are collaborating by sending to the Committee records of all cases of poliomyelitis diagnosed in their areas, and special inquiries are being made into cases occurring within three months after a prophylactic inoculation; in addition, Medical Officers of Health of County Boroughs are sending weekly records of the number and types of prophylactic inoculations given in their clinics, so that an estimate may be made of the risk associated with different prophylactics. The possibility that various forms of tissue injury, other than inoculations, may also serve on occasion as activating factors in poliomyelitis is simultaneously being examined by clinicians and field workers in seven areas of England, with special reference to the time relationship of accidents and of surgical and dental operations to the occurrence of paralysis in patients contracting the disease. Meanwhile, warnings have been issued by the Ministry of Health and the Department of Health for Scotland against the unnecessary performance of tonsillectomy in epidemic periods.

Experimental work on the invasion of the nervous system by neurotropic viruses has been carried out at Oxford with support from the Nuffield Foundation, and at Bristol with support from the Council. The Council have also supported studies of the histopathology of the later stages of poliomyelitis at the Royal National Orthopaedic Hospital, where special attention is being given to the extent of the damage to the nervous system which is compatible with normal muscle power.

*Treatment*

Pending the development of a reliable method for preventing poliomyelitis in its paralytic form, it is of paramount importance to improve the standards of treatment for the established disease. Among the centres devoting special attention to this aspect of the problem are the Western Hospital, Fulham, the Royal National Orthopaedic Hospital (Institute of Orthopaedics, University of London), the Radcliffe Infirmary, Oxford, the Nuffield Orthopaedic Centre, Oxford, and the Stoke Mandeville Hospital, Aylesbury.

It is common knowledge that the severe form of poliomyelitis associated with paralysis of the respiratory muscles requires treatment in a respirator or " iron-lung ". During the 1947 epidemic, doubts whether the respirators then available were really satisfactory led the Ministry of Health to set up a special Working Party on the subject. The Council are represented on this Working Party by the Director of their Electro-Medical Research Unit at the Stoke Mandeville Hospital, and intensive work on the design and improvement of respirators and ancillary apparatus has since been carried out by the Unit with the co-operation of clinical colleagues at Stoke Mandeville and at the Western Hospital, Fulham. A new design of respirator—incorporating a split front, first suggested by Dr. Ritchie Russell—is under trial. The Both respirator has been modernised along similar lines and the alterations to it have been made sufficiently simple to be copied by other hospitals without difficulty—a significant point, since some 700 Both respirators are at present distributed throughout the country, as the result of a generous gift by Lord Nuffield before the war. Other work by the Unit and its associates includes the designing of auxiliary breathing machines and resuscitators, the construction of a miniature cabinet respirator for infants, the development of portable and recording oximeters and of carbon dioxide analysers (for assessing the degree of respiratory failure) and the improvement of laryngeal microphones (for enabling the patient with partial paralysis of the vocal cords to talk). In conjunction with the Plastics Research Unit of the Royal National Orthopaedic Hospital, work is also in hand on the development of plastic cuirass-type respirators for production in this country.

With these improvements of the therapeutic apparatus available, and the adoption in appropriate cases of the methods of early tracheotomy and of bronchial and gastric drainage used in Denmark during the serious outbreak there in 1952, there is reason to hope that the number of deaths from poliomyelitis may in future be substantially reduced.

## RECENT WORK ON THE PHYSIOLOGY OF THE RED BLOOD CELL AND THE METABOLISM OF PORPHYRINS

Investigations during the last few years have greatly increased our knowledge of the physiology of the red blood cell, and of the way in which haemoglobin, the pigment protein of the blood, is formed and partly converted to bile pigment. Although the investigations were primarily physiological in character, they are likely to increase our understanding of diseases of the blood and to lead ultimately to the development of improved methods of treatment.

*The life span of the red blood cell*

The mammalian red blood cell differs from almost all other cells in the body in not having a cell nucleus and in its low rates of metabolism and respiration. It had been known for some time that these cells remained in the circulation for only a limited period, but until recently the exact length of their life span in normal man had remained uncertain. The problem was solved at about the same time by workers in this country and in the United States. In this country, largely through the work of Professor L. J. Witts and his colleagues in Oxford and the studies of Dr. P. L. Mollison of the Council's Blood Transfusion Research Unit, in collaboration with Dr. J. V. Dacie and others, it was established that the normal human red cell has an average life span of 120 days. These workers used a method, originally devised by the American scientist, Dr. Winifred Ashby, which consists in transfusing blood cells from blood group O donors into recipients belonging to groups A or B and estimating, by a series of agglutination tests, the length of time the injected cells survive in the circulation. Extension of the investigations to pathological conditions in which premature destruction of the red cells occurs has shown that in many such diseases the destruction is caused by a defect in the red cells themselves and not by a destructive agent in the plasma.

In the United States results obtained with isotopic techniques led to similar conclusions. In 1946 Dr. D. Shemin and Dr. D. Rittenberg, working in Columbia University, New York, showed that the nitrogen atom of the simple amino-acid, glycine, is a specific precursor of the nitrogen of the pigment, protoporphyrin, which forms part of the haemoglobin molecule. By administering glycine which had had its normal nitrogen atom replaced by the non-radioactive isotope $^{15}N$ and by following the excess isotope in the porphyrin of the haemoglobin, they also found an average life span for the red cell of 120 days. By the same technique it could be shown that a large proportion of the red cells in cases of untreated pernicious anaemia have an extremely short life span. In this disease porphyrin production is much above the normal, while the cells produced are defective or their maturation is inhibited. The isotope method has been used by Dr. A. Neuberger and Dr. H. M. Muir of the National Institute for Medical Research, working in collaboration with Professor C. H. Gray of King's College Hospital, to investigate the life span of red cells in the rare condition, congenital porphyria. In this disease large amounts of porphyrins are excreted in the urine and faeces and there is also a deposition of porphyrins in the tissues, leading to a sensitivity to light which may produce skin pigmentation and various skin rashes. It was found that this disturbance of porphyrin production is apparently associated with a defect of red cell formation which may lead to release of red cells of abnormally short life span.

These investigations with $^{15}N$ have shown that no significant synthesis or breakdown of the proteins of the mammalian red cell takes place between the appearance of the cell in the circulating blood and the disintegration of the cell at the end of its life span. This metabolic inertia of the proteins of the red cell itself is to be contrasted with the metabolic activity of the cholesterol of the cell membrane, which Dr. G. J. Popjak and Dr. Muir, working at the National Institute, have shown to be consistently synthesised and broken down during the period when the cell is circulating in the blood.

*Synthesis of porphyrins and haemoglobin in the body*

The haemoglobin molecule consists of an iron-containing pigment portion combined with a protein known as globin. The structure of protoporphyrin, the pigmented component, was established by H. Fischer in Germany more than 20 years ago, but the mechanism of the biological synthesis of this complex molecule could not be effectively studied until stable and radioactive isotopes became available. The new technique was used in experiments carried out mainly and at about the same time by Dr. Shemin in New York and Dr. Neuberger and Dr. Muir at the National Institute in London. Reference has already been made to the work of Dr. Shemin and Dr. Rittenberg on the origin of the nitrogen atoms of protoporphyrin. Later work showed that all four nitrogen atoms are taken from glycine molecules and so also are eight carbon atoms. The remaining twenty-six carbon atoms originate from $\alpha$–ketoglutarate or from succinate, substances arising in the breakdown of carbohydrate by oxidation. Dr. Shemin, in his most recent work, has been able to establish the origin of each of the carbon atoms in porphyrin. Further work is required to elucidate the details of the synthesis of this molecule, but the facts already established provide a good illustration of an apparently general phenomenon—that the body can build complex structures from relatively simple molecules containing two, three or four carbon atoms.

Workers at the National Institute have also investigated the synthesis in the body of the globin fraction of the haemoglobin molecule. By administering radioactive glycine they found that the rates of incorporation of the radioactive carbon atom into the porphyrin and globin are almost equal, a fact indicating that for both reactions the glycine is derived from a common source. This is in contrast to the behaviour of iron, another integral part of the haemoglobin molecule. The iron liberated on the breakdown of haemoglobin is used for the formation of new haemoglobin in preference to other iron supplied. Measurement of radioactivity suggested, however, that porphyrin is made first and that globin is synthesised round the porphyrin or iron-porphyrin complex.

*Bile pigment formation*

Bile pigments were considered until recently to arise exclusively from the breakdown of haemoglobin liberated from red cells at the end of their life span. It was therefore thought that the amount of bile pigment excreted was an exact measure of blood destruction. Isotope experiments carried out with $^{15}N$, first in New York by Dr. Shemin and Dr. London and shortly afterwards in this country by Professor Gray and Dr. Neuberger, showed that this assumption was incorrect. In experiments on normal subjects who had been given glycine labelled with $^{15}N$, the bile pigment was extensively labelled not only, as expected, 120 to 140 days after administration of the isotope but also in the period immediately following its administration. It was shown that about 20 per cent. of the bile pigment excreted by normal man originates from sources other than the disintegration of red cells at the end of their normal life span. It would seem that blood formation as well as blood destruction is associated with bile pigment formation and that any increase in the first is likely to produce a rise in the output of bile pigment.

The American workers found that in cases of pernicious anaemia there was a great increase in the labelling of bile pigment in the period immediately following the administration of marked glycine, an increase which was partly explained by increased red cell destruction and partly by enhanced porphyrin formation. Similar results were obtained by the British workers in a case of congenital porphyria in which there was only a small increase in red cell destruction ; it would appear that in this case the bile pigment was mainly derived from a process associated with porphyrin formation.

# ADMINISTRATION

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RESEARCH ESTABLISHMENTS

During the year covered by this Report the Industrial Medicine and Burns Research Units at the Birmingham Accident Hospital were combined, as the Industrial Injuries and Burns Research Unit, under the direction of Dr. J. P. Bull (p. 87). A new Unit for Research on the Experimental Pathology of the Skin has been formed in the University of Birmingham under the honorary direction of Professor J. R. Squire (p. 79), formerly Honorary Director of the Industrial Medicine and Burns Research Units. Dr. S. Wyatt has relinquished charge of the Group for Research in Industrial Psychology, of which he had been Director for many years, but he will be remaining a member of the Council's scientific staff to write up results of his work. This Group, which has moved to new accommodation at University College, London, is now under the honorary direction of Professor R. W. Russell, with Mr. J. W. Whitfield as honorary deputy director (p. 94). Following the death of Dr. J. C. E. Simpson, the Group for Research in Chemotherapy at the University of Manchester is being dissolved.

At the end of the year, the organisation consisted of the National Institute for Medical Research, 38 Research Units (in some cases with other titles), seven less formally constituted Research Groups, the Antibiotics Research Station, the Laboratory Animals Bureau, and in addition, the Field Research Station in the Gambia. Some members of the staff continue to be attached to other institutions. The Council are also responsible for providing for a very substantial part of the research activities of the Institute of Cancer Research, at the Royal Cancer Hospital.

OVERSEAS LIAISON

During the year, many Commonwealth and foreign scientists visited the Council's headquarters office and research establishments, some of them staying to work for varying periods in the latter. Members of the Council's staff, and a few others closely associated with the Council's work, attended various international conferences, visited laboratories and research establishments abroad and undertook lectures and investigations on behalf of the Council or of other official organisations.

Over 20 members of the Council's staff were present at the Second International Congress of Biochemistry in Paris, while among other congresses and symposia attended were the following: on Virus Nomenclature and Classification in New York; on the Inhalation of Industrial Dusts at Saranac Lake, New York; on Haematology at Mar del Plata, Argentina; on Geographical Pathology in Liége; on Dietetics in Amsterdam; and on Therapeutics and Comparative Pathology in Madrid. Two members of the Council's Whooping Cough Immunisation Committee, Dr. D. G. Evans (University of Manchester) and Dr. W. C. Cockburn (Public Health Laboratory Service), reported on the trials being supervised by this Committee at the Annual Meeting of the American Public Health Association in San Francisco. In connexion with the joint U.K.–U.S. investigation into the value of cortisone and ACTH in the treatment of rheumatic fever, Professor A. Bradford Hill (London School of Hygiene and Tropical Medicine, and Honorary Director of the Council's Statistical Research Unit) and Dr. E. G. L. Bywaters (Canadian Red Cross Memoral Hospital, Taplow), both members of the Council's Rheumatic Fever Panel, attended a meeting of the U.S. Rheumatic Fever Council in Chicago. Opportunity was taken by many attending congresses abroad to extend their visits to see the progress of research work in neighbouring laboratories.

Once again, invitations were received by members of the scientific staff to work at various centres in the United States of America. Leave of absence for the academic year 1951–2 to accept such invitations was granted to Dr. Alice Heim (Applied Psychology Research Unit) to continue her psychological research at Stanford University, and to Dr. E. A. Johnson (Spectrographic Research Unit) to work with Professor Chargaff at Columbia University. Dr. E. B. Reeve and Dr. B. McArdle (both of the Clinical Research Unit at Guy's Hospital) spent periods of eight and six months respectively at Columbia and Johns Hopkins Universities.

A number of shorter visits to the American continents were made during the year. The Council provided the necessary expenses to enable Dr. A. A. Miles (National Institute for Medical Research), Dr. E. R. Holiday (Spectrographic Research Unit), and Dr. R. H. Mole (Radiobiological Research Unit) to visit research laboratories undertaking work related to their own. As the Council's representative, Professor H. H. Stones (University of Liverpool) took part in the Ministry of Health mission visiting the United States to investigate the fluoridation of water supplies. Leave of absence was granted to Dr. M. H. F. Wilkins (Biophysics Research Unit) to accept various invitations; to Dr. S. R. Pelc (Radiotherapeutic Research Unit) to take part in seminar courses in the

University of Brazil (Rio de Janiero) and in the University of São Paulo ; to Dr. A. S. Parkes (National Institute for Medical Research) to undertake a lecture tour in Brazil, Uruguay and Chile ; and to Dr. E. Kodicek (Dunn Nutritional Laboratory, Cambridge) to visit centres of nutrition research in the United States.

In January, Brigadier J. S. K. Boyd (Wellcome Laboratories of Tropical Medicine), Sir John Taylor and Sir Landsborough Thomson (both of the Headquarters Staff) visited the Gambia to report on the opportunities for the wider development of the Council's Field Research Station there. At the request of the Colonial Office, the Secretary of the Council attended a meeting of the West African Advisory Committee on Medical Research at Ibadan, Nigeria.

Dr. J. O. Irwin (Statistical Research Unit) visited India for the meetings of the Indian Statistical Institute and the Biometric Society, and went on to Singapore to advise the Royal Naval Tropical Research Unit on statistical problems connected with its work ; Dr. L. G. C. E. Pugh (National Institute for Medical Research) was granted four months' leave of absence to act as physiologist on the 1952 British Himalayan Expedition.

A large number of visits were made to Europe. Various requests were received from the World Health Organisation for assistance by members of the Council's staff ; Dr. M. Daniels (Tuberculosis Research Unit) undertook a survey of a tuberculosis outbreak among refugees in Trieste ; Dr. J. M. Barnes (Toxicology Research Unit) acted as consultant toxicologist advising on the toxic effects of insecticides and herbicides ; Dr. A. Isaacs (National Institute for Medical Research) visited Yugoslavia to advise on the work of bacteriological laboratories ; and Dr. J. N. Morris (Social Medicine Research Unit) acted as consultant on a World Health Organisation report on social and preventive medicine and its relation to other forms of medical study. Among those accepting invitations to lecture were Dr. W. S. Feldberg (National Institute for Medical Research) in the University of Amsterdam ; Dr. N. H. Mackworth (Applied Psychology Research Unit) in the Universities of Bonn, Münster, Göttingen and Hamburg, at the request of the Foreign Office ; Dr. A. E. Mourant (Blood Group Reference Laboratory) at the inauguration of the Liége Blood Transfusion Service ; Dr. J. J. D. King (Dental Research Unit) in the Royal Colleges of Dentistry in Stockholm and Malmö ; Dr. M. F. Perutz (Unit for Research on the Molecular Structure of Biological Systems) in the University of Rome ; and Dr. J. D. Abbatt and Mr. N. Veall (both of the Radiotherapeutic Research Unit) in the Instituto de Alta Cultura, Lisbon.

Dr. P. A. Merton (Neurological Research Unit) spent six months at the Karolinska Institute, Stockholm, continuing his work on muscle contraction in man ; Dr. D. M. Maurice (Ophthalmological Research Unit) worked for a period of eight months in the Istituto della Sanita in Rome ; and Dr. M. E. Langham of the same Unit spent two months at the University of Uppsala. Shorter visits were made by Dr. G. H. Beavan (Spectrographic Research Unit) to Oslo and Stockholm ; by Dr. M. H. F. Wilkins and Miss S. Jackson (Biophysics Research Unit) to collect material for work on the structure of nucleic acid from the Stazione Zoologica, Naples ; by Professor G. P. Crowden (and two other members of the staff of the London School of Hygiene and Tropical Medicine) to Dortmund, to discuss the calibration and maintenance of special calorimeters being used in the work of the Council's Diet and Energy Committee ; and by Mr. J. W. Boag (Radiotherapeutic Research Unit) to work with Dr. Chapiro and Dr. Magat in the Institut de Biologie Physicochimique in Paris.

Dr. F. H. K. Green continued to represent the Council on the Committee on Overseas Scientific Relations appointed by the Advisory Council on Scientific Policy. Dr. Green was also the Council's representative on the United Kingdom

delegation to the British Commonwealth Scientific Conference held in Australia in February, 1952, and his journey included visits to the Royal Naval Tropical Research Unit at Singapore and to research centres in Australia, New Zealand and the United States of America.

### SCIENTIFIC COMMITTEES

A number of changes among the Council's committees took place during the year. A co-ordinating committee was appointed to supervise, with the assistance of a working party, the conduct of clinical trials of influenza vaccine; other committees were set up on industrial epidermophytosis, at the request of the National Coal Board, and to investigate the possible carcinogenic action of detergents.

Another panel of the General Committee on Clinical Trials of Cortisone and Adrenocorticotrophic Hormone (ACTH) was appointed to investigate the application of these and related substances in the treatment of collagen diseases and hypersensitivity; and a joint sub-committee of the Council's Committee on Analgesia in Midwifery and of the Anaesthetics Committee of the Royal College of Obstetricians and Gynaecologists was set up to supervise clinical trials of " Trilene " inhalers.

An advisory committee on the Council's Laboratory Animals Bureau replaced the Laboratory Animals Committee, which was dissolved; similarly, the Streptomycin Clinical Trials (Tuberculosis) Committee was replaced by a Tuberculosis Chemotherapy Committee appointed to advise and assist the Council on the conduct of clinical trials of new drugs (such as isonicotinic acid hydrazide) in the treatment of tuberculous infection. The Joint Services Personnel Research Committee was set up in place of the former Inter-Services Personnel Research Committee.

Other committees dissolved during the period, on the completion of their work, were those dealing with antihistaminic drugs in the treatment of the common cold, with acute infections in infancy, and with the tuberculin sensitivity survey. In agreement with the Building Research Board of the Department of Scientific and Industrial Research, the joint Committee on Sound in Buildings was also disbanded.

The Colonial Medical Research Committee (jointly with the Colonial Office) was reconstituted for a further three years; and the members of the Industrial Health Research Board were re-appointed for one year.

Shortly after the end of the period covered by this Report two committees were appointed jointly with the Department of Scientific and Industrial Research, to study human problems in industry (p. 220). These committees will be concerned respectively with individual efficiency and with human relations in industry and will continue the work initiated by the Human Factors Panel of the Committee on Industrial Productivity.

### PUBLIC HEALTH LABORATORY SERVICE

Early in 1952, at the end of the initial five-year period for which the Council had agreed to accept responsibility for the administration of the Public Health Laboratory Service (pp. 106–114), the Ministry of Health invited the Council to continue to administer the Service on its behalf for an indefinite period, terminable at the end of any financial year by six months' notice on either side. The Council agreed to do this. The detailed administration of the Service was delegated, as before, to the Public Health Laboratory Service Board.

At the same time, it was made clear by the Treasury and the Ministry of Health that no further development of the Service might take place during the present period of financial stringency; only in very special circumstances might new laboratories be opened, and the numbers of staff in the different

categories must remain at the level reached in January, 1952. This inevitably led to difficulties. The building of three new laboratories which was just about to begin had to be suspended, and three other laboratories which were almost ready for occupation had to remain closed for several months before special permission to engage staff for them was given.

In the summer of 1952, the Public Health Laboratory at Sheffield was established as a new regional laboratory. The Epidemiological Research Laboratory, temporarily housed at the headquarters office, returned to the Central Public Health Laboratory at Colindale ; preparations were made to move the Dysentery Reference Laboratory from Oxford to Colindale in October.

During the year, Dr. G. S. Wilson was appointed by the World Health Organisation as one of its representatives on a Committee set up to advise on the new Tuberculosis Immunisation Research Centre at Copenhagen. Also at the request of the World Health Organisation, Dr. Wilson and Dr. A. Felix paid a three weeks' visit to Israel to advise the Israeli Government on the organisation of a public health laboratory service and the establishment of a central vaccine and serum laboratory. Dr. F. O. MacCallum and Dr. W. C. Cockburn visited Yugoslavia as consultants in virus diseases and epidemiology under the auspices of the World Health Organisation, and Dr. Cockburn attended the annual meeting of the American Public Health Association at San Francisco as already mentioned. Dr. A. P. Goffe worked for a short period at research laboratories in the United States.

## FINANCE

### EXPENDITURE OF PUBLIC FUNDS

In the financial year ended on 31st March, 1952, the total expenditure of public funds by the Council was £1,587,544 on ordinary account and £137,704 on non-recurrent account.

Most of this expenditure was met from the grants-in-aid made by Parliament for the respective purposes during the year. These were augmented, however, by sundry receipts arising from the Council's activities and by contributions from government departments and other sources for special purposes. These included payments from the Ministry of Health for statistical work and the maintenance of the Blood Group Reference Laboratory ; from the Admiralty for investigations proposed by the Royal Naval Personnel Research Committee ; from the Colonial Development and Welfare Fund for the cost of the Field Research Station in the Gambia ; and from the World Health Organisation for work on international biological standards and for that of the World Influenza Centre, both at the National Institute for Medical Research.

The allocation under main heads of the total expenditure of public funds on ordinary account was as follows (financial year 1951–2) :—

| | *Per cent.* |
|---|---|
| Administration .. .. .. .. .. .. .. | 4·0 |
| General scientific purposes .. .. .. .. .. | 0·8 |
| National Institute for Medical Research .. .. .. | 21·9 |
| Research units and external staff .. .. .. .. | 53·0 |
| Special schemes .. .. .. .. .. .. .. | 11·6 |
| Temporary research grants and training awards .. .. | 8·7 |
| | 100·0 |

(The percentage cost of administration is 3·7 if calculated on the total ordinary and non-recurrent expenditure of public funds, and would be still lower if expenditure from benefactions were included and the figures were combined with those for the Public Health Laboratory Service.)

### BENEFACTIONS

By the terms of their Charter, the Council are expressly empowered to accept and administer funds of unofficial origin, coming to them by gift or bequest, either for the general purposes of their work or for special objects within their field. In performing this function the Council act autonomously. Further valuable augmentations of the Council's resources have thus become available to them during the period under review, and of these they wish here to make grateful acknowledgment. A list is given on page 222.

Two important new benefactions came from Eli Lilly and Company of Indianapolis, U.S.A., namely, a grant of 20,000 dollars for the purchase of scientific equipment in America, to be spent over a period of two years ending on the 31st December, 1953, and a grant of 16,000 dollars over a period of three years for the award of travelling fellowships in medicine. Income from these sources was not received until after the close of the financial year 1951–2.

The Rockefeller Foundation added to its benefaction a further grant of 38,000 dollars for the purchase of scientific equipment in America during the period ending on the 30th April, 1952.

The income from such sources in the financial year ended 31st March, 1952, was £6,434, together with 26,958·89 dollars from the Rockefeller Foundation (U.S.A.): £16,352 was expended on behalf of the Alexander Pigott Wernher Memorial Trust.

### PUBLIC HEALTH LABORATORY SERVICE

Financial provision for the Public Health Laboratory Service in England and Wales is made quite separately, the cost being borne on the Vote of the Ministry of Health. The expenditure in the financial year 1951–2 was £872,390 on ordinary account and £198,456 on non-recurrent account.

### BLOOD PRODUCTS

The cost of work undertaken for the Ministry of Health in the preparation and supply of blood products for transfusion and other purposes is provided in the same way, the expenditure being £24,492 in the financial year 1951–2.

## ACCOMMODATION

### RESEARCH ESTABLISHMENTS

Conversion and some new building work has been started at the Hampstead laboratories, where facilities for research on climatic physiology are to be provided for the Division of Human Physiology of the National Institute for Medical Research. When completed, the new laboratories will enable research work to be carried out under conditions similar to those prevailing in Arctic regions.

Work has also been started on a new building in the grounds of the Christie Hospital, Manchester. This new building will house a betatron and other high-voltage apparatus used in research on cancer.

The Blood Transfusion Research Unit has moved into its new laboratories at the Hammersmith Hospital; accommodation at University College, London, has been secured for part of the Group for Research in Industrial Psychology. Work on the buildings to house the cyclotron and linear accelerator at Hammersmith for the Radiotherapeutic Research Unit and on the building at Elstree for research on blood products is still in progress.

The Poole laboratory has been closed, and the staff and equipment transferred to new premises in the grounds of the Royal Victoria Hospital, Boscombe. The Taunton laboratory has moved into its new building in the grounds of Musgrove Park Hospital, Taunton. Additional accommodation in its present building has been secured for the Exeter laboratory.

The new building or conversion work previously reported in progress at Bath, London (County Hall), Northampton and Portsmouth has been completed. The new laboratory block at Colindale was ready for occupation at the close of the period.

## PERSONNEL

### OBITUARY

The death of the Viscount Addison, Chairman of the Council, occurred early in the period now under review but was the subject of full reference in the preceding Report.

The deaths are recorded with deep regret of Dr. W. J. Elford, late of the National Institute for Medical Research, on the 14th February, 1952, and of Dr. J. C. E. Simpson, who lately directed the Council's Group for Research in Chemotherapy at Manchester, on the 7th February, 1952.

William Joseph Elford, who was born in 1900 and was a graduate in chemistry of the University of Bristol, joined the Council's scientific staff in 1930. After a short period of work in collaboration with the late J. E. Barnard he started an independent line of study directed towards the problem of the measurement of the size of virus particles. This led him to the development of the collodion membranes of graded porosity with which his name will always be associated. These membranes made possible the first measurements of the size of viruses and Elford's early results were fully confirmed when more elaborate techniques became available. Elford was a devoted research worker and continued to the time of his death to make important additions to knowledge of viruses in spite of being severely handicapped by ill-health for the last nine years of his life. He was elected a Fellow of the Royal Society in 1950.

James Charles Edward Simpson, who was born in 1908, graduated from the University of Liverpool in 1929 ; for some years he undertook research at Liverpool and at the Rockefeller Institute in New York. He returned to England in 1935 and lectured at King's College, London, and later in the University of Durham. In 1945 he took up a further fellowship in the Chemotherapy Department of the Liverpool School of Tropical Medicine, and in the following year was appointed to the Council's staff, continuing his work at Liverpool for a time and then moving to the University of Manchester as Director of a new Group for Research in Chemotherapy. His untimely death came when he was starting a new programme in which his experience of natural products and synthetic work would have proved invaluable.

### RETIREMENTS

The names of the members of Council who retired during the period are given on p. iii.

Miss E. M. M. Hume, a member of the external scientific staff, retired from the Council's service during the year. She had been associated with the Council's work since 1920, when she was sent to Vienna to join Dr. Harriette Chick in a study of deficiency diseases. Thereafter, she worked on their behalf at the Lister Institute of Preventive Medicine in studies of the role of vitamins in nutrition. She was for a long time secretary of the Accessory Food Factors Committee, and took part in the writing or editing of a number of its reports.

The following among the more senior members of the staff left to take up other work: Dr. A. A. Miles (National Institute for Medical Research) to become Director of the Lister Institute of Preventive Medicine; Dr. C. M. Fletcher (Pneumoconiosis Research Unit) to take up an appointment in the Department of Medicine at the Postgraduate Medical School of London; Dr. E. M. Glaser (Department of Experimental Medicine, Cambridge) to become Professor of Physiology in the University of Malaya; Dr. W. D. M. Paton (National Institute for Medical Research) to take up a readership at University College and University College Hospital Medical School, London; and Dr. J. A. B. Gray (National Institute for Medical Research) to become a Reader at University College, London.

Dr. Miles was appointed to the Council's scientific staff in 1945 and assumed the directorship of the Division of Biological Standards on Sir Percival Hartley's retirement in 1946. In 1948 he was appointed, in addition, Deputy Director of the National Institute for Medical Research. During Dr. Miles's tenure of his post the work on International Standards rapidly increased; his personal success in this work is indicated by his election in 1950 as Chairman of the Expert Committee on Biological Standardisation of the World Health Organisation. At the same time he carried on active and distinguished research work. The Council record their appreciation of his services and wish him well in his new and enlarged opportunity.

On retiring from his appointment as Professor of Experimental Psychology in the University of Cambridge, Sir Frederic Bartlett also ceased to be Honorary Director of the Council's Applied Psychology Research Unit. He remains associated with it, however, in a consultant capacity; the Council are glad that they still retain his help in this way.

Similarly, on retiring from his post as Director of the Lister Institute of Preventive Medicine, Sir Alan Drury ceased to be Honorary Director of the Blood Products Research Unit. Earlier, he had been a member of the Council's staff from 1921 to 1943, first in the Department of Clinical Research at University College Hospital Medical School, then as an external member for many years in the Department of Pathology of Cambridge University, and latterly on special wartime duty at Headquarters. He was a member of the Council from 1944 to 1948, and has been Chairman or a member of several of their special committees. For a great deal of help in many directions the Council are much indebted to Sir Alan Drury, and they are glad to know that he is continuing his distinguished scientific work under the auspices of a sister organisation.

## HONOURS

During the period covered by the Report the following honours were conferred by His late Majesty on members of the Council's staff:

| | | |
|---|---|---|
| K.C.B. | .. | Dr. H. P. Himsworth |
| M.B.E. | .. | Mr. L. W. Collison |

A former member of Council received the following honour:

| | | |
|---|---|---|
| Knight Bachelor | .. | Professor R. A. Peters |

Dr. R. R. Race, a member of the Council's staff, together with Dr. Honor B. Fell, Professor J. S. Mitchell and Dr. D. D. Woods, all closely associated with the Council's work, were admitted as Fellows of the Royal Society. Dr. A. J. P. Martin of the National Institute for Medical Research was awarded the Berzelius Gold Medal of the Swedish Medical Academy.

## STAFF: NUMBERS

The number of the staff employed by the Council for their own purposes, at the end of the period covered by the Report, was 1,427. This figure was made up of 441 scientific staff (of whom 152 were medically qualified), 519 technical

staff, 264 administrative staff (including clerical grades), and 156 full-time and 47 part-time maintenance staff (including tradesmen, drivers and cleaners). Not included in the total of 1,427 were the 50 African staff employed at the Field Research Station in the Gambia.

The Council, as agents of the Ministry of Health in this matter, also employed 920 members of the Public Health Laboratory Service. This figure was made up of 151 scientific staff (of whom all but 30 were medically qualified), 460 technical staff, 139 administrative staff and 93 full-time and 77 part-time maintenance staff.

### ADVISERS, COMMITTEES AND ASSESSORS

The Council wish once more to express their gratitude to all the independent medical and other scientists—in addition to members of their own staff—who have assisted them with advice, whether individually or as members of special committees. A list of the committees and their membership is given on page 205 *et seq.*

The respective Secretaries of the Department of Scientific and Industrial Research and of the Agricultural Research Council, and the respective Chief Medical Officers of the Ministry of Health and of the Department of Health for Scotland, are assessors, *ex officiis*, to the Council. Sir Ben Lockspeiser and Sir William Slater, in this capacity, receive papers on a reciprocal basis, and Sir John Charles and Sir Andrew Davidson have regularly attended meetings.

LIMERICK,
Chairman of the Medical Research Council

H. P. HIMSWORTH,
Secretary of the Council,

38 Old Queen Street,
Westminster,
London, S.W.1

15th May, 1953

# OUTLINE OF RESEARCH PROGRAMME

The main function of the Medical Research Council is to promote scientific investigations for the acquisition of knowledge likely to be of value for the prevention, diagnosis and treatment of disease, and for the maintenance of normal health and full human efficiency. In addition, the Council undertake particular investigations required by Government Departments for their administrative purposes, and they also advise Departments on questions involving use of the latest knowledge in medical science.

The programme of research work supported or assisted by the Council covers the whole field of preventive and curative medicine. The items which receive particular attention are constantly changing, and in allocating resources the Council have to be guided by considerations both of need and of opportunity. As regards the latter, the governing factors are the supply of workers of first class ability with the special qualifications appropriate to the subject, and the existence of, or possibility of finding, a promising line of attack upon a problem ; a frontal attack on a problem which has already proved intractable is seldom successful, and it is generally more profitable to await the opening up of a new approach as the result of an increase in fundamental knowledge.

The Council promote research work in the following two ways. Firstly, they employ scientific staff of their own : some of the members of this staff work in the Council's own premises, of which the chief is the National Institute for Medical Research ; others are attached (either individually or as Research Units or less formal groups) to external institutions. Secondly, the Council make temporary grants for particular purposes to independent workers in universities, hospitals, and elsewhere ; such grants may be for personal remuneration (whole-time or part-time), for scientific or technical assistance, or for special research expenses.

In the following sections of this Report, the summary account of the research work is necessarily given under administrative headings, in accordance with the allocation of expenditure outlined on page 44. While this classification of subject matter gives a picture of the Council's organisation, and of the work of the various parts, it inevitably separates cognate investigations which happen to be promoted under different arrangements. It is therefore supplemented here by a survey of the research programme under main scientific heads, with references to the summary statements which come later. In the following tabulation the names of the establishments of the Council's scientific staff organisation are shown in the right-hand column, where mention is also made of grant-aided researches when these form a substantial part of the work under a particular heading ; in the cases where researches on a subject are directed or co-ordinated by an expert Committee of the Council, the name of the Committee is given in the left-hand column. Any attempt at a classification of researches on these lines cannot be other than arbitrary, and it will be seen that there is some overlapping between the different subject heads.

ANAESTHESIA

| | |
|---|---|
| Anaesthetic Committee (p. 205) | |
| Analgesia in Midwifery Committee (p. 215) | |

ANATOMY

| | |
|---|---|
| Growth and Form Committee (p. 213) | Climate and Working Efficiency Research Unit (p. 91) |
| | Grants (pp. 120, 124, 127–8) |

ATOMIC PHYSICS AND RADIOBIOLOGY

Clinical Applications of Nuclear Physics Committee (p. 206)
Protection Against Ionising Radiations Committee (p. 206)
Tracer Elements Committee (p. 207)
Biological (Non-medical) Applications of Nuclear Physics Committee (p. 219)

Department of Clinical Research (p. 65)
Radiobiological Research Unit (p. 73)
Radiotherapeutic Research Unit (p. 74)
External Scientific Staff (pp. 100–102)
Grants (pp. 123–4, 126, 128, 131–2)

BACTERIOLOGY

National Institute for Medical Research (pp. 61, 62)
Public Health Laboratory Service (pp. 110 *et seq.*)
National Collection of Type Cultures of Micro-organisms (p. 109)
Serum Research Institute (p. 97)
Grants (pp. 120, 133)

BACTERIAL CHEMISTRY

Chemical Microbiology Committee (p. 209)

National Institute for Medical Research (p. 62)
Chemical Microbiology Research Unit (p. 85)
Grants (pp. 120, 124)

BIOCHEMISTRY : the chemical basis of the structure and behaviour of living tissues

National Institute for Medical Research (pp. 60 *et seq.*)
Department of Experimental Medicine (p. 67)
Cell Metabolism Research Unit (p. 84)
External Scientific Staff (pp. 100–105)
Grants (pp. 120–133)

BIOLOGICAL STANDARDISATION : preparation and maintenance of standards for therapeutic substances of which the activity cannot be determined by direct chemical methods ; the definition of standard units of measurement and methods of testing

Anterior Pituitary Hormones Standards Committee (p. 218)

National Institute for Medical Research (p. 64)

BIOPHYSICS : the physical basis of the structure and behaviour of living tissues

Biophysics Committee (p. 208)

National Institute for Medical Research (p. 64)
Unit for Research on the Molecular Structure of Biological Systems (p. 83
Biophysics Research Unit (p. 83)
Spectrographic Research Unit (p. 84)
Grants (pp. 127, 129)

BLOOD DISEASES

Cortisone and ACTH Haematology Panel (p. 214)
Haemophilia Committee (p. 206)

Blood Transfusion Research Unit (p. 70)
Grants (pp. 128, 131, 133)

BLOOD GROUPS

Blood Transfusion Research Unit (p. 70)
Blood Group Research Unit (p. 71)
Blood Group Reference Laboratory (p. 72

BLOOD TRANSFUSION

Blood Transfusion Research Committee (p. 205)

National Institute for Medical Research (p. 63)
Blood Transfusion Research Unit (p. 70)
Blood Products Research Unit (p. 71)
Industrial Injuries and Burns Research Unit (p. 87)
External Scientific Staff (p. 101)

BURNS

Industrial Injuries and Burns Research Unit (p. 87)

CANCER

Possible Carcinogenic Action of Detergents Committee (p. 217)
Carcinogenic Action of Mineral Oils Committee (p. 217)
Clinical Applications of Nuclear Physics Committee (p. 206)
Tracer Elements Committee (p. 207)

Institute of Cancer Research (p. 115)
Department of Clinical Research (p. 65)
Neurological Research Unit (p. 66)
Radiotherapeutic Research Unit (p. 74)
Industrial Injuries and Burns Research Unit (p. 87)
Statistical Research Unit (p. 96)
External Scientific Staff (pp. 100, 102)
Grants (pp. 120–1, 124, 128)

CARDIOVASCULAR DISEASES : conditions of the heart and circulation

Cortisone and ACTH Rheumatic Fever Panel (p. 215)

Clinical Research Unit (p. 66)
Clinical Chemotherapeutic Research Unit (p. 69)
Social Medicine Research Unit (p. 95)
External Scientific Staff (p. 101)
Grants (pp. 127–8)

CHEMOTHERAPY : preparation, preliminary testing in animals, and trial in man of chemical substances for the prevention or treatment of infections

Chemotherapy Committee (p. 209)
Tuberculosis Chemotherapy Trials Committee (p. 215)
Antibiotics Clinical Trials (Non-tuberculous Conditions) Committee (p. 215)

National Institute for Medical Research (p. 61)
Group for Research in Chemotherapy (p. 86)
Tuberculosis Research Unit (p. 69)
Antibiotics Research Station (p. 98)
Serum Research Institute (p. 97)
Grants (pp. 121, 124–5, 127, 129, 132–3)

CHILDREN'S DISEASES

Cortisone and ACTH Rheumatic Fever Panel (p. 215)

Blood Transfusion Research Unit (p. 70)
Clinical Chemotherapeutic Research Unit (p. 69)
Otological Research Unit (p. 75)
Human Nutrition Research Unit (p. 80)
Public Health Laboratory Service (pp. 110 *et seq.*)
External Scientific Staff (pp. 102, 104–5)
Grants (pp. 126, 129, 131)

CLIMATOLOGICAL MEDICINE

Royal Naval Personnel Research Committee (p. 211)
Climatic Physiology Committee (p. 211)
Heating and Ventilation Committee (p. 220)
High Altitude Committee (p. 217)

National Institute for Medical Research (p. 63)
Department of Experimental Medicine (p. 67)
Environmental Hygiene Research Unit (p. 90)
Climate and Working Efficiency Research Unit (p. 91)
Royal Naval Tropical Research Unit (p. 92)
Applied Psychology Research Unit (p. 93)

DENTAL DISORDERS

Dental Research Committee (p. 208)

Nutrition Building (National Institute for Medical Research) (p. 79)
Dental Research Unit (p. 82)
External Scientific Staff (p. 102)
Grants (pp. 120, 125, 134)

ELECTRICAL METHODS FOR THE DIAGNOSIS AND TREATMENT OF DISEASE

Electro-Medical Research Unit (p. 70)

ENDOCRINOLOGY : conditions of the glands of internal secretion

Clinical Endocrinology Committee (p. 205)

National Institute for Medical Research (pp. 61, 63)
Department of Clinical Research (p. 65)
Clinical Endocrinology Research Unit (p. 68)
Radiotherapeutic Research Unit (p. 74)
Grants (pp. 120, 123–7)

EPIDEMIC DISEASES : causes of infection, and modes of transmission ; factors influencing epidemic spread

Air Hygiene Committee (p. 210)
Inoculation Procedures and Neurological Lesions Committee (p. 216)
Whooping Cough Immunisation Committee (p. 218)
Clinical Trials of Influenza Vaccine Committee (p. 216)

National Institute for Medical Research (p. 63)
Environmental Hygiene Research Unit (p. 90)
Public Health Laboratory Service (pp. 110 *et seq.*)
Statistical Research Unit (p. 96)
External Scientific Staff (p. 102)
Grants (p. 129)

GASTRO-INTESTINAL DISORDERS

Department of Clinical Research (p. 65)
Statistical Research Unit (p. 96)
Public Health Laboratory Service (pp. 110, 111)
External Scientific Staff (p. 102)
Grants (pp. 125, 131)

GENETICS : studies of inherited characteristics

Blood Group Research Unit (p. 71)
Radiobiological Research Unit (p. 73)
Statistical Research Unit (p. 96)
Institute of Cancer Research (p. 115)
External Scientific Staff (p. 101)
Grants (pp. 124, 129)

IMMUNOLOGY : production of immunity or reduced susceptibility to infection by use of vaccines and sera

Whooping Cough Immunisation Committee (p. 218)
Clinical Trials of Influenza Vaccine Committee (p. 216)
Tuberculosis Vaccines Clinical Trials Committee (p. 216)

National Institute for Medical Research (p. 62)
Blood Products Research Unit (p. 71)
Serum Research Institute (p. 97)
Public Health Laboratory Service (pp. 110 *et seq.*)

MENTAL DISORDERS

Occupational Adaptation Research Unit (p. 95)
Grants (pp. 122, 124, 133)

METABOLIC DISORDERS

Department of Clinical Research (p. 65)
Department of Experimental Medicine (p. 67)

MYCOLOGY : the study of fungi and of the diseases to which they give rise in man

Medical Mycology Committee (p. 213)

Public Health Laboratory Service (p. 111)
External Scientific Staff (p. 103)
Grants (pp. 119, 131)

NEUROLOGY : diseases and injuries of the central and peripheral nervous systems

Nerve Injuries Committee (p. 205)
Inoculation Procedures and Neurological Lesions Committee (p. 216)

Clinical Research Unit (p. 66)
Neurological Research Unit (p. 66)
Electro-medical Research Unit (p. 70)
Public Health Laboratory Service (p. 112)
Grants (pp. 119, 126–8, 132–3)

NUTRITION : the nutritional needs of the body under various conditions, and the nutritive value of different foodstuffs

Accessory Food Factors Committee (p. 207)
Food Adulterants Committee (p. 208)
Diet and Energy Committee (p. 208)
Nutritional Aspects of the Extraction Rate of Flour Committee (p. 216)
Food Rationing (Special Diets) Committee (p. 221)

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Nutrition Building (National Institute for Medical Research) (p. 79)
Human Nutrition Research Unit (p. 80)
Dunn Nutritional Laboratory (p. 81)
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Grants (pp. 120, 125, 132)

OBSTETRICS AND GYNAECOLOGY

Analgesia in Midwifery Committee (p. 215)

Clinical Endocrinology Research Unit (p. 68)
Social Medicine Research Unit (p. 95)
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OCCUPATIONAL HEALTH

Industrial Health Research Board (p. 209)
Occupational Health Committee (p. 210)
Carcinogenic Action of Mineral Oils Committee (p. 217)
Growth and Form Committee (p. 213)
Industrial Epidermophytosis Committee (p. 217)
Industrial Pulmonary Diseases Committee (p. 209)
Air Hygiene Committee (p. 210)
Committee on Breathing Apparatus for Protection against Dangerous Fumes and Gases (p. 217)
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Road Users Committee (p. 221)
Climatic Physiology Committee (p. 211)

Group for Research in Occupational Optics (p. 78)
Department for Research in Industrial Medicine (p. 86)
Industrial Injuries and Burns Research Unit (p. 87)
Pneumoconiosis Research Unit (p. 88)
Environmental Hygiene Research Unit (p. 90)
Climate and Working Efficiency Research Unit (p. 91)
Statistical Research Unit (p. 96)
Toxicology Research Unit (p. 89)
Grants (pp. 122, 127, 131, 134)

OCCUPATIONAL PSYCHOLOGY

Psychology Committee (p. 212)
Committee on Individual Efficiency in Industry (p. 220)
Committee on Human Relations in Industry (p. 220)
Selection of Medical Students Advisory Committee (p. 218)

Applied Psychology Research Unit (p. 93)
Group for Research in Industrial Psychology (p. 94)
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OPHTHALMOLOGY AND PHYSIOLOGY OF VISION

Lighting and Vision Committee (p. 220)
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Group for Research on the Physiology of Vision (p. 77)
Ophthalmological Research Unit (p. 77)
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OTOLOGY

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Educational Treatment of Deafness Committee (p. 207)
Medical and Surgical Problems of Deafness Committee (p. 207)
Otological Research Unit (p. 75)
Wernher Research Unit on Deafness (p. 76)
External Scientific Staff (pp. 103)
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PARASITOLOGY : the natural history of animals parasitic on man or acting as vectors in the transmission of disease

National Institute for Medical Research (p. 61)
Group for Research on Bilharzia Disease (p. 93)
Public Health Laboratory Service (p. 111)
Grants (p. 125)

PATHOLOGY : studies of the structural and functional changes caused by disease

National Institute for Medical Research (p. 62)
Human Nutrition Research Unit (p. 80)
Neurological Research Unit (p. 66)
Otological Research Unit (p. 75)
Unit for Research on the Experimental Pathology of the Skin (p. 79)
Grants (pp. 120–3, 125, 128, 130, 132–4)

PHARMACOLOGY : actions of substances of medicinal importance

BAL and Allied Substances Committee (p. 216)
General Committee on Clinical Trials of Cortisone and ACTH (p. 213)
Cortisone and ACTH Experimental Biological Committee (p. 214)
Cortisone and ACTH Chemical Committee (p. 214)
National Institute for Medical Research (pp. 62)
Clinical Chemotherapeutic Research Unit (p. 69)
Grants (pp. 122, 124, 126, 129, 130, 134)

PHYSIOLOGY : the normal functions of the organs and systems of the body

Climatic Physiology Committee (p. 211)
National Institute for Medical Research (pp. 62, 63)
Department of Clinical Research (p. 65)
Clinical Research Unit (p. 66)
Department of Experimental Medicine (p. 67)
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Grants (pp. 119, 120–5, 128–132, 134)

PSYCHOLOGY : the normal functions of the mind

Psychology Committee (p. 212)
Committee on Methodology in the Study of Social Behaviour (p. 212)
Applied Psychology Research Unit (p. 93)
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PUBLIC HEALTH

Public Health Laboratory Service Board (p. 106)
Air Hygiene Committee (p. 210)
Tuberculosis Research Unit (p. 69)
Environmental Hygiene Research Unit (p. 90)
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RADIOTHERAPY : treatment of cancer and other diseases by radiations

Clinical Applications of Nuclear Physics Committee (p. 206)
Institute of Cancer Research (p. 115)
Radiotherapeutic Research Unit (p. 74)
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RHEUMATIC CONDITIONS

Joint Committee on the Treatment of Chronic Rheumatic Diseases by Cortisone and ACTH (with the Nuffield Foundation) (p. 213)
Cortisone and ACTH : Collagen Diseases and Hypersensitivity Panel (p. 214)

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Clinical Endocrinology Research Unit (p. 68)
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SERVICE MEDICINE

Joint Services Personnel Research Committee (p. 218)
Royal Naval Personnel Research Committee (p. 211)

Climate and Working Efficiency Research Unit (p. 91)
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SKIN DISORDERS

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Industrial Epidermophytosis Committee (p. 217)

Industrial Injuries and Burns Research Unit (p. 87)
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Grants (p. 132)

SOCIAL MEDICINE

Resettlement of the Disabled Committee (p. 217)
Social and Environmental Health Committee (p. 212)

Pneumoconiosis Research Unit (p. 88)
Social Medicine Research Unit (p. 95)
Statistical Research Unit (p. 96)
External Scientific Staff (pp. 103)
Grants (pp. 119, 120, 132)

STATISTICS : vital statistics ; advice on the use of statistical methods in other researches

Statistical Committee (p. 212)

Statistical Research Unit (p. 96)

SURGERY

Clinical Research Unit (p. 66)
Neurological Research Unit (p. 66)
External Scientific Staff (p. 101)
Grants (pp. 119, 120, 122–3, 128)

TOXICOLOGY : the nature and effects of poisons

Food Adulterants Committee (p. 208)
Toxicology Committee (p. 210)
BAL and Allied Substances Committee (p. 216)
Fungicide and Insecticide Research and Development Committee (p. 219)

Department for Research in Industrial Medicine (p. 86)
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UROGENITAL DISEASES
Clinical Research Unit (p. 66)

VENEREAL DISEASES
Public Health Laboratory Service (p. 113)

VIROLOGY
National Institute for Medical Research (p. 63)
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WOUND INFECTION
Industrial Injuries and Burns Research Unit (p. 87)

WOUND SHOCK
Clinical Research Unit (p. 66)
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# ESTABLISHMENTS, SCIENTIFIC STAFF AND SUMMARIES OF RESEARCH

## National Institute for Medical Research

### The Ridgeway, Mill Hill, London, N.W.7 (1915)*

*Staff: 1st October, 1951–30th September, 1952*

*(Workers from other laboratories are shown as Attached Workers when the period spent, or to be spent, at the Institute is more than six months; those attending part-time or for less than six months are shown as Visiting Workers.)*

BIOCHEMISTRY

*Staff*

Sir Charles Harington, Sc.D., F.R.S. (*Director of the Institute*)
A. Neuberger, M.D., Ph.D., F.R.S.
H. R. V. Arnstein, Ph.D.
J. C. Crawhall, Ph.D.
C. E. Dalgliesh, Ph.D.
Miss B. M. A. Davies, M.A., M.Sc.
D. F. Elliott, Ph.D.
N. Fisher, B.Sc.
A. H. Gordon, Ph.D.
P. T. Grant, B.Sc.
G. D. Hunter, Ph.D.
S. Jacobs, Ph.D., F.R.I.C.
Miss I. H. M. Muir, D.Phil.
Mrs. R. V. Pitt-Rivers, Ph.D.
G. J. Popjak, M.D.
J. J. Scott, B.A.

*Attached Workers*

R. L. Blakley, Ph.D. (*Dunedin, New Zealand*)
J. Gross, M.D., Ph.D. (*Montreal; Merck Fellow; until July*, 1952)
R. D. Harkness, M.B. (*University College, London; until Dec.*, 1951)
W. E. Knox, A.B., M.D. (*U.S. Public Health Service Fellow; until Dec.*, 1951)
Mme. F. Charconnet-Harding, Ing. C.N.A.M. (*Paris; French Government Exchange Fellow*)
T. H. Kennedy, M.Sc. (*Dunedin, New Zealand; until Dec.*, 1951)
Miss A. Tietz, M.Sc. (*Jerusalem*)

*Visiting Workers*

Dr. L. Berlinguet, Quebec
Mr. M. J. Cross, Oxford
Dr. V. Thaller, Zagreb

CHEMOTHERAPY

(Chemical)

*Staff*

J. Walker, D.Sc.
Miss B. A. Askonas, Ph.D.
R. K. Callow, D.Phil.
P. N. Campbell, Ph.D.
B. H. Chase, Ph.D.
J. W. Cornforth, D.Phil., F.R.S.
D. A. A. Kidd, D.Phil.
J. M. Osbond, Ph.D.
P. A. Robins, Ph.D.
P. C. Spensley, D.Phil.
J. A. Stock, Ph.D.
D. A. H. Taylor, D.Phil.
T. S. Work, D.Sc.

*Attached Workers*

I. E. Bush, B.A. (*M.R.C. Scholar; until Aug.*, 1952)
W. B. Renfrow, Ph.D. (*Ohio; until July*, 1952)

*Visiting Workers*

Mr. R. M. Brachi, Leatherhead
Mr. M. P. Stack-Dunne, Cambridge

* The date of establishment of each of the Council's Units and Groups is recorded in brackets immediately below the address.

## CHEMOTHERAPY

(Biological)

*Staff*

F. Hawking, D.M., D.T.M.
D. R. Bangham, M.B.
Miss M. Byers, B.Sc.
S. Crowther, B.Sc.
Miss K. R. de Bouk, B.Sc. (*until Dec.*, 1951)
A. T. Fuller, Ph.D., F.R.I.C.
J. D. Fulton, M.B., Ph.D., D.T.M.
D. F. Spooner, B.Sc.
Miss J. P. Thurston, Ph.D.
Miss W. A. F. Webber, B.Sc.

## BACTERIAL CHEMISTRY

*Staff*

M. R. Pollock, M.B.
F. L. Jackson, M.B.
D. A. Lowther, B.Sc.
Mrs. E. E. D. Manson, B.Sc.
L. O'Rourke, M.Sc.
C. J. Perret, M.A.
R. R. Porter, Ph.D.
H. J. Rogers, Ph.D.

*Visiting Worker*

Dr. R. H. Smith, Cambridge

## PHYSIOLOGY AND PHARMACOLOGY

*Staff*

W. S. Feldberg, M.D., F.R.S.
W. W. Douglas, M.D.
J. A. B. Gray, M.B.
W. D. M. Paton, B.M. (*until March*, 1952)
W. L. M. Perry, M.D.
J. M. Ritchie, Ph.D.
M. Schachter, M.Sc., M.D.
*Technical Officer*, L. W. Collison, M.B.E.

*Attached Workers*

A. N. Smith, M.B. (*M.R.C. Clinical Research Fellow*)
J. Talesnik, Dr. Med. (*Santiago ; until Aug.*, 1952)
C. C. Toh, Ph.D. (*Singapore ; Colonial Research Scholar*)

*Visiting Workers*

Dr. H. B. van Dyke, New York
Dr. K. A. Exley, Leeds
Dr. S. L. Sherwood, London

## HUMAN PHYSIOLOGY

*Staff*

O. G. Edholm, B.Sc., M.B.
W. J. H. Butterfield, M.D., M.R.C.P.
K. E. Cooper, M.Sc., M.B.
R. F. Mottram, B.Sc., L.M.S.S.A.
L. G. C. E. Pugh, M.A., B.M.

*Attached Workers*

M. J. Allwood, M.B. (*Satra Fellow*)
H. S. Burry, B.Sc. (*Satra Fellow*)
H. S. Hatfield, Ph.D. (*London*)

*Visiting Worker*

Major J. H. McLaughlin, R.A.M.C., London

## EXPERIMENTAL BIOLOGY

*Staff*

A. S. Parkes, Sc.D., F.R.S.
Miss H. M. Bruce, B.Sc.
Miss R. Deanesly, M.A., D.Sc. (*part-time*)
J. E. Lovelock, Ph.D.
E. J. C. Polge, B.Sc. (*until March*, 1952)
Miss A. U. Smith, B.Sc., M.B.
S. E. Smith, M.A.
Miss A. Williams, B.Sc. (*until July*, 1952)

*Attached Workers*

Miss J. East, Ph.D. (*Western Australia ; Science and Industry Travelling Fellow*)
P. E. Lake, B.Sc., Dip.Agric.Sc. (*Agricultural Research Council ; until Dec.*, 1951)
E. J. C. Polge, B.Sc. (*Agricultural Research Council*)
H. A. Sloviter, M.D. (*Philadelphia ; Damon Runyon Research Fellow ; until March*, 1952)

*Visiting Worker*

Miss J. I. Scott, Aberdeen

## BACTERIOLOGY AND VIRUS RESEARCH

*Staff*

C. H. Andrewes, M.D., F.R.C.P., F.R.S. (*Deputy Director of the Institute*)
Miss D. M. Chapronière, B.Sc.
G. W. A. Dick, B.Sc., M.D., M.R.C.P.
K. R. Dumbell, M.B. (*until June*, 1952)
A. W. Gledhill, Ph.D., M.R.C.V.S.
Mrs. A. E. H. Gompels (nee A. Harding), B.Sc.
A. Isaacs, M.B.
Miss J. S. F. Niven, M.D.
H. G. Pereira, Dr.Med.
J. S. Porterfield, M.B. (*until Dec.*, 1952)
R. J. W. Rees, B.Sc., M.B.
A. T. Roden, M.D., D.P.H., D.C.H.
A. A. de C. Sampaio, Dr.Med.

*Visiting Workers*

Dr. Selwyn Hills, Auckland, New Zealand
Professor H. Lippelt, Hamburg.
Dr. A. L. Terzin, Belgrade

## PHYSICAL CHEMISTRY

*Staff*

The late W. J. Elford, Ph.D., F.R.S. (*died 14th Feb.*, 1952)
A. J. P. Martin, Ph.D., F.R.S.
J. E. Hotchin, M.B.
A. T. James, Ph.D.
Mrs. O. Kennard, M.A., A.Inst.P.

*Visiting Worker*

Dr. B. Drake, Uppsala

## BIOPHYSICS AND OPTICS

*Staff*

A. S. McFarlane, B.Sc., M.B.
J. E. S. Bradley, Ph.D.
C. E. Challice, Ph.D.
Miss H. Donald, M.Sc.
Mrs. A. Dovey, B.Sc.
R. C. Holloway, B.Sc.
J. Smiles, A.R.C.S.

*Attached Worker*

W. Hennessen, Dr.Med. (*Düsseldorf; British Council Scholar; until July*, 1952)

*Visiting Workers*

Mr. D. O. Brock, London
Miss M. J. Masson, Bucksburn

## BIOLOGICAL STANDARDS

*Staff*

A. A. Miles, M.D., F.R.C.P. (*Deputy Director of the Institute*)*
A. A. C. Dutton, B.M.
Mrs. R. C. Grey, M.A.
J. H. Humphrey, M.D.
R. Jaques, Dr.Med.
J. W. Lightbown, M.Sc., Dip.Bact.
D. A. Long, M.D.
Mrs. E. M. Miles (*part-time; until March*, 1952)
Miss M. V. Mussett, B.Sc.

*Visiting Workers*

Dr. M. L. Ahuja, Kasauli
Dr. D. Ikic, Zagreb
Dr. M. N. Pai, Madras
Dr. P. M. Wagle, Bombay
Mr. U. Wisler, Basle

## DESIGNER AND SUPERVISOR OF APPARATUS

W. C. Lister, B.Sc., M.I.E.E., A.Inst.P.

## LIBRARY

*Staff*

Miss J. R. Taylor, B.A.
Mrs. R. E. Arnstein, B.A.
Miss M. Harvey, B.A.

*Visiting Workers*

Dr. L. Markic-Cucukovic, Zagreb
Mrs. B. Löken, Oslo
Miss L. A. Mevorah, Belgrade

## ADMINISTRATIVE OFFICER

Major-General G. Brunskill, C.B., M.C.

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* In September, 1952, Dr. Miles left to become Director of the Lister Institute of Preventive Medicine and was succeeded as Deputy Director by Dr. C. H. Andrewes.

The work of the Institute is generally designed to cover as wide a field as possible in basic non-clinical medical research, and investigations undertaken there are mostly of a long-term character. In occasional instances, such as the research on the common cold, the work verges on the clinical field ; and members of the scientific staff at the Institute commonly collaborate in clinical developments arising from their discoveries. Certain major themes, such as chemotherapy, both in its chemical and biological aspects, and virus diseases, are constantly under study ; sometimes, as in the case of the Division of Human Physiology where the main task is to investigate the effects of low temperatures on human performance, a fairly closely defined field of research may be allocated; for the rest, the direction that the work takes is largely determined by the particular interests of the senior members of the staff. This principle is at present illustrated by the preoccupation of the Division of General Biochemistry with problems of biosynthesis and intermediary metabolism and with hormones, by the work of the Division of Physiology and Pharmacology on substances such as histamine and acetylcholine that control certain bodily processes, and by the investigations in the Division of Experimental Biology into the survival of cells and tissues at low temperatures.

Although for administrative purposes the Institute is organised in separate Divisions, there is a large measure of collaboration in the attack on problems requiring more than one technique for their solution. Moreover, special tasks, such as those relating to Biological Standards and the epidemiology of influenza which the Council undertake for the World Health Organisation, are interwoven with the normal research activities of appropriate Divisions throughout the Institute. For these reasons, the researches enumerated in the following summary often represent the joint work of members of more than one Division ; the summary is in fact constructed on a scientific and not on an administrative basis.

*Summary of Research*

GENERAL BIOCHEMISTRY

*Biosynthesis and Intermediary Metabolism*

1. Lipids :
   (1) Demonstration that milk phospholipids are formed by synthesis in the mammary gland
   (2) Formation of fat from carbohydrate ; identification of the carbon atoms of glucose that are converted into acetate and thence to fatty acid ; proof that glucose is the precursor of glycerol in fat
   (3) Use of ovarian tissue of the laying hen as a source of enzyme systems for *in vitro* biosynthesis of fatty acids and cholesterol
   (4) Further development of stepwise chemical breakdown of cholesterol
2. Proteins :
   (1) Evidence that milk proteins are formed by synthesis in the mammary gland from amino-acids and peptides
   (2) Turnover rates of collagen in different tissues ; special study of collagen formation in skin
   (3) Demonstration of the rapidity of blood protein synthesis ; evidence that amino-acids of the diet pass through a phase as blood protein on the way to utilisation in the body

3. Amino-acids :
   (1) Identification of tryptophan metabolites in pyridoxin deficiency
   (2) Effect of riboflavin on the metabolism of tryptophan
   (3) Intermediary metabolism of cystine
   (4) Enzymic conversion of glycine to serine
4. Miscellaneous :
   (1) Biosynthesis of penicillin with special reference to the role of cystine
   (2) Effect of vitamin $B_{12}$ on methyl group biosynthesis

*Structure of Proteins*

1. Development of a method for specific breakdown of the protein molecule at the hydroxyamino-acid linkages, and its application to the study of the structure of lysozyme
2. Stepwise degradation of peptides from the carboxyl end

*Hormones*

1. Identification of triiodothyronine in human blood plasma and in the thyroid gland ; synthesis of triiodothyronine and demonstration that its physiological activity is greater than that of thyroxine
2. Further studies of the parathyroid hormone
3. Application of partition chromatography to the purification of insulin, with special reference to the separation of the hyperglycaemic factor

CHEMOTHERAPY

1. Tropical diseases :
   (1) Search for new antimalarial drugs among the aryl diaminopyrimidines and analogous derivatives of other heterocyclic nuclei
   (2) Study of the natural history of filariasis, both in the experimental laboratory infection and in the human disease ; synthesis of Hetrazan labelled with $^{14}C$, preparatory to studying the mode of action of the drug
   (3) Mode of action of Antrycide, with special reference to its effect on the nucleic acids of trypanosomes
   (4) Synthesis and biological test of potential amoebicides
   (5) Analysis of the purines and pyrimidines derived from the nucleic acids of normal and drug-resistant trypanosomes
2. Tuberculosis :
   (1) Analysis of the effect of polyoxyethylene ethers in protecting against tuberculous infection ; relation of their structure and molecular size to therapeutic efficacy and toxicity
   (2) Variations in virulence of tubercle bacilli
   (3) Effects of steroid hormones on host resistance to tuberculosis
   (4) Synthesis of derivatives of *p*-aminosalicylic acid and biological tests for their antitubercular activity
   (5) Experimental studies of isonicotinic acid hydrazide
3. Antibiotics :
   (1) Isolation and preliminary purification of new antibiotics from various organisms
   (2) Investigation of the principles of the cup-plate assay of antibiotics

1. Synthesis of analogues of deoxycorticosterone having significant biological activity
2. New approaches to total synthesis of steroids
3. Studies of the synthesis of cortisone from hecogenin
4. Development of a method for the isolation on a large scale of hecogenin from sisal juice
5. Micro-analytical estimation of steroid hormones and its application to clinical studies
6. Investigation of glycosides from Strophanthus species
7. Adrenal perfusion as a basis for assay of ACTH
8. Assay of ACTH by effect on thymus involution in immature rats
9. Analysis of effect of cortisone in suppressing tuberculous allergy in guinea-pigs; further study of anti-allergic effects of other compounds, e.g. sphingosine and its derivatives and an active principle from liquorice; discovery of anti-allergic effect of glucose-1-phosphate and certain other sugar phosphates

## BACTERIAL CHEMISTRY

1. Development of a technique for continuous culture of bacteria in the steady state and its use to study enzyme biosynthesis with special reference to penicillinase
2. Study of the formation of hyaluronic acid and of hyaluronidase by bacteria
3. Growth of *Pr. vulgaris* in media containing limiting concentrations of nitrogen
4. Further work on the inhibitory effects of long-chain fatty acids on the growth of *H. pertussis*
5. Production of penicillin labelled with $^{35}S$ having a high degree of specific activity

## EXPERIMENTAL PATHOLOGY

1. Effects of histamine and histamine liberators on capillary permeability
2. Further studies of primary lodgement of bacteria in local infections in the guinea-pig
3. Hyaluronidase in relation to capillary permeability
4. Role of polymorphonuclear leucocytes in allergic tissue damage
5. Metabolism of antibodies
6. Relation of the histamine content of the lung to the rat's susceptibility to pulmonary oedema
7. Histamine-liberating effects of animal venoms

## PHYSIOLOGY AND PHARMACOLOGY

1. Histamine and histamine liberators :
   (1) Demonstration that histamine is released in the skin in allergic reactions, and in some species as a primary effect of injection of foreign protein
   (2) Discovery that histamine can be almost completely removed from the skin and skeletal muscle by histamine liberators but not from the intestinal tract, and that after such depletion it is only very slowly restored
   (3) Demonstration that the gastric secretory response to histamine liberators is due to histamine of extra-gastric origin

2. Identification of 5-hydroxytryptamine as a normal constituent of gastro-intestinal mucosa, and study of the pharmacology of this compound
3. Direct evidence from work on the ciliary ganglion that transmission at parasympathetic ganglia is mediated by acetylcholine
4. Effect in isolated preparations of arterial injections of acetylcholine on electrical activity of the spinal cord
5. Analysis of the effect of ACTH in lowering body temperature
6. Further work on the mechanism of action of peripheral mechano-receptors

HUMAN PHYSIOLOGY

1. Effect of body build on cooling in water ; demonstration of importance of subcutaneous fat
2. Studies of oxygen consumption of muscle under various conditions
3. Circulatory studies :
   (1) Analysis of phenomena of reflex vaso-dilatation
   (2) Measurements of blood flow through the calf of the leg in intermittent claudication
   (3) Reflex changes in heart rate resulting from heating large areas of skin
4. Studies of physiological phenomena at high altitudes
5. Investigation of a submarine escape suit
6. Studies of energy expenditure in cadets training at the Royal Military Academy, Sandhurst.
7. Development of an installation for studying the effects of cold on human performance

EXPERIMENTAL BIOLOGY

1. Survival of cells and tissues at low temperatures :
   (1) Definition of conditions for satisfactory preservation of red cells in the frozen state
   (2) Physico-chemical analysis of the effect of glycerol and other substances in protecting cells from damage by freezing
   (3) Successful insemination of cows with bull spermatozoa stored at −79° C
   (4) Demonstration of possibility of freezing and thawing fertilised rabbit ova without destroying their capacity to divide
   (5) Further experiments on grafting of ovarian and testicular tissues after varying periods of preservation at low temperature ; preliminary experiments of this type on adrenal cortical tissue
2. Further work on the growth of various endocrine tissues in culture

VIRUS RESEARCH

1. The common cold :
   (1) Further observations on the natural transmission of common cold infection
   (2) Study of the behaviour of the common cold virus in tissue cultures, especially human embryonic nasal epithelium
2. Influenza :
   (1) Development of methods for titrating influenza vaccines
   (2) Antigenic analysis of influenza viruses
   (3) Serological studies of swine influenza, indicating no present epidemiological relationship to the human infection
   (4) Studies of the growth of influenza virus in the chorio-allantoic membrane of the chick embryo

3. Mouse hepatitis :
   (1) Discovery of two aetiological factors in this disease and the study of their individual properties
   (2) Histological investigations of the lesions of mouse hepatitis
4. Bacteriophage :
   (1) Morphological studies of bacteriophages
   (2) Development of an adsorption-elution method for purification of bacteriophage
   (3) Studies of nucleic acids of bacteriophages

### BIOPHYSICS, OPTICS AND PHYSICAL CHEMISTRY

*(apart from research included under other headings)*

Extensive collaboration with other Divisions in researches requiring the use of the electron microscope, the mass spectrometer, radio-active counting technique and electrophoretic analysis, or the application of optical and chromatographic methods

### BIOLOGICAL STANDARDS

1. International Standards :
   (1) Establishment of new International Standards for Penicillin, Penicillin K, Insulin, Oxophenarsine
   (2) Organisation of collaborative assays for projected International Standards for dihydrostreptomycin, aureomycin, terramycin, bacitracin and dimercaprol
   (3) Preparatory researches on materials for the proposed 2nd International Standard for corticotrophin, and for new Standards for vitamin $B_{12}$, scarlet fever antitoxin and diagnostic salmonella antisera
   (4) Preparation (in collaboration with Dr. Orpwood Price) of dried reference sera for control of serological tests for syphilis
2. Establishment of a British Biological Standard for globin zinc insulin
3. Advisory work for the Ministry of Health (Therapeutic Substances Regulations), and for the British Pharmacopoeia Commission

# Research Units and Groups

## DEPARTMENT OF CLINICAL RESEARCH

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, LONDON, W.C.1
(1919)

*Director**
E. E. Pochin, M.D., F.R.C.P.

*Staff*

Mrs. E. K. B. Ball, B.Sc. (*part-time ; until August*, 1952)
B. D. Corbett, B.A.
D. A. W. Edwards, M.D.
K. Fletcher, B.A.
A. J. Honour
N. B. Myant, B.Sc., D.M.
E. N. Rowlands, B.Sc., M.D., M.R.C.P.

*Attached Worker*
H. Billion, M.D. (*University of Rostock ; until July*, 1952)

The Department is primarily concerned with the study of selected diseases as they occur in man, and with the development of methods of treatment. Its work is at present centred upon the use of radioactive iodine for investigating and treating overactivity and cancer of the thyroid gland ; and upon the processes involved in peptic ulcer and in obesity.

*Summary of Research*

1. Thyroid function :
   (1) The rate of metabolism of iodine in health and in Graves' disease, during different phases of its metabolic cycle
   (2) The treatment of certain cases of Graves' disease with radio-iodine, and the definition of criteria of adequate treatment
2. Thyroid carcinoma :
   (1) The detection and quantitative measurement of iodine uptake in thyroid tumours and their metastases
   (2) Changes in the amount of radio-iodine concentrated in tumours before and after destruction of normal thyroid tissue, and during the course of radio-iodine treatment
   (3) Comparison of the metabolism of carcinomatous and normal thyroid tissue
3. Protein metabolism :
   (1) The disposal of protein solutions injected locally under the skin
   (2) The distribution and metabolic " turnover " of protein solutions injected intravenously
4. Obesity :
   (1) Relationship of individual fat cell content to total quantity of stored fat
   (2) Study of the distribution of stored fat throughout the body
   (3) Studies of the skin temperature and of blood vessel activity in the skin overlying large fat-deposits in the lower leg
   (4) Measurement of blood volume in obese subjects
   (5) The occurrence, mechanism and significance of water retention in obesity, with special reference to weight-reducing regimes

* Salary of post largely provided by permanent endowment from Rockefeller Foundation

5. Intestinal function :
   (1) Studies of the pressures developed in the digestive tract in man
   (2) Role of the motor and acid factors in peptic ulcer pain
   (3) Clinical assessment of drugs which inhibit gastric secretion
   (4) Study of the mechanism whereby iodide becomes concentrated in certain human digestive juices and in milk
6. The anatomy of the venous drainage and arterial supply of the skin and subcutaneous tissues of the lower leg

## CLINICAL RESEARCH UNIT

GUY'S HOSPITAL, LONDON, S.E.1

(1934)

*Director*

R. T. Grant, O.B.E., M.D., F.R.C.P., F.R.S.

*Staff*

H. E. Holling, M.Sc., M.B., M.R.C.P.
B. McArdle, M.D., M.R.C.P., D.C.H.
E. B. G. Reeve, B.M., M.R.C.P.

The general aim of the Unit is to study disease in man by observations on patients and by animal experiment. Its chief interest at present is in diseases of the cardiovascular system and of the skeletal muscles.

*Summary of Research*

1. Blood volume and other studies of the circulatory adjustments following haemorrhage
2. Experimental studies on the interpretation of the data obtained by blood volume measurements
3. Reflex circulatory changes during surgical operation on man and animals
4. The circulatory adjustments associated with mitral stenosis, and the changes resulting from surgical relief of the valve obstruction
5. The metabolic disturbance in myotonia atrophica
6. Development of methods for measuring the exchange of substances between muscle and blood
7. Studies on familial periodic paralysis

## NEUROLOGICAL RESEARCH UNIT

NATIONAL HOSPITAL FOR NERVOUS DISEASES, QUEEN SQUARE, LONDON, W.C.1

(1933)

*Director*

E. A. Carmichael, C.B.E., M.B., F.R.C.P.

*Staff*

J. A. V. Bates, M.B.
Miss M. A. Crosskey, M.A.
G. D. Dawson, M.Sc., M.B.
A. Elithorn, M.B., M.R.C.P., D.P.M.
P. A. Merton, M.B.
P. W. Nathan, M.D., M.R.C.P.
Mrs. M. C. Smith, B.Sc., M.B.

The Unit studies the nervous system of man by observing the response of healthy persons to various applied stimuli, and the changes in function and structure resulting from disease or its treatment.

*Summary of Research*

1. Cerebral action potentials :
   (1) The elaboration of methods for recording cerebral action potentials
   (2) The design and assembly of apparatus for recording direct from the cerebral cortex during surgical operation
   (3) The detection of focal cerebral abnormalities in epileptics
   (4) The study of infantile hemiplegics and epileptics before and after hemispherectomy
2. Action potentials in peripheral nerves :
   Studies of the " secondary response " in muscle following stimulation of its peripheral nerve
3. Stretch reflex :
   Studies of the reflex nature and sensory mechanism of the " silent period " of muscle action potentials and of the effects of synchronous and asynchronous motor volleys, and the application of the methods to the investigation of myasthenia gravis and the myopathies, including familial periodic paralysis
4. Studies of nerve and spinal cord :
   (1) The sensory and autonomic functions in inoperable cancer before and after cordotomy, and their correlation with histological changes
   (2) Histological studies of nerve cell degeneration following posterior root section and injury to the Gasserian ganglion
   (3) The autonomic responses before and after leucotomy and in transection of the spinal cord
   (4) An inquiry into the physiological disturbances underlying pain in amputation stumps

## DEPARTMENT OF EXPERIMENTAL MEDICINE

TENNIS COURT ROAD, CAMBRIDGE

(1945)

*Director*

Professor R. A. McCance, M.D., Ph.D., F.R.C.P., F.R.S.

*Staff*

Miss E. Colbourn, S.R.N.
R. F. A. Dean, Ph.D., M.R.C.S.*
J. W. T. Dickerson, B.Sc.
E. M. Glaser, M.C., M.D., Ph.D. (*until Dec.*, 1951)
G. R. Hervey, M.B.
Mrs. B. E. Hines, M.A.
W. I. M. Holman, Ph.D., F.R.I.C.
Mrs. N. J. B. Naylor, M.D. (*part-time*)
Miss R. Schwartz, B.Sc.*
W. M. B. Strangeways, M.B.
Miss L. A. Thrussell, S.R.N.
Miss E. M. Widdowson, D.Sc. (*Assistant Director*)

*Attached Workers*

J. H. Cort, M.D. (*Fellow of the National Foundation of Infantile Paralysis, U.S.A.*)
J. R. Robinson, M.D., Ph.D.

The Department is engaged in detailed studies of the changes which take place in disease, rather than in evaluating methods of treatment, and the work includes studies of normal men and women and of animals.

*Summary of Research*

1. The composition of the living body and the measurement of its fluid compartments
2. The osmoregulation of living cells

* Working in Uganda

3. The effect of starvation and undernutrition on the composition of the liver
4. The control of plasma-volume and extracellular volume by the kidney
5. Renal function before and after birth, with special reference to the excretion of water and the regulation of pH
6. The role of glutaminase in the production of ammonia in the kidney
7. Cholinesterase in piglet organs and sow's milk
8. Katabolism of protein and calorie requirements in the newborn period
9. Respiratory shivering reflexes
10. A study of kwashiorkor in Uganda

## CLINICAL ENDOCRINOLOGY RESEARCH UNIT

### CLINICAL LABORATORY, ROYAL INFIRMARY, EDINBURGH

(1946)

*Honorary Directing Committee*

Professor J. H. Gaddum, Sc.D., M.R.C.S., F.R.S. (*Chairman*)
Professor D. M. Dunlop, M.D., F.R.C.P.
Professor R. J. Kellar, M.B.E., M.B., F.R.C.S.E., F.R.C.P.E., F.R.C.O.G.
Professor G. F. Marrian, D.Sc., F.R.S.
C. P. Stewart, D.Sc. (*Secretary*)

*Staff*

J. B. Brown, M.Sc.
G. C. Kennedy, M.B.
J. A. Loraine, M.B., M.R.C.P.
Mrs. E. Michie, B.Sc.
N. R. W. Taylor, M.B.

After a period in which the work of the Unit was directed mainly to the development of suitable methods of assaying hormones, attention is now being given to the application of these methods to clinical problems.

*Summary of Research*

1. Chorionic gonadotrophin :
   (1) The serum concentration, urinary excretion and renal clearance of chorionic gonadotrophin in normal pregnancy, pregnant diabetics with and without stilboestrol medication, pre-eclamptic toxaemia, essential hypertension, and essential hypertension with superimposed toxaemia
   (2) The chorionic gonadotrophin in multiple pregnancy, hyperemis gravidarum, hydatidiform mole and chorion epithelioma
   (3) The extraction of chorionic gonadotrophin from normal and pathological placentae
2. The development of a new method of assay for pituitary gonadotrophin depending on the enlargement of the ventral lobe of the prostate in hypophysectomised rats
3. The problems of ACTH release from the pituitary gland and the investigation of methods for its extraction from blood
4. The range of pregnandiol excretion in normal and diabetic pregnancy
5. 17–keto–steroids :
   (1) The urinary excretion of 17–keto–steroids in rheumatoid arthritis treated with ACTH, cortisone or insulin
   (2) Testosterone metabolism in rheumatoid arthritis
6. The development of a method for estimating natural urinary oestrogens and its application to the problem of oestrogen metabolism in breast cancer

## CLINICAL CHEMOTHERAPEUTIC RESEARCH UNIT

GARDINER INSTITUTE OF MEDICINE, 50 CHURCH STREET, GLASGOW, W.1

(1946)

*Director*

J. Reid, M.D., M.R.C.P. (*part-time*)

*Staff*

J. B. Cochran, M.B., M.R.C.P.
D. H. Sproull, B.Sc., M.B.
R. D. Watson, B.Sc.

The mode of action of sodium salicylate in the treatment of rheumatic fever is being investigated in the hope of improving our understanding of the pathology of the disease, and in order to develop more effective drugs.

*Summary of Research*

1. The clinical and biochemical changes in acute rheumatism during natural remission and remission on treatment with salicylate and other drugs
2. The pharmacology of sodium salicylate and related compounds, with particular reference to their metabolic effects
3. The action of salicylate and $\gamma$-resorcylate in rheumatic fever and in various experimental lesions of animals
4. Preparation of new compounds with possible anti-rheumatic action

## TUBERCULOSIS RESEARCH UNIT

MEDICAL RESEARCH COUNCIL LABORATORIES, HOLLY HILL, HAMPSTEAD, LONDON, N.W.3

(1948)

*Director*

P. M. D'Arcy Hart, M.D., F.R.C.P.

*Staff*

The late M. Daniels, M.D., M.R.C.P., D.P.H.*
W. Fox, M.D., M.R.C.P.
J. P. W. Hughes, M.D., D.P.H.
G. G. Lindsay, M.B., D.P.H.
T. M. Pollock, M.B.

This Unit has so far studied tuberculosis as it affects the community rather than the individual, and has paid particular attention to epidemiology and to methods of prevention; large-scale clinical trials of the value of different chemotherapeutic agents have also been undertaken. The director also works part-time in the National Institute for Medical Research on problems of new drugs and host-resistance in tuberculosis, and on the virulence of the mycobacterium causing this disease.

*Summary of Research*

1. Trials of chemotherapy in tuberculosis:
   (1) The treatment of pulmonary tuberculosis with isonicotinic acid hydrazide (isoniazid)
   (2) A follow-up of patients treated with streptomycin in earlier trials
2. Clinical trials of anti-tuberculosis vaccines

*Dr. Daniels died on March 3rd, 1953, after the end of the period under review.

## ELECTRO-MEDICAL RESEARCH UNIT

STOKE MANDEVILLE HOSPITAL, AYLESBURY, BUCKS

(1946)

*Director*

R. B. Bourdillon, C.B.E., M.C., A.F.C., D.M.

*Staff*

Miss A. F. Cullis, B.A.
G. Hunter, D.Sc., F.R.S.C.
F. D. Stott, D.Phil.
Miss S. Wolfenden, B.Sc.

*Attached Worker*

A. B. Kinnier Wilson, M.B., M.R.C.P.
(Under the direction of Dr. W. Ritchie Russell)

The Unit is at present engaged on studies of diseases of the nervous system. A main part of its programme has the aim of reducing the present high mortality of patients with poliomyelitis who need respirator treatment; studies of the circulation of cerebrospinal fluid in various diseases are also in progress.

*Summary of Research*

1. Studies of new types of cabinet respirators and of their use in poliomyelitis; the development of improved British models (with Dr. W. Ritchie Russell, Dr. W. H. Kelleher, the Breathing Machines Working Party of the Ministry of Health and various manufacturing firms)
2. The development of improved oximeters and their clinical use in poliomyelitis
3. Studies on the blood-CSF and blood-brain barriers, and their penetration by the bromide ion, radiosodium, and other agents, with special reference to disseminated sclerosis and tuberculous meningitis (with the late Sir Hugh Cairns, Dr. Ritchie Russell, and their colleagues)
4. The development of precise methods for estimating bromide in cerebrospinal fluid and in sera
5. Electromyography on paraplegic patients (with Dr. L. Guttmann)

Dr. E. H. J. Schuster has again given valuable assistance to the Unit's work by designing and constructing numerous pieces of apparatus.

## BLOOD TRANSFUSION RESEARCH UNIT

POSTGRADUATE MEDICAL SCHOOL OF LONDON, DUCANE ROAD, LONDON, W.12

(1946)

*Director*

P. L. Mollison, M.D., M.R.C.P.

*Staff*

Miss M. Cutbush, B.Sc.
Miss H. Crawford, B.Sc.

*Visiting Worker*

Senr. Asst. Surg. H. Chaplin, Jr.

The Unit's object is to improve the practice of blood transfusion by investigating its effects in man; and to use transfusion as a method of research, particularly in the study of haemolytic syndromes.

*Summary of Research*

1. Transfusion experiments with red cells previously frozen at −79° C and −15° C (in co-operation with the National Institute for Medical Research)
2. Methods of diminishing the lysis which occurs when human red cells are frozen, stored and recovered for transfusion
3. Analysis of the results of controlled trials of treatment of haemolytic disease of the newborn (in co-operation with the Statistical Research Unit)
4. Haemolytic disease of the newborn due to A antibodies
5. A study of plasma trapped in the red cell column of the venous haematocrit
6. The relationship of the " body haematocrit " to the venous haematocrit
7. Fibrinolysis in newborn infants
8. Preparation of specific antiglobulin sera by differential absorption,

## BLOOD PRODUCTS RESEARCH UNIT*

LISTER INSTITUTE, CHELSEA BRIDGE ROAD, LONDON, S.W.1

(1946)

*Honorary Director*

Sir Alan Drury, C.B.E., M.D., F.R.C.P., F.R.S.

*Staff*

Miss Margaret E. Mackay, Ph.D.

Miss M. H. Nance, M.Sc.

*Associated Workers*

Miss S. M. Evans, B.Sc.

L. Vallet, B.A.

R. A. Kekwick, D.Sc.

The Unit has developed techniques for the fractionation of human and animal blood plasma, and for the concentration of plasma fractions and their large-scale production.

*Summary of Research*

1. Preparation of dried human plasma and plasma fractions
2. The properties of human gamma globulin
3. The properties of human fibrinogen and plasmin
4. Clinical trials of irradiated plasma
5. Clinical trials of human albumin
6. Isolation of enzyme-rich plasma fractions
7. Identification of immune bodies in plasma fractions

## BLOOD GROUP RESEARCH UNIT

LISTER INSTITUTE, CHELSEA BRIDGE ROAD, LONDON, S.W.1

(1946)

*Director*

R. R. Race, Ph.D., M.R.C.S., F.R.S.

*Staff*

Miss R. A. Sanger, Ph.D.

Miss J. S. Thompson, B.Sc.

The Unit is occupied in the search for unrecognised blood group antigens, and in the genetical analysis of those which are already known. These antigens are of importance in the study of human genetics and of anthropology, and are the cause of haemolytic disease of the newborn and of transfusion reactions.

*The Unit was dissolved on Sept. 30th, 1952.

*Summary of Research*

1. Genetical studies of the MNSs, Duffy and Kidd blood group systems
2. Analysis of some 500 families for evidence of genetic linkage between the blood group genes, data on these families having been collected since 1938 by this Unit or its parent, the Galton Laboratory Serum Unit
3. Study of the relative effect on the red cells of one and of two $Fy^a$ genes in the germ plasm
4. Demonstration of a relationship between the presence of anti-H in the serum and the absence of the ABH antigens from the saliva
5. Examination of sera sent from abroad suspected of containing "new" antibodies
6. Collaboration with Dr. B. H. Kirman of the Fountain Hospital, with Dr. Eliot Slater and Mr. James Shields of the Maudsley Hospital, and with Dr. Raymond Hierons of the National Hospital for Nervous Diseases, Queen Square, in twin investigations and linkage studies.

## BLOOD GROUP REFERENCE LABORATORY

*(Administered since April, 1950, by the Council for the Ministry of Health)*

LISTER INSTITUTE, CHELSEA BRIDGE ROAD, LONDON, S.W.1

*Director*

A. E. Mourant, D.M., D.Phil.

*Staff*

Mrs. B. J. Graff, B.Sc. (née J. A. E. Walby)  Miss E. W. Ikin, B.Sc.
Miss D. M. Parkin, M.R.C.S.

The function of the Laboratory is to help in the establishment and maintenance of blood transfusion services in Great Britain and elsewhere. For this purpose the Laboratory prepares and issues blood grouping sera, advises on methods and technical procedures, and investigates special problems when required.

*Summary of Activities*

1. Selection, preparation and issue of testing sera for all the known blood groups, and of anti-human-globulin sera, to the National Blood Transfusion Service, to the Armed Forces and Colonies, and to other users in Great Britain and abroad
2. Conducting training courses, for pathologists and technicians from British and foreign hospitals and transfusion centres, in advanced blood grouping techniques and special aspects of blood transfusion
3. Testing of hospital and laboratory staffs for the 16 principal blood group antigens ; compilation and maintenance of a register of 1,800 blood donors similarly tested, for use in special transfusion cases ; Rh genotyping of all new recruits to London Red Cross Blood Transfusion Service
4. Research and advice on clinical blood grouping and transfusion problems referred by the Regional Transfusion Centres and hospitals in Great Britain and abroad
5. Anthropological blood group surveys and research into new and unusual blood groups found in the course of these surveys
6. Preliminary stages in the making of National Standard preparations of anti-C, anti-D and anti-E sera

# RADIOBIOLOGICAL RESEARCH UNIT

ATOMIC ENERGY RESEARCH ESTABLISHMENT,
HARWELL, DIDCOT, BERKS

(1947)

*Director*

J. F. Loutit, D.M., M.R.C.P.

*Staff*

D. E. Andrew, B.A.
D. W. H. Barnes, B.M.
Mrs. O. D. Batt, M.B.
B. G. Chapman, M.Sc.
C. E. Ford, Ph.D.
J. L. Hamerton, B.Sc.
G. E. Harrison, Ph.D., F.Inst.P.
Mrs. P. H. Herbert, B.A.
Miss E. M. S. Lumsden, B.Sc. (*until Dec.*, 1951)
M. McInally, B.Sc.
R. H. Mole, B.M., M.R.C.P.
R. J. Munson, Ph.D.
G. J. Neary, Ph.D.
J. St. L. Philpot, M.A.
L. A. Stocken, D.Phil., F.R.I.C. (*honorarium*)
Miss A. Sutton, Ph.D.
O. A. Trowell, M.D., F.R.S.E.

The Unit is studying the action of ionising radiation on living tissue, particular attention being paid to fast neutrons and to X- and $\gamma$-radiation.

*Summary of Research*

1. Physical studies :
   (1) Further measurements of the mean energy of fast neutrons
   (2) Studies of the dependence of the surface dose of $\beta$ rays on the size of the animal irradiated
   (3) Theoretical and experimental studies of the ionisation resulting from recoil particles of low energy released in tissue by fast neutrons
   (4) Estimation of neutron dosage by measurements of ionisation
   (5) The use of nuclear emulsions for high energy nuclear reactions
   (6) Further development of specialised electrometers
   (7) Preliminary investigations of the stopping-power of liquids for $\alpha$ particles
   (8) Determination of the activation cross-section of $^{84}Sr$ for slow neutrons
   (9) Construction by Dr. E. H. J. Schuster of an interference microscope
2. Chemical studies :
   (1) Analysis of the plasma of X-irradiated guinea pigs for changes in the distribution of proteins and in the content of cholinesterases
   (2) The distribution of organo-phosphates in the livers of X-irradiated guinea pigs
   (3) The uptake of strontium by bone-powders
   (4) The estimation by activation-analysis of the normal excretion of strontium in the human subject
   (5) The micro-estimation of calcium
   (6) Search for the presence of organic peroxides in tissues of irradiated mice and the differentiation of reacting substances from oxidation-catalysts
3. Clinical and physiological effects of radiation :
   (1) The iodide metabolism of rats after whole body irradiation
   (2) The effects of chronic exposure to irradiation by fast neutrons on life span, fertility, the incidence of tumours, the production of cataracts, and the blood picture, in mice
   (3) An investigation of the effects of whole body X-irradiation, with particular reference to the prevention of lethal effects, the activity of the adrenal glands, the pathology of the intestinal lesions, circulatory changes, the basal metabolism and the time of cell-death in relation to the time of irradiation

(4) The effects on mice of single exposures of part of the body to high intensity $\beta$-irradiation
(5) A study of the water and electrolyte balance of X-irradiated monkeys
(6) Immunological responses of irradiated animals
(7) Study of the effects of splenic tissues administered after irradiation
(8) A preliminary study of the "Evans Blue Space" in animals after irradiation

4. Fundamental biological effects of radiation :
   (1) Comparison of biological effects of fast neutrons (150 MeV) and gamma rays on roots of the broad bean
   (2) Further development in the irradiation of single cells with a collimated beam of $\alpha$ particles
   (3) Production of structural changes in chromosomes by ionising radiations and chemical agents
   (4) Assays of the relationship between loss of chromosomal fragments and survival of cells in irradiated tissues
   (5) Further study of the effects of various physical and chemical factors in normal and irradiated lymph glands
5. Miscellaneous :
   (1) Attempts to develop a method of lymph node culture on a large scale for the study of the metabolism of lymphocytes
   (2) Examination of synthetic materials for glycogenic activity

## RADIOTHERAPEUTIC RESEARCH UNIT

HAMMERSMITH HOSPITAL, DUCANE ROAD, LONDON, W.12

(1941)

*Director*

Miss C. A. P. Wood, M.R.C.P., F.F.R. (*part-time*)

*Staff*

J. D. Abbatt, M.B., D.M.R.T.
J. W. Boag, B.Sc., F.Inst.P.
M. Ebert, Dipl. Ingenieur, Dr.rer.nat.chemic.
W. Emery, B.Sc.
J. W. Gallop, B.Sc., M.I.E.E.
L. H. Gray, Ph.D. (*Deputy Director*)
Mrs. S. Hornsey, B.Sc.
Mrs. A. Howard, Ph.D.
P. Howard-Flanders, B.Sc.
G. R. Newbery, B.Sc., A.Inst.P.
S. R. Pelc, D.Phil.
W. B. Powell, B.A.
J. Sharp, B.Sc.
F. S. Stewart, B.Sc., A.M.I.E.E. (*until April*, 1952)
N. Veall, B.Sc.
D. D. Vonberg, B.Sc.
P. J. Waterton, B.Sc.

*Attached Workers*

Miss T. Alper, M.A., M.Sc.
O. C. A. Scott, M.B. (*M.R.C. Scholar*)

*Visiting Workers*

R. A. Dudley, Ph.D. (*Fulbright Memorial Scholar*)
T. Hanley, M.D., M.R.C.P. (*Nuffield Foundation Scholar*)
W. S. Plaut (*Research Scholar, National Cancer Institute, Bethesda*)

The Unit is studying the use of various types of radiation in the treatment of cancer. Radioactive isotopes are being applied also to a number of problems in general medicine. Radiobiological investigations are in progress with the object of obtaining a better control over the differential response of malignant and normal tissue to radiation, the radiation source for this work being a 2 MeV electrostatic generator to be supplemented in due course by a 45-inch cyclotron.

*Summary of Research*

1. Supervoltage X-ray therapy :
   (1) Collaboration in the design of the 10 million volt linear accelerator
   (2) Planning the clinical use of the 10 million volt linear accelerator
   (3) Collaboration in the design of a new, mobile 4 million volt linear accelerator

2. Clinical trial of treatment of cancer of the lung by medium voltage X-rays
3. Radioactive isotopes :
   Therapeutic applications :
   (1) The investigation and treatment of thyroid carcinoma
   (2) Localisation of functional thyroid tissue by means of a directional counter and $^{131}I$ uptake
   (3) The treatment of thyrotoxicosis by a single dose technique employing $^{131}I$
   (4) The treatment of polycythaemia vera and the reticuloses by radioactive phosphorus
   General medical problems :
   (1) The use of radioactive sodium for studies of the circulation in tubed skin pedicles
   (2) The measurement of red cell volume by $^{32}P$ labelled erythrocytes
   (3) The use of radiosodium for studies of placental circulation
   Physical aspects :
   (1) Development of instruments and techniques for the detection and assay of radio-isotopes by electrical counting and ionisation procedures
   (2) The development of photographic procedures for the precise localisation of radioactive substances within the tissues
4. The production and measurement of high voltage electron and neutron beams for radiobiological investigations by means of the 2 MeV electrostatic generator
5. Radiobiological research :
   (1) Chemical changes resulting from absorption of ionising radiation in aqueous solutions
   (2) Cytological damage induced by ionising radiation
   (3) The study of the synthesis of desoxyribonucleic acid, and of nucleoprotein in relation to mitosis, and differentiation by means of autoradiographs showing the localisation of $^{32}P$ and $^{35}S$ incorporated into these molecules
   (4) The disturbance in the above synthetic processes induced by X– and neutron irradiation, and its relation to cytological damage
   (5) The induction of cataract in rabbit lenses by X– and fast neutron irradiation
   (6) The induction of tumours by mono-energetic electron beams
   (7) Collaboration in a study of the effects of electron radiation on the sterility, taste and other properties of food materials
6. Work on the construction of the 45-in. cyclotron

## OTOLOGICAL RESEARCH UNIT

NATIONAL HOSPITAL FOR NERVOUS DISEASES, QUEEN SQUARE, LONDON, W.C.1

(1944)

*Director*

C. S. Hallpike, M.B., F.R.C.P., F.R.C.S.

*Staff*

Miss M. R. Dix, M.B., F.R.C.S. J. D. Hood, Ph.D.

The work of the Unit is concerned with the anatomy and physiology of the temporal bones, and of the VIIIth cranial nerve and its central connexions and also with the changes produced in them by disease. New methods and equipment are being developed for clinical and laboratory investigation of the auditory apparatus.

*Summary of Research*

1. Clinico-pathological investigations, including histological examination, of the temporal bones and central nervous pathways in vertigo, deafness and other organic derangements of cochlear and vestibular function
2. Clinical, anatomical and electro-acoustic investigations of the loudness recruitment phenomeon and other aspects of cochlear function in health and disease of the VIII nerve system
3. Physiological studies of the horizontal semicircular canal system in man
4. Clinical studies of deafness in young children
5. Statistical studies of the test results of vestibular function in normal and pathological subjects
6. New equipment and methods of investigation :
   (1) Design and construction of a new type of revolving chair for the investigation of semicircular canal function
   (2) Design and construction of a new operating ear-microscope (in collaboration with the Royal Naval Scientific Service), and of magnifying spectacles for aural surgery
   (3) Development of large microtome knives, celloidin and other technical aspects of temporal bone microtomy (in collaboration with the National Physical Laboratory and others)
   (4) Improvement of equipment for pure tone audiometry in young children

## WERNHER RESEARCH UNIT ON DEAFNESS*

ROYAL NATIONAL THROAT, NOSE AND EAR HOSPITAL, GOLDEN SQUARE, LONDON, W.1

(1949)

*Director*

T. S. Littler, Ph.D., F.Inst.P.

*Staff*

R. F. Naunton, M.B.
Miss P. H. Strange, B.Sc.
Mrs. E. F. Shutt, B.Sc. (*part-time*)

*Attached Worker*

J. J. Knight, B.Sc., A.Inst.P.

The Unit was established by the Trustees of the Alexander Pigott Wernher Memorial Trust to investigate the medical and physical aspects of deafness. It works in close collaboration with the Institute of Laryngology and Otology, the Royal National Throat, Nose and Ear Hospital's Audiology Unit and its Deaf Children's Clinic, and with the Ministry of Health Hearing Aid Distribution Centre attached to the Hospital.

*Summary of Research*

1. The early diagnosis of deafness in young children and the use of hearing aids, lip reading and auditory training in fitting them for normal education
2. The testing of hearing by bone conduction as a diagnostic procedure ; and the design and development of improved bone conduction hearing aids
3. Improvements in hearing aid equipment
4. Development of methods of alleviation for patients not benefited by existing forms of hearing aids
5. The auditory masking effect of noise and its application to clinical tests of hearing
6. The measurement of auditory recruitment

* Supported by funds made available to the Council by the trustees of the Alexander Pigott Wernher Memorial Trust

## OPHTHALMOLOGICAL RESEARCH UNIT

INSTITUTE OF OPHTHALMOLOGY, JUDD STREET, LONDON, W.C.1

(1948)

*Director*

Sir Stewart Duke-Elder, K.C.V.O., M.D., D.Sc., F.R.C.S., F.A.C.S. (*part-time*)

*Staff*

N. Ambache, M.A., M.R.C.S.
M. E. Langham, Ph.D.
D. M. Maurice, Ph.D.
A. M. Woodin, Ph.D.

*Attached Workers*

C. A. G. Cook, F.R.C.S. (*Institute of Ophthalmology*)
D. P. Greaves, M.B., F.R.C.S. (*Grant from the Alexander Pigott Wernher Memorial Trust Fund*)
A. Lister, M.B., F.R.C.S.
E. S. Perkins, M.B., F.R.C.S. (*Grant from the Alexander Pigott Wernher Memorial Trust Fund*)
J. W. Ridge, B.Sc. (*Grant from the Alexander Pigott Wernher Memorial Trust Fund*)
P. A. Robertson, B.Pharm. (*M.R.C. Grant*)
E. J. Ross M.R.C.S. (*Grant from the Alexander Pigott Wernher Memorial Trust Fund*)
Katharine Tansley, D.Sc. (*Grant from the Alexander Pigott Wernher Memorial Trust Fund*)

The general aim of this Unit is to investigate problems peculiar to the physiology of the eye, particularly the control of the intraocular circulation, the causes of variations in the intraocular pressure, and the metabolism of the non-vascular tissues, that is, of the cornea and the lens. These investigations are being correlated with pathological studies in the Institute of Ophthalmology and Moorfields Hospital, with the particular aim of elucidating the aetiology of glaucoma, cataract and the development of corneal opacities.

*Summary of Research*

1. The intraocular pressure, its measurement and nervous control
2. The pharmacology of the autonomic nervous supply to the eye
3. The circulation of the aqueous humour
4. The blood-aqueous barrier
5. The metabolism of the cornea and of the lens
6. The effect of cortisone on the eye
7. Neutron cataract
8. The histopathology of the retina

## GROUP FOR RESEARCH IN THE PHYSIOLOGY OF VISION

INSTITUTE OF OPHTHALMOLOGY, JUDD STREET, LONDON, W.C.1

(1951)

*Director*

L. C. Thomson, M.B., Ph.D.

*Staff*

H. J. A. Dartnall, Ph.D., F.R.I.C.
R. Gunter, B.A.
R. A. Weale, M.Sc., A.Inst.P.

*Attached Worker*

G. B. Arden, B.Sc.

This Unit is studying the mechanism of sight, with particular attention to the changes in the visual pigments which occur when light is first absorbed by the retina and to the mode of transmission of visual sensations to the brain.

*Summary of Research*

1. A study of the receptive fields of single fibres of the optic nerve of rabbits
2. The electro-retinography of a strain of red Irish setters showing a type of hereditary blindness, and the development of a diagnostic test for this blindness (with Mr. H. B. Parry and Dr. Katharine Tansley)
3. Investigation of two new visual pigments, from the tench and from the bleak
4. Investigation of additional photosensitive pigments in retinal extracts from bleak
5. Standardisation of a grey solution which might be used as a standard density
6. Investigation of the reflectivity of the cat's tapetum
7. Measurement of the absorption of light in the optical media of the eye
8. An examination of 4 cases of total colour blindness (cone monochromatism)
9. Construction of apparatus for measuring the absorption of visual pigment solutions in the visible and ultraviolet regions of the spectrum
10. Investigation of the speed of development of the visual sensation in the human eye
11. Localisation of the site of visual reflexes in the cerebral cortex
12. Investigation of colour vision in cats

## GROUP FOR RESEARCH IN OCCUPATIONAL OPTICS

INSTITUTE OF OPHTHALMOLOGY, JUDD STREET, LONDON, W.C.1

(1949)

*Director*

H. C. Weston, F.I.E.S.

The Group is investigating, and is evaluating methods of easing, the visual strain imposed by different occupational tasks and working conditions.

*Summary of Research*

1. Studies to determine the best conditions of lighting for the performance of different visual tasks
2. Measurement of eye and head postures in bench and desk work
3. Recording and time study of movements of ocular accommodation and convergence in " fine " work
4. The effect upon the facial expression of varying the demands for visual discrimination in the presence of glare
5. Measurement of visual acuity for coloured test-objects presenting no brightness contrast

## UNIT FOR RESEARCH ON THE EXPERIMENTAL PATHOLOGY OF THE SKIN

THE MEDICAL SCHOOL, UNIVERSITY OF BIRMINGHAM

(1952)

*Honorary Director*

Professor J. R. Squire, M.D., F.R.C.P.

*Staff*

C. N. D. Cruickshank, M.D.
P. G. H. Gell, M.D. (*honorary*)
Miss Isobel Hinde, M.B.
B. C. Tate, M.D., F.R.C.P. (*honorary*)

The Unit will be concerned chiefly with the investigation of the inflammatory responses of the skin, and in particular with its behaviour in allergic conditions and with the problem of skin vesiculation. It is proposed to undertake both clinical and pathological studies, and it is hoped to collaborate with industry in the investigation of selected problems of occupational skin disease.

*Summary of Research*

1. The mechanism of hypersensitivity and inflammatory reactions of the skin and its modification by cortisone and ACTH
2. The effects of sensitising agents and toxic substances upon skin cultivated *in vitro*
3. The effects and therapeutic value of cortisone in certain skin conditions, particularly those of allergic origin
4. The mechanism of infection and sensitisation by dermatophytes

## NUTRITION BUILDING

NATIONAL INSTITUTE FOR MEDICAL RESEARCH, THE RIDGEWAY, MILL HILL, LONDON, N.W.7

(1939)

*Director*

Sir Edward Mellanby, G.B.E., K.C.B., M.D., F.R.C.P., F.R.S.

*Staff*

Lady Mellanby, D.Sc.
Mrs. Helen Mellanby, M.D., Ph.D.

The general object of the work in this laboratory is to investigate experimentally the parts played by certain dietetic factors of nutritional importance in the development and function of the tissues and organs of the body.

*Summary of Research*

1. Nutrition research :
   (1) Studies of the action of physiological substances on the growth and development of tissues *in vitro*
   (2) The interaction of some food constituents in the development and composition of bone in young animals
   (3) Conditions affecting the toxic action of methionine sulphoximine produced in the processing of flour by nitrogen trichloride
2. Dental research :
   (1) Analysis of data obtained in surveys among British schoolchildren, relating to caries and other conditions affecting permanent teeth
   (2) Analysis of data obtained in surveys in India
   (3) Surveys among schoolchildren in Australia, New Zealand, and Honolulu
   (4) Analysis and assessment of data obtained in the London section of a three-fold investigation into the effect of sugar on dental caries
   (5) Investigations on the development of teeth *in vitro* under varying conditions

# HUMAN NUTRITION RESEARCH UNIT

MEDICAL RESEARCH COUNCIL LABORATORIES, HOLLY HILL, HAMPSTEAD, LONDON, N.W.3 AND FIELD RESEARCH STATION, FAJARA, GAMBIA, W. AFRICA

(1944)

*Director*

Professor B. S. Platt, C.M.G., M.B., Ph.D.

*Staff*

Miss B. M. Balfour, M.R.C.S.
Miss J. C. Chettle, B.Sc. (*until March*, 1952)
Miss H. M. Dewey, M.Sc.
J. Done, Ph.D.
O. Lindan, M.D., Ph.D.
Mrs. R. Lindan, M.B.
J. A. McFadzean, M.B.
I. A. McGregor, L.R.C.S., L.R.F.P.S., D.T.M.&H.
P. R. Payne, B.Sc.
J. R. Penney, Ph.D., A.R.I.C. (*until June*, 1952)
D. F. White, B.Sc.

*Associated Workers*

(*At the London School of Hygiene and Tropical Medicine*)

F. E. Byron, Ph.D., F.R.I.C.
Miss J. C. Chettle, B.Sc.
Miss M. W. Grant, B.Sc.
D. A. Smith, O.B.E., M.D., D.T.M.&H. (*until Aug.*, 1952)

*Visiting Workers*

O. Bassir, Ph.D. (*until Nov.*, 1951)
J. Nagchaudhuri, B.Sc., M.B.
A. A. Abd El Raheim, M.Sc. (*until Jan.*, 1952)

The staff of the Unit is engaged in a study of the dietary and other factors responsible for the malnutrition which is widespread among peoples in colonial territories. Interrelated studies are being undertaken in villages in the Gambia, at the Field Research Station, and at the Unit's Headquarters at Hampstead.

*Summary of Research*

1. In village areas in the Gambia :
   (1) An assessment of the effects on the health and state of nutrition of the inhabitants of Keneba of the reduction or elimination of parasitic diseases, principally malaria
   (2) Continued study in Protectorate villages, accessible from Fajara, of the effect of protecting infants against malaria
   (3) A study of the effects of a concentrate of vitamin $B_{12}$ on growth and haemoglobin levels in schoolchildren
2. At the Field Research Station :
   (1) Continued study of nitrogen metabolism in Gambian infants and children
   (2) Examination of the pattern of amino-acid excretion in the urine, including a study of the occurrence of $\beta$-amino-iso-butyric acid
3. At the Medical Research Council Laboratories, Hampstead :
   (1) Tritium as a tracer element in the study of protein metabolism
   (2) The isolation of protein from tropical foods and their analysis for amino-acids by specially developed methods
   (3) An experimental study of the relation of changes in the pancreas to the development of deficiency disease syndromes, particularly those caused by shortage of protein and certain amino-acids
   (4) A study of the pigment changes in hair in malnutrition
   (5) The effects on experimental animals of diets similar to those eaten in the Gambia
   (6) Further studies on milk and its role in the infant animal

# DUNN NUTRITIONAL LABORATORY

MILTON ROAD, CAMBRIDGE

(1926)

*Director*

L. J. Harris, Sc.D., F.R.I.C.

*Staff*

M. N. Bland, B.A.
Miss K. M. Clegg, M.Sc.
Miss E. M. Cruickshank, Ph.D.
R. E. Hughes, B.A.
E. H. Kodicek, M.D., Ph. D.
T. Moore, Sc.D. (*Deputy Director*)
I. M. Sharman, Ph.D., F.R.I.C.
R. J. Ward, B.Sc., A.R.I.C.

*Attached Workers*

V. H. Booth, Ph.D. (*Member of scientific staff, Agricultural Research Council*)
S. P. Mistry, Ph.D. (*Indian Institute of Science, Bangalore ; until Jan.*, 1952)
K. K. Reddi, Ph.D. (*Indian Institute of Science, Bangalore ; until Jan.*, 1952)

At the Dunn Nutritional Laboratory the principal interest is research on vitamins, including the physiology of their action, the effects of deficiency, and their estimation in various natural and treated food products.

Special studies are also in progress at the request of various government departments.

*Summary of Research*

1. ACTH and cortisone :
   (1) Effect of ACTH and cortisone on the weight, composition, and structure of the liver and other organs, and on vitamin C metabolism in different species
2. Vitamin C :
   (1) Differentiation of vitamin C from various other naturally occurring indophenol-reducing substances
   (2) Formation of vitamin C in germinating plant tissues
   (3) Study of the joint lesions induced by chronic deficiency of vitamin C and of the influence on them of cortisone
   (4) Determination of the biological activity of concentrates prepared from lucerne
   (5) Survey of the vitamin C resources of the Aden Protectorate
3. Vitamin B complex :
   (1) Mechanism of selection of diets by rats with vitamin $B_1$ deficiency
   (2) Production and study of nicotinamide deficiency in different species
   (3) Influence of intestinal bacteriostatic agents in various B vitamin deficiencies
   (4) Investigations on the chemical nature and biological activity of the " bound form " of nicotinic acid, present in some foods
   (5) Fluorimetric estimation of co-enzymes I and II
4. Vitamin A :
   (1) Influence of vitamin A in protein deficiency
   (2) Effect of deficiency of vitamin A on mineral content of rats' teeth
   (3) Action of vitamin A on growth of BCG
   (4) Effect of hormones on the distribution of vitamin A in animal tissues
   (5) Search for oxidation products of vitamin A in lungs and other organs
   (6) The fate of " vitamin A acid " in the animal organism
   (7) Possible vitamin A activity of cyclopentadiene polymers
   (8) Surveys of the vitamin A and carotenoid content of the blood of normal subjects and of mental patients, and of the vitamin A levels in various skin diseases
   (9) Occurrence of carotenoids in the human gonads
   (10) Study of the importance of vitamin A for farm animals
   (11) Absorption of carotene by vitamin A deficient and non-deficient rats
   (12) Stability of carotene in dried green crop meal

5. Vitamin E :
   (1) The vitamin E-like action of methylene blue
   (2) Studies on the absorption of vitamin E by human subjects
   (3) Surveys of vitamin E levels in normal subjects and in mental patients
   (4) Effects of deficiency of vitamin E on the mineral content of the teeth of rats
6. Vitamin D :
   (1) Occurrence of pro-vitamin $D_3$ (7-dehydrocholesterol) in the sex organs of rats
   (2) Effect of vitamin $D_2$ and other sterols on the growth of micro-organisms
   (3) Chromatographic separation of D vitamins and related substances
   (4) The distribution of vitamin D in the animal body
   (5) Factors influencing the destruction of vitamin D, *in vivo* and *in vitro*
   (6) Influence of adrenalectomy in vitamin D deficiency
   (7) Effect of antibiotics on calcium metabolism, and on the vitamin D content of the tissues
7. Flour "improvers"; cereal fumigants :
   (1) Nutritive value of, and possible production of toxic properties in, flours treated with certain "improvers"
   (2) Influence of fumigants (used for pest control) on the vitamin values of cereals
8. Miscellaneous :
   (1) Attempt to induce kwashiorkor experimentally in rats
   (2) Nutritive value of fresh and conserved green crops, with special reference to protein and carotenoids

## DENTAL RESEARCH UNIT

### KING'S COLLEGE HOSPITAL, LONDON, S.E.5

(1946)

*Director*

The late J. J. D. King, D.Sc., F.D.S.*

*Staff*

Mrs. R. C. Bruce, M.A. (*until Feb.*, 1952)
P. H. Staple, Ph.D., B.D.S.
S. L. Rowles, D.Phil.

The Unit investigates, experimentally and clinically, the biological factors which influence the development and metabolism of the teeth and related tissues, with special reference to their resistance and susceptibility to disease.

*Summary of Research*

1. Biochemistry of saliva and dental calculus (in association with physical studies by Dr. J. Thewlis and Dr. K. Little of the Atomic Energy Research Establishment, Harwell)
2. Aetiology, pathology and prevention of parodontal disease due to calculus
3. Aetiology and pathology of gingival hyperplasia due to sodium diphenyl hydantoinate
4. The effect of the diet of experimental animals in producing lesions resembling dental caries in man

*Dr. King died on November 22nd, 1952, after the end of the period under review.

## UNIT FOR RESEARCH ON THE MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS

CAVENDISH LABORATORY, FREE SCHOOL LANE, CAMBRIDGE

(1946)

*Director*

M. F. Perutz, Ph.D.

*Staff*

F. H. C. Crick, B.Sc.
V. M. Ingram, D.Sc.
J. C. Kendrew, Ph.D. (*part-time*)

*Attached Worker*

H. E. Huxley, M.B.E., M.A. (*M.R.C. Scholar ; until Aug.* 1952)

*Visiting Worker*

J. D. Watson, Ph.D. (*Merck Fellow, California Institute of Technology*)

In this Unit the structure of proteins is being studied by X-ray diffraction, a physical method which has helped to elucidate the arrangement of the atoms in many simpler substances. The X-ray analysis of proteins cannot be expected to demonstrate the positions of individual atoms, but is capable of showing the size and shape of the molecules and the general distribution of matter inside them.

*Summary of Research*

1. X-ray analysis of the structure of crystalline proteins, especially of the haemoglobins of blood and muscle
2. Polypeptide configuration in proteins and synthetic polypeptides
3. X-ray micro-diffraction analysis of living muscle and of the structural changes produced by the presence or absence of adenosine triphosphate
4. Structure of tobacco mosaic virus (in collaboration with the Agricultural Research Council Plant Virus Unit)
5. Development of high-powered X-ray tubes

## BIOPHYSICS RESEARCH UNIT

KING'S COLLEGE, STRAND, LONDON, W.C.2

(1947)

*Honorary Director*

Professor J. T. Randall, D.Sc., F.R.S.

*Senior Biological Adviser*

Miss H. B. Fell, D.Sc., F.R.S.

*Staff*

G. L. Brown, Ph.D.
H. G. Davies, B.Sc., A.Inst.P.
Mrs. M. J. Fraser, Ph.D. (*until March*, 1952)
Miss E. J. Hanson, Ph.D.
Miss A. V. W. Martin, Ph.D.
R. H. Smith, Ph.D., A.R.I.C.
P. M. B. Walker, B.A.
M. H. F. Wilkins, Ph.D. (*Assistant Director*)

*Attached Workers*

F. C. Kelly, M.Sc. (*M.R.C. Scholar*)
B. M. Richards, B.Sc. (*M.R.C. Scholar*)

This Unit is mainly concerned with the study of cells, especially living cells and materials derived from them, and in particular with the nature of protein synthesis and the function of nucleic acids. The methods employed include X-ray diffraction pattern analysis, electron microscopy, and micro-spectrometry in the infra-red, visible, and ultraviolet regions of the spectrum.

*Summary of Research*

1. Molecular structure of collagen
2. Fibrogenesis in tissue culture
3. Molecular structure of crystalline nucleic acid fibres and of nucleoproteins in cells
4. Synthesis of nucleic acids in tissue cultures and in differentiating cells
5. Development of ultraviolet reflecting microscopes for use in cytochemistry
6. Study of living myofibrils

## SPECTROGRAPHIC RESEARCH UNIT

LONDON HOSPITAL, WHITECHAPEL, LONDON, E.1

(1949)

*Director*

E. R. Holiday, B.M.

*Staff*

G. H. Beaven, Ph.D.

E. A. Johnson, D.Phil.

In certain special problems spectral analysis offers advantages over other analytical techniques. The work of the Unit is devoted to improving spectrographic and spectro-photometric techniques and to applying these to problems in chemistry and biochemistry.

*Summary of Research*

1. The chemical structure of vitamin $B_{12}$
2. Distribution of human adult and foetal haemoglobins in red blood cells
3. Preparation of pure pyrimidine and purine derivatives for the determination of definitive absorption spectra
4. Relation between the absorption spectrum and co-planarity in the diphenyl series
5. Studies of purine metabolism

## CELL METABOLISM RESEARCH UNIT

DEPARTMENT OF BIOCHEMISTRY, SHEFFIELD UNIVERSITY

(1945)

*Director*

Professor H. A. Krebs, M.D., F.R.S. (*part-time*)

*Staff*

W. C. Bartley, B.Sc.
R. E. Davies, D.Sc.
D. E. Hughes, B.Sc.

*Attached Workers*

J. S. D. Bacon, Ph.D. (*Department of Biochemistry, University of Sheffield*)
F. J. Bealing, B.Sc. (*M.R.C. Scholar*)
K. Burton, Ph.D. (*Department of Biochemistry, University of Sheffield*)
R. Heyworth, B.Sc. (*M.R.C. Scholar*)
L. E Hokin, M.D. (*American Cancer Society Fellow ; until April*, 1952)
M. A. G. Kaye, Ph.D. (*Department of Biochemistry, University of Sheffield*)
H. G. Klemperer, B.M. (*M.R.C. Scholar*)
H. L. Kornberg, B.Sc. (*Stokes Research Fellow, University of Sheffield*)
P. M. Nossal, Ph.D. (*Australian National Health and Medical Research Council ; until Jan.*, 1952)
W. S. Pierpoint, B.Sc. (*Agricultural Research Council Student*)
P. G. Walker, M.B., Ph.D. (*Graves Research Fellow, University of Sheffield*)
R. Whittam, B.Sc. (*Agricultural Research Council Student*)
T. H. Wilson, M.D. (*American Cancer Society Fellow*)

The Unit is concerned with the study of metabolic processes in which energy is produced or consumed, with special reference to the mechanism of energy transmission. In addition, the properties of various enzymes are being investigated.

*Summary of Research*

1. Metabolic processes :
   (1) Oxidative phosphorylation
   (2) Rate-controlling factors in respiration
   (3) The exchange of inorganic and organic ions *in vitro* and *in vivo*
   (4) Secretory activity of mitochondria
   (5) Water transport by isolated tissues
   (6) The metabolism of urea and bicarbonate in the cat
   (7) Protein synthesis in isolated tissues, especially the synthesis of amylase *in vitro* by surviving slices of pigeon pancreas, and the role of nucleic acid in protein synthesis and protein transport
   (8) Metabolism of dicarboxylic acids in yeasts
   (9) Absorption of glucose from the intestine
   (10) Metabolism of fluorine compounds in bacteria
   (11) Synthesis of lactose in the mammary gland
2. Enzymes :
   (1) The action of hydrolytic enzymes on carbohydrates
   (2) Synthesis of cozymase from nicotinic acid and of co-enzyme A from pantothenic acid
   (3) Enzymes of snake and insect venoms
3. Techniques :
   (1) The development of methods for breaking up bacterial and other microbial cells and for extracting enzymes and other cell constituents
   (2) Separation of phosphorylated intermediate metabolites by paper chromatography
   (3) Isolation and quantitative estimation of oestrogen in tissues
   (4) Separation of oligosaccharides by chromatography

## CHEMICAL MICROBIOLOGY RESEARCH UNIT

SCHOOL OF BIOCHEMISTRY, SIR WILLIAM DUNN INSTITUTE, TENNIS COURT ROAD, CAMBRIDGE

(1944)

*Director*

E. F. Gale, Sc.D., F.R.S.

*Staff*

R. Davies, Ph.D.
B. A. Newton, B.A.
J. Tosic, Ph.D.

*Attached Workers*

L. C. Bigger, Ph.D. (*U.S. National Institutes of Health Fellow*)
O. J. Browne, B.A.
V. A. Knivett, B.A. (*M.R.C. Scholar*)
K. McQuillen, Ph.D. (*University of Cambridge*)
P. Plackett, B.A. (*M.R.C. Scholar*)
P. J. Samuels, B.A. (*M.R.C. Scholar*)

Micro-organisms provide admirable material for the study of the synthesis of proteins and their organisation as enzymes within the living cell. The investigations in this Unit are mainly concerned with the biochemistry of these processes in bacteria and yeasts, and with the ways in which such processes can be inhibited by antibiotics.

*Summary of Research*

1. The assimilation and metabolism of amino-acids by bacteria and yeasts
2. The conditions for synthesis of peptides, proteins and nucleic acids by a variety of micro-organisms
3. Electrophoretic studies of the nature of the bacterial surface and the effect of drugs upon its charge
4. Factors controlling the inheritance of enzymic activities and their adaptive capacity in micro-organisms
5. Points of interference in bacterial anabolic processes by various chemotherapeutic agents, with special reference to the mode of action of antibiotics
6. The accumulation of sodium and potassium ions by micro-organisms

## GROUP FOR RESEARCH IN CHEMOTHERAPY

MOLTENO INSTITUTE, DOWNING STREET, CAMBRIDGE

(1927)

*Director*

Miss A. Bishop, Sc.D.

*Staff*

Miss E. W. McConnachie, M.A.

This Group is studying the biology of protozoa, and the effect on their metabolism of chemotherapeutic drugs, with particular reference to the mechanism of development of drug-resistant strains of the organism.

*Summary of Research*

1. Factors determining gametocyte production of *Plasmodium gallinaceum* treated with sub-inhibitory doses of sulphadiazine or proguanil
2. Cross-resistance tests of the relationship of a synthetic pteridine compound to other antimalarials which are folic acid antagonists
3. The sensitivity of *Entamoeba invadens* to emetine and three quinoline compounds
4. The effect of bacterial flora upon the growth and development of *E. invadens*, and its adaptation to increased environmental temperature

## DEPARTMENT FOR RESEARCH IN INDUSTRIAL MEDICINE

LONDON HOSPITAL, E.1 AND MEDICAL RESEARCH COUNCIL LABORATORIES, HOLLY HILL, HAMPSTEAD, LONDON, N.W.3

(1943)

*Physician-in-Charge*

D. Hunter, M.D., F.R.C.P. (*part-time*)

*Staff*

Miss P. L. Bidstrup, M.B., M.R.C.P.
J. A. L. Bonnell, M.B.
R. G. Drew, B.Sc.
D. G. Harvey, M.B.E., Ph.D.
E. King, B.Sc.
D. J. Lawford, B.Sc.

The Department investigates substances and processes which may constitute occupational hazards in industry or in agriculture.

*Summary of Research*

1. Experimental work on the electrostatic precipitator and electronic dust counter

2. Mercury :
   (1) The effect of mercury on enzyme systems in experimental animals
   (2) The distribution of mercury in the tissues of animals, following inhalation of mercury vapour
   (3) The effects of mercury storage on the histology and functions of tissues
   (4) Modification of the Buckell technique for the analysis of mercury in the atmosphere
3. Dinitro-*ortho*-cresol :
   (1) Investigation of cases of DNOC poisoning
   (2) Modification of Parker's method of estimating DNOC in serum, for use on small quantities (0·1 ml) of whole blood
   (3) Further experiments on the metabolism of DNOC in animals
   (4) Comparative toxicity of commercial preparations of DNOC
4. Organo-phosphorus insecticides :
   (1) Follow-up study of cases of paralysis due to poisoning by *bis*-mono-isopropyl aminofluoro-phosphine oxide
   (2) Investigation of cases of acute organo-phosphorus poisoning in greenhouse workers
   (3) Pilot study of effects on nurserymen of repeated small exposures to parathion
   (4) Investigations on the excretion and metabolism of *para*-nitrophenol, a metabolite of parathion, and a comparison with other nitro-compounds, including dinitro-phenol, dinitro-*ortho*-cresol and dinitro-*ortho*-naphthol (Martius yellow)
5. Beryllium :
   Follow-up study of patients with symptoms and signs suggestive of chronic berylliosis
6. Carcinoma of the lung in the chromate-producing industry :
   Follow-up study of workmen examined in 1949–50
7. Chronic cadmium poisoning :
   (1) Preliminary inquiries in industries where cadmium is used, other than the storage-battery industry
   (2) Investigation of patients with symptoms and signs suggestive of chronic cadmium poisoning
8. Investigation of cases of poisoning due to lead, mercury, benzene and other substances

## INDUSTRIAL INJURIES AND BURNS RESEARCH UNIT

BIRMINGHAM ACCIDENT HOSPITAL, BATH ROW, BIRMINGHAM, 15

(1952)

*Director*
J. P. Bull, M.D.

Professor J. R. Squire, M.D., F.R.C.P. (*Honorary Director until April*, 1952)

*Staff*

C. N. D. Cruickshank, M.D., D.I.H. (*until April*, 1952)
N. W. J. England, M.B.
Miss A. J. Fisher, B Sc.
Miss J. E. Fox, B.Sc.
D. MacG. Jackson, M.B., F.R.C.S. (*part-time*)
E. J. L. Lowbury, B.M.
C. R. Ricketts, Ph.D., F.R.I.C.
S. Sevitt, M.Sc., M.D., F.R.C.P.I., D.P.H. (*part-time*)
Miss E. Topley, M.D.

This Unit is the successor of both the Industrial Medicine Research Unit and the Burns Research Unit. It aims to continue and extend their studies on the local and general pathology of injuries, and on the occurrence of infection, as well as on methods of prevention and treatment. The Unit is housed in the Birmingham Accident Hospital and works in close liaison with the hospital staff.

*Summary of Research*

1. The types, causes and prevention of common industrial injuries; in particular, those due to swarf and other hazards of machine tool workers
2. General response to trauma :
   (1) Biochemical studies of shock due to burns, and of fluid and electrolyte requirements in its treatment
   (2) Evaluation of dextran as a plasma substitute
   (3) The role of blood transfusion in the clinical management of extensive trauma and burns
   (4) Study by Ashby agglutination technique of the fate of transfused cells, in relation to the anaemia following extensive trauma and burns
   (5) Adrenocortical activity in burns and trauma, with special reference to endocrine failure
   (6) Histological studies on human burn necropsy material
3. Special aspects of pathology and treatment of injuries :
   (1) Chemotherapy and chemoprophylaxis of burns infected with *Staph. aureus*, including clinical trials of local aureomycin and bacteriophage ; the antibiotic resistance, phage pattern and toxin production of the infecting staphylococci
   (2) The immune responses to *Ps. pyocyanea* in burned patients and in immunised rabbits
   (3) Further studies on the mechanism of transfer of burns infection, including experiments on a disinfectant barrier for use in dressings
   (4) The development of dextran sulphate as an anticoagulant for clinical and laboratory use ; study of the relation between the molecular features of sulphated polysaccharides and their biological behaviour
   (5) Effect of antihistamine drugs on the local changes in experimental human burns
   (6) The role of homografts in the treatment of burns

## PNEUMOCONIOSIS RESEARCH UNIT

LLANDOUGH HOSPITAL, PENARTH, GLAMORGANSHIRE

(1945)

*Director*

J. C. Gilson, O.B.E., M.B., M.R.C.P.

C. M. Fletcher, M.D., F.R.C.P. (*Director until March*, 1952)

*Staff*

R. G. H. B. Boddy, Ph.D.
R. G. Carpenter, B.A.
W. G. Clarke, M.S.R.
A. L. Cochrane, M.B.E., M.B., D.P.H.
J. E. Cotes, B.M., M.R.C.P.
I. Davies, C.B.E., M.D., M.R.C.P., D.P.H. (*part-time*)
E. O. Henschel, M.D., T.D.D. (*until July*, 1952)
P. Hugh-Jones, M.D., M.R.C.P. (*until Jan.*, 1952)
M. C. S. Kennedy, M.R.C.S.
G. S. Kilpatrick, M.B., M.R.C.P.E.
Mrs. M. McDermott, B.Sc.
C. B. McKerrow, M.D., M.R.C.P.
R. F. Mahler, M.B., M.R.C.P. (*until March*, 1952)
W. E. Miall, M.B.
T. G. Morris, Ph.D.
P. D. Oldham, M.A.
D. Rivers, L.M.S.S.A.
S. A. Roach, B.Sc.
A. D. Thomas, B.Sc. (*until Sept.*, 1952)
G. G. Thomas, Ph.D. (*until Dec.*, 1951)
V. Timbrell, Ph.D., A.R.C.S.
H. H. Watson, B.Sc., F.Inst.P. (*until Jan.*, 1952)
B. M. Wright, M.B.

The Unit is investigating the medical and biological aspects of pneumoconiosis, and is developing improved techniques for dust sampling and analysis and for chest radiography. Studies are being undertaken also on other chronic pulmonary diseases, such as tuberculosis, bronchiectasis, emphysema and bronchitis, which are commonly associated with pneumoconiosis.

1. Epidemiology :
   (1) Investigation of the possibility of control of tuberculous infection in a mining community, by means of mass radiography with the isolation and education of sputum-positive individuals ; the effect of these measures on the attack rate of tuberculosis and massive fibrosis in miners
   (2) Collaboration with the National Coal Board in a series of combined radiological and dust sampling surveys at a number of mines throughout the country
2. Dust sampling and analysis :
   (1) The design of an automatic dust sampling apparatus devised to enable the dust exposure of miners to be measured over long periods
   (2) The design of other instruments for the collection of dust samples suitable for physical and chemical analyses
3. Clinical investigations :
   (1) A controlled trial of the value of isonicotinic acid hydrazide in the treatment of early cases of complicated pneumoconiosis
   (2) A study of the incidence of rheumatoid arthritis occurring in association with massive fibrosis
   (3) A controlled trial of the value of aluminium therapy in cases of silicosis in the pottery industry
   (4) The investigation of patients with bronchiectasis, discovered in a survey of a mining community
4. Physiological studies :
   The investigation of pulmonary function in patients suffering from pneumoconiosis and other disabling chronic respiratory diseases
5. Radiological studies :
   (1) The development of radiographic techniques for use in field work
   (2) Studies of observer-error in radiological diagnosis, in collaboration with workers from other European countries
6. Experimental pathology :
   (1) The effect of exposure of animals to dusts of various compositions, including samples of airborne dusts obtained from mines
   (2) The effect of particle size on the inhalation and retention of dust (using a cloud of spherical glass particles of known diameter)
   (3) The effect of prolonged inhalation of tobacco smoke on the lungs of mice

## TOXICOLOGY RESEARCH UNIT

SERUM RESEARCH INSTITUTE, WOODMANSTERNE ROAD, CARSHALTON, SURREY
(1947)

*Director*
J. M. Barnes, M.B.

*Staff*

W. N. Aldridge, Ph.D.
G. V. R. Born, M.B., D.Phil.
K. K. Cheng, M.B., Ph.D.
A. N. Davison, B.Sc., B.Pharm.
F. A. Denz, M.Sc., M.D.
Miss J. I. McDougal, B.Sc.
V. H. Parker, B.Sc.

The Unit is studying a number of toxic materials selected for their economic importance and for the light their study may throw on the mode of action of poisons in general.

*Summary of Research*

1. The mode of action of organophosphorus insecticides :
   (1) The mechanism of the inhibition of the cholinesterase enzymes
   (2) The reversal and recovery from inhibition *in vitro* and *in vivo*
   (3) Factors in the production of demyelination by certain inhibitors of cholinesterase
   (4) The effect of inhibition of cholinesterase on the production of acetylcholine
2. The effect of dinitrophenol on adenosine triphosphate and similar compounds in the tissues of poisoned animals
3. Biochemical changes in pulmonary tissue in oedema of the lung
4. Factors influencing the response of the liver to toxic agents

## ENVIRONMENTAL HYGIENE RESEARCH UNIT

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, KEPPEL STREET, LONDON, W.C.1, AND MEDICAL RESEARCH COUNCIL LABORATORIES, HOLLY HILL, HAMPSTEAD, LONDON, N.W.3

(1950)*

*Director*

T. Bedford, D.Sc.

*Staff*

F. A. Chrenko
C. N. Davies, D.Sc., F.Inst.P.
J. McK. Ellison, B.A.
D. W. Jordan, B.Sc.
O. M. Lidwell, D.Phil.
F. E. E. Smith
G. W. Spicer, M.Sc.
Miss B. E. Tredre, B.Sc.
D. Turner, M.Sc.
W. L. Welman, B.Sc.
Mrs. D. W. Peetz (née C. V. Williamson), B.Sc.

The staff of the Unit is concerned with those factors of the atmospheric and thermal environment which affect health, comfort and efficiency.

*Summary of Research*

1. Heating and ventilation :
   (1) Effects of heated ceilings on comfort, and of a cold wall when the ceiling is heated
   (2) Effects of heated floors on comfort
   (3) Investigation of the air-conditioning of the House of Commons in relation to the comfort of Members
   (4) Thresholds of perception of warmth and air movement
   (5) Factors contributing to " freshness " in an environment
   (6) Measurement of small changes in skin temperature
   (7) Radiant heat exchanges between man and his surroundings ; studies with models of approximately the size and shape of the human body
   (8) Variability of air movement in ventilated rooms
   (9) Further development of the ion anemometer
2. Naval hygiene :
   (1) Statistical examination of indices of thermal stress
   (2) Thermal insulation of gunhouses
   (3) Sickness incidence in H.M. ships in relation to climatic conditions
   (4) Prediction of thermal conditions in ships

* Previously the Group for Research in Industrial Physiology (1938)

3. Air hygiene :
   (1) Analysis of experimental data on effects of indirect ultraviolet irradiation of schools (with Dr. R. E. O. Williams and Dr. D. D. Reid)
   (2) Epidemiological studies of the common cold in families and in offices (with Dr. R. E. O. Williams)
   (3) Experiments on a test method for formaldehyde disinfection
   (4) Design and testing of semi-automatic apparatus for the measurement of ventilation and environmental conditions, and for the sampling of airborne micro-organisms
4. Industrial dusts :
   (1) Methods of air filtration
   (2) Mode of action of cyclones and other dust separators
   (3) Trajectories of dust particles approaching a rod
   (4) Aspiration of dust into sampling orifices
   (5) Optical assessment of coal-dust concentrations
   (6) Scattering of light by suspensions of quartz particles
   (7) Relation between the amount of dust retained in lungs and the degree of industrial exposure
   (8) Fractionation of house dust for the detection of allergens

## CLIMATE AND WORKING EFFICIENCY RESEARCH UNIT

### DEPARTMENT OF HUMAN ANATOMY, UNIVERSITY MUSEUM, OXFORD

(1948)

*Honorary Director*

Professor W. E. Le Gros Clark, M.D., D.Sc., F.R.C.S., F.R.S.

*Staff*

H. D. Darcus, B.Sc., B.M.
K. Hellman, D.Phil.
R. F. Hellon, B.Sc.
R. M. Jones, M.A.
K. A. Provins, M.A.
Miss A. E. Salter, B.Sc.
A. G. McD. Weddell, M.D., D.Sc. (*Honorary*)
J. S. Weiner, Ph.D., M.R.C.S. (*Honorary*
R. J. Whitney, Ph.D.

*Visiting Workers*

Major J. M. Adam, B.Sc., M.B., R.A.M.C. (*Royal Army Medical College, Millbank*)
Surgeon Lieutenant Commander B. Geoghegan, M.R.C.S. (*Royal Naval Medical School, Alverstoke*)

Climatic studies are in progress on the physiology of sweating and on the effect of high temperatures on the circulatory system and on kidney function. The working efficiency section of the Unit is concerned with the investigation of problems of applied anatomy and physiology in relation to the working environment.

*Summary of Research*

1. The physiology of climatic adaptation :
   (1) The limits of tolerance for work at high temperatures and humidity and the effect of " heat stress " in relation to age, physique and race (in co-operation with the Royal Naval Tropical Research Unit, Singapore)
   (2) The investigation of circulatory changes during acclimatisation to heat
   (3) Excretion of antidiuretic substance during heat exposure
   (4) Histochemistry of sweat glands
   (5) Improvement of a technique for recording skin temperature

2. Working efficiency :
   (1) The application of strain-gauge dynamometry to the measurement of muscle strength and the analysis of muscle action
   (2) The investigation of the effects of repeated muscular exertion on the strength of normal and paretic muscles
   (3) The simultaneous measurement of the electrical activity of muscles and applied muscle strength
   (4) The measurement of the amplitude of joint movement
   (5) A study of the anatomical and physiological factors involved in turning rotatory manual controls, such as cranks and hand wheels, against heavy loads
3. Research on *ad hoc* problems includes :
   (1) The design of seats and standing supports for the Services and for industry
   (2) The design of optical sights for the Royal Navy
   (3) The manual loading of guns
   (4) Postural problems in cartography
   (5) Analysis of photogrammetric records for anthropometric purposes

## ROYAL NAVAL TROPICAL RESEARCH UNIT*

*(Jointly with the Admiralty)*

MEDICAL FACULTY, UNIVERSITY OF MALAYA, SEPOY LINES, SINGAPORE 3

(1948)

*Director*

Surgeon Commander F. P. Ellis, O.B.E., M.D., M.R.C.P., R.N.

*Staff*

Miss H. M. Ferres, M.Sc.
Captain R. H. Fox, M.B., R.A.M.C.
Surgeon Lieutenant Commander R. T. John, M.B., R.N. (*until Nov.*, 1951)
A. R. Lind, B.Sc.
R. K. Macpherson, M.Sc., M.D.
P. S. B. Newling, B.Sc.
R. D. Pepler, B.A. (*until June*, 1952)

*Administrative Officer*

Senior Commissioned Wardmaster J. T. L. Burns, R.N.

*Associated Workers*

Ezer Griffiths, O.B.E., D.Sc., Hon.M.Inst.R., F.R.S. (*National Physical Laboratory*)
J. O. Irwin, Sc.D., D.Sc. (*Statistical Research Unit, London School of Hygiene and Tropical Medicine*)
R. M. Jones, B.Sc. (*Climate and Working Efficiency Research Unit and Department of Statistics, Oxford*)
Lee Teow Seng (*Department of Physiology, University of Malaya*)
You Poh Seng, Ph.D. (*Department of Economics, University of Malaya*)
F. E. E. Smith (*Environmental Hygiene Research Unit, London School of Hygiene and Tropical Medicine*)
J. S. Weiner, Ph.D., M.R.C.S. (*Climate and Working Efficiency Research Unit, Oxford*)

This Unit, which was established jointly with the Admiralty, is investigating the thermal conditions which may cause ill-health or physical or psychological inefficiency in the tropics.

*Summary of Research*

1. Physiological reactions of man to warm and hot environments under varying conditions of air temperature, humidity, radiant heat, air movement, clothing and rates of work, and in varying states of acclimatisation
2. The effects of hot climates on human performance and alertness
3. Determination of thermal conditions necessary for comfort
4. Measurement of the amount of radiant heat absorbed under given conditions, by the use of " metal " men
5. Measurement and assessment of the effects of climatic conditions between decks in warships in the tropics

* The Unit was dissolved in March, 1953.

6. Nature of fatigue among naval personnel in the tropics
7. Effect of variations in air temperature on morbidity among men on board ships of the Royal Navy (with the Environmental Hygiene Research Unit)
8. Preliminary studies of physiological responses to heat in people of different races
9. Trials of an ion-anemometer for measuring turbulent air currents, and of a solar still, for distilling fresh water from sea-water, suitable for use by castaways

## GROUP FOR RESEARCH ON BILHARZIA DISEASE

WINCHES FARM, HATFIELD ROAD, ST. ALBANS

(1947)

*Director*

J. Newsome, M.B., D.T.M. & H.*

*Staff*

L. Mirabel, M.B., M.R.C.P.E. (*until July*, 1952)

This Group is studying the aetiology and treatment of bilharzia disease—a widespread cause of illhealth in the tropics.

*Summary of Research*

1. Trials of Miracil compounds in bilharzia infections of animals and man
2. Investigation of diet, repeated infection and hyper-infection, as aetiological factors in bilharzial cirrhosis in baboons and small animals
3. Investigation of the basic causes of the activity of the xanthone drugs

## APPLIED PSYCHOLOGY RESEARCH UNIT

PSYCHOLOGICAL LABORATORY, DOWNING PLACE, CAMBRIDGE

(1944)

*Director*†

N. H. Mackworth, M.B., Ph.D.

*Staff*

Mrs. E. Belbin, B.A. (*part-time*
R. M. Belbin, Ph.D.
D. E. Broadbent, M.A.
R. B. Buzzard, B.M.
Miss V. R. Cane, M.A.
A. Carpenter, M.B.
E. G. Chambers, M.A.
R. Conrad, B.A.
E. R. F. W. Crossman, B.A.
Miss J. Elliott, B.A.
E. Farmer, M.A.
D. C. Fraser, M.Sc.
C. B. Gibbs
R. L. Gregory, B.A.
A. D. Harris, M.R.C.S.
Mrs. N. Harris, B.Sc.
Miss A. W. Heim, Ph.D.
W. E. Hick, M.D.
R. E. F. Lewis
R. D. Pepler, B.A.
E. C. Poulton, M.B.
Mrs. E. C. Roberts, B.A.
B. S. Shackel, M.A.
W. J. Shaw, B.A., Ll.B.
G. J. Siddall, B.A.
Mrs. V. E. Simmonds (*until Sept.*, 1952)
Miss M. A. Vince, B.A.
P. B. Waldron, B.A.
Miss M. M. Woodhead

*Attached Workers*

A. E. Bursill, B.A. (*National Coal Board*)
Sick Berth Petty Officer G. Joisce, R.N.
Wardmaster A. G. White, R.N.

The Unit investigates the principles governing the performance of work under different conditions and studies their practical application to particular tasks undertaken in industry or the Services. The researches range from physiological to sociological studies, with the general aim of enabling people to work more effectively and with less fatigue and fewer accidents.

*Since appointed resident director of the Field Research Station in the Gambia

†Professor Sir Frederic Bartlett was honorary director of the Applied Psychology Research Unit until his retirement in September, 1952 ; he now acts as honorary consultant to the Unit. Professor G. S. Drew also acts in this capacity.

*Summary of Research*

1. Problems of bodily and mental skill :
   (1) Anticipation and forethought in human performance
   (2) Speed and load stress in a variety of skilled performances in laboratory and factory
   (3) Display and control in machine operations
   (4) The nature of the peripheral and central nervous processes which select and use perceptual evidence in the interests of skilled action
   (5) The ways in which information can be efficiently used when conveyed to a listener along a number of channels simultaneously
   (6) Studies of hearing through stethoscopes
   (7) Principles of synthetic training
2. The effects of abnormal environments :
   (1) The effect on performance of exposure to high degrees of heat and humidity
   (2) Local adaptation to extreme cold
   (3) The effect on performance of prolonged exposure to very loud noise
   (4) Investigation of the effects of lack of sleep
3. Mental tests :
   (1) Methods of selection of medical students, including the development of new types of test examination
   (2) The effect of practice on score levels in intelligence tests
   (3) The effect of apparent test difficulty in intelligence scores
   (4) Development of a new series of spatial perception tests
4. Road research problems :
   Driver reactions on the road under experimental conditions

## GROUP FOR RESEARCH IN INDUSTRIAL PSYCHOLOGY

UNIVERSITY COLLEGE, LONDON, W.C.1, AND OTHER CENTRES

(1918)

*Honorary Director*

Professor R. W. Russell, Ph.D.

S. Wyatt, D.Sc. (*Director ; until June*, 1952)

*Staff*

H. Campbell, M.A.
Miss Norah M. Davis, Ph.D. (*Assistant Director*)
R. A. Denerley, B.A.
Mrs. I. C. Grant, M.A.
D. E. R. Hughes
Mrs. Y. H. Kapp
R. Marriott, M.Sc. (*Assistant Director*)
Mrs. D. M. Z. Pool (*until April*, 1952)
F. G. L. Stock
Mrs. C. Tenen, Ph.D. (*until Aug.*, 1952)
J. Walker, M.A.
J. W. Whitfield, M.A. (*Honorary Deputy Director*)

The general aim has been to study the effects and relative importance of factors in industry which tend to promote satisfaction or cause discontent, and to assess the value of the methods used in this type of study.

*Summary of Research*

1. The merits and defects of some incentive payment schemes and their effects on workers
2. Relation between paid sick leave and absence from work
3. Analysis of causes of personal and social conflict in various groups of semi-skilled and unskilled workers
4. Studies of two merit-rating schemes for clerical and industrial workers
5. Studies of group methods of working
6. Appraisal of some interview methods for obtaining research data on industrial problems

## UNIT FOR RESEARCH IN OCCUPATIONAL ADAPTATION

MAUDSLEY HOSPITAL, DENMARK HILL, LONDON, S.E.5

(1948)

*Honorary Director*

Professor Aubrey Lewis, M.D., F.R.C.P.

*Staff*

L. E. D. Barber, B.Sc.
J. H. Champness, M.A. (*until May*, 1952)
Mrs. F. Eisler, Ph.D.
Alastair Heron, Ph.D.
F. Loos, Ph.D.
M. Markowe, M.D., D.P.H., D.P.M.
N. O'Connor, Ph.D.
J. Tizard, B.Litt., Ph.D.
P. H. Venables, B.A.
K. A. Yonge, M.D., C.M. (*until Sept.*, 1952)

The influence of psychological abnormality upon the ability to work steadily and productively is being investigated from the medical and social standpoints. Special attention is given to the employability of high-grade mental defectives, to the effects of neurotic or psychopathic personality upon output and labour turnover, and to the objective analysis of the interview as a means of detecting personality traits.

*Summary of Research*

1. The relationship between mental health, labour mobility and occupational adaptation in unskilled male and female workers in an engineering firm, and in male bus conductors in a large municipal transport undertaking
2. Experimental studies of the importance of motivation and methods of work in the training of imbeciles
3. Survey of the occupational attainments of high-grade defectives who are under statutory supervision
4. The variations in the speed and content of linguistic behaviour of adults in interviews carried out under different conditions

## SOCIAL MEDICINE RESEARCH UNIT

CENTRAL MIDDLESEX HOSPITAL, ACTON LANE, LONDON, N.W.10 AND DEPARTMENT OF MIDWIFERY, ABERDEEN UNIVERSITY

(1948)

*Director*

J. N. Morris, M.A., M.R.C.P., D.P.H., D.C.H.

*Staff*

E. M. Backett, B.Sc., M.B., M.R.C.P.
Miss E. H. L. Duncan, B.Sc.
J. C. G. Evans, M.B. (*part-time*)
Miss E. M. Goldberg
J. A. Heady, M.A.
R. Illsley, B.A.
V. B. Kanter, M.A.
Miss E. M. Scott, M.A.
Miss L. A. E. Shaw, M.A.
C. F. Stevens, B.A.
Miss E. D. B. Thompson, B.A.
P. M. Turquet, M.R.C.S., D.P.M. (*part-time*)

*Attached Worker*

D. H. Allcorn, B.A. (*Halley Stewart Trust research student in Social Anthropology*

The Unit is investigating social factors influencing health and sickness, and their interaction with other factors.

*Summary of Research*

1. Reproduction :
   (1) The clinical, psychological and environmental factors affecting the reproductive performance of primiparous women (jointly with the Department of Midwifery, University of Aberdeen)
   (2) Biological, social and medical factors affecting stillbirths, infant mortality and mortality in the second year of life (jointly with the General Register Office)
2. Duodenal ulcer :
   Family relations, personality development and duodenal ulcer in young men
3. Coronary disease :
   (1) The incidence of coronary heart disease in various occupations
   (2) The importance of coronary heart disease and hypertension as causes of death ; the value of the death certificate as a source of information
4. Medical and social services :
   (1) The work of the general practitioner in relation to current trends in medicine, in social services, in family life, and in the population
   (2) The needs of different types of family on a local general practitioner's list for medical and social services

## STATISTICAL RESEARCH UNIT

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, LONDON, W.C.1

(1926)

*Honorary Director*

Professor A. Bradford Hill, C.B.E., D.Sc.

*Staff*

P. Armitage, Ph.D.
J. T. Boyd, M.B., D.P.H. (*part-time*)
W. R. S. Doll, M.D., M.R.C.P.
J. O. Irwin, Sc.D.
J. Knowelden, M.D., D.P.H. (*part-time*)
W. J. Martin, D.Sc.
I. Sutherland, D.Phil.

The Unit is concerned with the development and application of statistical methods in medicine and in its associated sciences, including research into the epidemiology and aetiology of disease, the promotion and analysis of vital statistics, the design and analysis of therapeutic trials of new drugs and other agents, the design and analysis of field trials of prophylactic agents, the application of mathematical-statistical techniques to the solution of laboratory problems and the development of methods of biological assay. The investigations listed below include not only the individual researches of members of the Unit's staff but also the main items of collaborative work with Council and other scientific workers.

*Summary of Research*

1. The epidemiology and aetiology of disease :
   (1) The aetiology of cancer of the lung, with particular reference to smoking
   (2) The aetiology of cancer of the cervix of the uterus
   (3) The effects upon the infant of virus diseases in the pregnant woman
   (4) The role of activating agents in the production of poliomyelitis
   (5) Social and environmental factors in chronic bronchitis
   (6) The epidemiology of upper respiratory infections
   (7) The epidemiology of industrial epidermophytosis

2. Therapeutic trials :
   (1) The aetiology, treatment and prognosis of gastric ulcers
   (2) Therapeutic trials of various drugs in respiratory tuberculosis
   (3) Therapeutic trials of cortisone, ACTH and related substances in rheumatic fever and in chronic rheumatic diseases
   (4) Therapeutic trials of antibiotics in whooping cough, bronchiectasis and infantile gastro-enteritis
   (5) Therapeutic trials of cortisone in ulcerative colitis
   (6) Trials of analgesics in midwifery
   (7) The domiciliary treatment of respiratory tuberculosis
   (8) Trials of hormone therapy in pregnant diabetics
3. Field trials of prophylactic agents :
   (1) Field trials of whooping cough vaccines
   (2) Field trials of BCG in the prevention of tuberculosis in children leaving school
   (3) Field trials of influenza vaccines
4. Application of mathematical and statistical techniques to laboratory problems :
   (1) Statistical problems involved in experiments to determine mutation rates of bacteria
   (2) The carcinogenic action of mineral oils
   (3) The heredity in rats of the output of nicotinamide methochloride
   (4) Injections of cortisone and ACTH in relation to the production of erythema
5. Methods of biological assay :
   The biological assay of whooping cough vaccines
6. Other studies :
   (1) The ability of man to withstand warm and hot environments
   (2) The incidence of homologous serum jaundice
   (3) Blood clotting in normal persons in relation to injections of antibiotics
   (4) The resettlement of disabled persons in industry
   (5) Sugar in children's diets in relation to the development of caries
   (6) Vitamin D in the tissues of the rat after ingestion of calciferol

## SERUM RESEARCH INSTITUTE*

WOODMANSTERNE ROAD, CARSHALTON, SURREY

(1947)

*Acting Director*

L. F. Hewitt, Ph.D., F.R.I.C.

*Staff*

Miss A. M. Brown, Ph.D.
Miss S. M. Lanham, B.Sc.
Miss E. J. McKillop, B.Sc.
Mrs. E. W. Sindall, B.Sc.
Miss M. J. Smith, B.Sc. (*until Nov.*, 1951)

*Attached Worker*

Mrs. B. Hewitt, M.P.S. (*honorary, part-time*)

Studies are in progress on aspects of immunology, serology, epidemiology and cognate microbiological and biochemical problems.

*This building also houses the Toxicology Research Unit.



(57424) D 3

*Summary of Research*

1. Effect of bacteriophage on bacterial evolution and epidemiology :
   (1) Selection of mutants by bacteriophage
   (2) Bacteriophage and serological specificity
   (3) Effect of phage on virulence and toxigenicity
   (4) Adaptation of bacteriophage
   (5) Development of phage-resistance and lysogenicity
   (6) Biochemistry of phage phenomena
2. Bacterial virulence and toxigenicity :
   (1) Relation to cellular enzymes and pigments
   (2) Effect of drugs and other chemicals
   (3) Relation to bacterial variation and serological type
3. Chemotherapy and antibiotics :
   (1) Treatment of carriers and chronic infections
   (2) Oral administration of antibiotics
   (3) Development of bacterial resistance
4. Whooping cough :
   (1) Study of antigens of *Haemophilus pertussis* and their relation to immunity
   (2) Evaluation of antigenicity of vaccines
5. Haemolytic streptococcal infections :
   (1) Study of haemolysins and antistreptolysin sera
   (2) Relation of streptolysins to rheumatic fever
6. Conjugated proteins :
   (1) Study of polysaccharide complex in proteins
   (2) Investigation of nucleoproteins

## ANTIBIOTICS RESEARCH STATION

4 ELTON ROAD, CLEVEDON, SOMERSET

(1949)

*Director*

B. K. Kelly, B.A.

*Staff*

Miss P. F. Boyd, B.Sc.
R. C. Codner, B.Sc.
C. W. Hale, A.R.I.C.
G. A. Miller
Miss N. Smith, B.Sc.

A survey of organisms known to produce antibiotics is being undertaken. Whenever an antibiotic is thought to be clinically promising, fermentation and extraction problems are studied with a view to producing sufficient for its clinical possibilities to be assessed.

Assistance is also given to other Council workers by carrying out fermentations and extractions on a scale larger than is convenient in the ordinary laboratory.

*Summary of Research*

1. The examination of some Basidiomycetes and Actinomycetes for antibiotic production
2. The production and investigation of clinically promising new antibiotics, including cephalosporin P1, cephalosporin N, and ageritin
3. The production of the enzyme desoxyribonuclease
4. The mass cultivation of bacteria

# LABORATORY ANIMALS BUREAU

MEDICAL RESEARCH COUNCIL LABORATORIES, HOLLY HILL, HAMPSTEAD, LONDON, N.W.3

(1947)

*Director*

W. Lane-Petter, M.B.

*Staff*

F. J. Dyer, Ph.D.

The main object is to collect and disseminate information about the supply of all species of laboratory animals, with a view to assisting laboratories to obtain animals of the type and quality best suited for their work. The Bureau provides an information exchange, but not a depot of animals. Opportunity is also taken to carry out investigations on problems relating to laboratory animals.

*Summary of Activities*

1. Collection and dissemination of information about the supply, breeding, maintenance and use of laboratory animals
2. Consultation, by personal visits and by correspondence, on the subject of laboratory animals
3. Administration of an accreditation scheme for breeders of guinea pigs, mice and rabbits, and production of a bulletin
4. Organisation of an annual congress for animal technicians
5. Distribution twice a year of a news letter, summarising current activities and indicating services available to laboratory workers : and of technical notes and other material on special problems relating to laboratory animals
6. Investigation of problems of small animal husbandry, and of animal house equipment
7. Comparison of different strains of guinea pigs for digitalis assay

# Members of the Council's External Scientific Staff and their Co-workers

## CAMBRIDGE

MOLTENO INSTITUTE, CAMBRIDGE UNIVERSITY

*Medical Research Council Staff*

H. W. Laser, M.D., Sc.D.

*Summary of Research*

1. Adaptation of bacteria to fatty acids
2. Experiments in the coupling of fatty acids with certain proteins, with a view to obtaining a conjugated antigen
3. Studies of the peroxidatic function of catalase

SIR WILLIAM DUNN INSTITUTE, CAMBRIDGE UNIVERSITY

*Medical Research Council Staff*

F. Sanger, Ph.D.

*Summary of Research*

The structure of insulin :

(1) Confirmation of the structure of the glycyl chain of insulin by the study of enzymic hydrolysates, thus establishing the complete amino-acid sequence of insulin (in collaboration with Mr. E. O. P. Thompson)
(2) Study of the distribution of the amide groups of insulin (in collaboration with Mr. E. O. P. Thompson)
(3) Investigation of the distribution of the disulphide bonds in insulin
(4) Study of a disulphide interchange reaction

STRANGEWAYS RESEARCH LABORATORY

*Medical Research Council Staff*

F. G. Spear, M.D., D.M.R.E.
M. Webb, Ph.D.

*Summary of Research*

1. Cancer research :
   (1) A study of the effect of high energy irradiation (30 MeV synchroton, Royal Cancer Hospital) on cell division in chick fibroblasts grown *in vitro*
   (2) Collaboration in the histological analysis of radiation effects in tumours of the skin, uterus, oral cavity, lung and breast, as an aid to prognosis ; and the selection of treatment for individual patients
   (3) Continuation of work on the effect of irradiation on the process of differentiation in chick embryos
   (4) Study of the effect of gamma irradiation on blood-vessel structure
2. Biochemical studies :
   (1) Collaboration in quantitative studies on the growth of tissues cultivated *in vitro*
   (2) Observations on the influence of magnesium on bacterial cell division
   (3) Collaboration in studies on enzyme action ; investigation of the properties and composition of desoxyribonucleic acids from plant and animal tissue

DEPARTMENT OF SURGERY, EDINBURGH UNIVERSITY

*Medical Research Council Staff*

E. J. Delorme, M.D., F.R.C.S.
G. I. C. Ingram, M.D., M.R.C.P.
D. C. Simpson, Ph.D.
I. D. E. Storey, Ph.D.

*Summary of Research*

1. The effect of cooling on the ability of dogs to survive tissue ischaemia and haemorrhagic shock
2. Measurement by isotopic techniques of circulation times and blood volumes in normal dogs and in dogs with haemorrhagic shock
3. Collaborative investigations on the use of various preparations of dextran as plasma substitutes
4. The formation of glucuronides in the liver, and search for the liver factor necessary for the synthesis of glucuronic acid
5. Blood coagulation in health and in patients with occlusive arterial disease
6. The liberation and decay of thrombin in crude plasma systems
7. Development of the multi-channel oscillograph and other apparatus for clinical use

(This work is carried out under the direction of Sir James Learmonth.)

INSTITUTE OF ANIMAL GENETICS, EDINBURGH UNIVERSITY

*Medical Research Council Staff*

T. C. Carter, O.B.E., Ph.D. (*seconded from the Radiobiological Research Unit, A.E.R.E., Harwell*)
Miss M. F. Lyon, Ph.D.
Miss R. J. S. Phillips, B.Sc. (*seconded from the Radiobiological Research Unit, A.E.R.E., Harwell*)
B. M. Slizynski, Ph.D.

*Summary of Research*

The main purpose of this group, which works under the direction of Professor C. H. Waddington, is to extend knowledge of the cytogenetics of the mouse, with the eventual aim of producing tool-stocks for mutation rate studies. Work continues also on the genetic effects of chronic gamma irradiation and on the developmental effects of various mutant genes.

1. Cytogenetics :
   (1) Genetic and cytological studies of X-ray induced translocations
   (2) Linkage studies
2. Chronic gamma irradiation experiments :
   (1) Mutation rate of recessive visibles at specified loci
   (2) Induced male sterility
3. Development of genetic syndromes :
   (1) Postaxial polydactyly and persistent mesonephros
   (2) Tibial hemimelia and horseshoe kidney
   (3) Absent otoliths and pallid coat
4. Chemical phenocopies

## GLASGOW

CHEMISTRY DEPARTMENT, GLASGOW UNIVERSITY

*Medical Research Council Staff*

W. Carruthers, Ph.D.

*Summary of Research*

The identification and isolation of substances responsible for the cancer-producing action of high-boiling petroleum fractions (under the direction of Professor J. W. Cook)

## HARWELL

DIFFRACTION BRANCH, ATOMIC ENERGY RESEARCH ESTABLISHMENT

*Medical Research Council Staff*

Miss K. Little, D.Phil.

*Summary of Research*

Examination by X-ray diffraction and electron microscopy of:

(1) Inorganic constituents of teeth and bone

(2) Organic constituents of teeth and other tissues, and related polymeric compounds

(This work is carried out under the direction of Dr. J. Thewlis of the staff of the A.E.R.E.)

## JAMAICA

UNIVERSITY COLLEGE OF THE WEST INDIES

*Medical Research Council Staff*

J. C. Waterlow, M.D. (*part-time*)

*Summary of Research*

Nutritional liver disease in infants and the search for biochemical changes which may precede structural damage

## LONDON

POSTGRADUATE MEDICAL SCHOOL OF LONDON

*Medical Research Council Staff*

W. M. Court Brown, B.Sc., M.B., F.F.R.

R. F. Mahler, B.Sc., M.B., M.R.C.P.

*Summary of Research*

Clinical and physiological effects of a single therapeutic dose of X-rays, with special reference to the effect on water and electrolyte metabolism, adrenal function and the blood picture

ST. ANN'S GENERAL HOSPITAL, TOTTENHAM

*Medical Research Council Staff*

Miss J. Wright, D.M.

*Summary of Research*

1. Bacteriological studies of infantile diarrhoea and vomiting, particularly in relation to cross-infection in hospital wards
2. Investigation of sero-fermentative types among *Bact. coli* O group 111 and O group 55 strains
3. Application of H antigen typing of *Bact. coli* O group 111 and O group 55 strains to epidemiological studies of infantile diarrhoea and vomiting

UNIVERSITY COLLEGE

*Medical Research Council Staff*
H. Davson, D.Sc.

*Summary of Research*

1. Kinetics of the transfer of substances from the blood to the aqueous humour of the eye
2. Studies on keratoplasty

## MANCHESTER

DEPARTMENT OF EDUCATION OF THE DEAF, MANCHESTER UNIVERSITY

*Medical Research Council Staff*
P. Gaskill, B.A., M.Ed.

*Summary of Research*

1. Hearing losses and capacity to benefit from the use of hearing aids among children of school age
2. A comparative study of hearing losses following the use of streptomycin (calcium chloride complex) and dihydrostreptomycin in the treatment of tuberculous meningitis
3. A survey in England and Wales of the mental abil. ies and educational achievements of an entire age group of schoolchildren \ ith defective hearing

(This work is carried out under the direction of Professor A. W. G. Ewing.)

DIVISION OF INDUSTRIAL BIOCHEMISTRY, FACULTY OF TECHNOLOGY, MANCHESTER UNIVERSITY

*Medical Research Council Staff*
Miss S. Murray, M.Sc.

*Attached Worker*
J. Garrido, Ph.D., A.M.Gad.

*Summary of Research*

Studies on the synthesis of fats by micro-fungi :

(1) Determination of the most suitable nutritional conditions for fat production, with glucose and other carbohydrates as sources of energy, in surface culture
(2) Studies of the conditions most favourable to the formation of fat in deep culture.

(This work is under the direction of Dr. T. K. Walker.)

## OXFORD

INSTITUTE OF SOCIAL MEDICINE

*Medical Research Council Staff*
Mrs. J. W. Webb, M.B., D.P.H., D.I.H.

*Summary of Research*

1. Techniques for extracting statistical data from Civilian Medical Board registers
2. The reliability of Civilian Medical Board records for studies of occupational morbidity
3. The relationship of morbidity to age, physique and occupation
4. A study of foot defects in men of working age

(This work is carried out under the direction of Dr. Alice Stewart.)

SIR WILLIAM DUNN SCHOOL OF PATHOLOGY

*Medical Research Council Staff*

A. Q. Wells, D.M.

*Attached Worker*

J. A. H. Wylie, M.D., D.Phil. (*part-time*)

*Summary of Research*

1. Trials of the use of the vole bacillus as a means of raising resistance to tuberculosis in man
2. Experiments in raising the resistance of guinea pigs to tuberculosis
3. The relationship of hypersensitivity and immunity in tuberculosis
4. Respiration of mycobacteria
5. The effects of drying on the viability of mycobacteria

## SHEFFIELD

DEPARTMENT OF PATHOLOGY, SHEFFIELD UNIVERSITY

*Medical Research Council Staff*

H. B. Stoner, B.Sc., M.D.
C. J. Threlfall, B.Sc.

*Attached Worker*

D. Dexter, M.B. (*M.R.C. Scholar ; until July*, 1952)

*Summary of Research*

1. Carbohydrate and nucleotide metabolism in nucleotide and ischaemic shock
2. Effect of nucleotide and ischaemic shock on the distribution of radioactive phosphorus in the body
3. Biochemical changes in dinitro-*ortho*-cresol poisoning
4. The role of the suprarenal gland in the response to injury
5. The role of the suprarenal medulla in water diuresis
6. The effect of nucleotide and ischaemic shock on water metabolism
7. The effect of systemic disease, ACTH and adrenal cortical hormones on the suprarenal glands of infants and children (with Dr. H. J. Whiteley and Dr. J. L. Emery)
8. The uptake of radioactive phosphorus by rabbit's skin (with Dr. H. J. Whiteley)
9. Chromatographic and ionophoretic separation of nucleotides in biological fluids

(This work is carried out under the direction of Professor H. N. Green.)

## TAPLOW

CANADIAN RED CROSS MEMORIAL HOSPITAL

*Medical Research Council Staff*

A. St. J. Dixon, M.D., M.R.C.P. (*until Sept.*, 1952)

*Summary of Research*

Participation in and co-ordination of the co-operative controlled study by American and British clinicians of the value of ACTH and cortisone in rheumatic fever, as compared with that of salicylates (under the direction of Dr. E. G. L. Bywaters)

# UGANDA

MULAGO HOSPITAL, KAMPALA

*Medical Research Council Staff*

Miss M. D. Thompson, M.D., M.R.C.P.

*Summary of Research*

1. Collaboration in trials of vegetable protein, as compared with milk protein, in the treatment of kwashiorkor
2. Effect of vegetable proteins on the restoration of gastro-intestinal enzymes in kwashiorkor
3. Secretion of pepsin and pancreatic enzymes in adults with severe protein deficiency

# The Public Health Laboratory Service
## (Directed by the Council for the Ministry of Health)

PUBLIC HEALTH LABORATORY SERVICE BOARD

Sir Landsborough Thomson, C.B., O.B.E., D.Sc. (*Chairman*)
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Sir Percival Hartley, C.B.E., M.C., D.Sc., F.R.S.
A. A. Miles, M.D., F.R.C.P.
W. H. Bradley, D.M., M.R.C.P. (*Observer, Ministry of Health*
Miss N. J. Small (*Secretary*)

DIRECTOR

G. S. Wilson, M.D., F.R.C.P., D.P.H.
38 Old Queen Street, London, S.W.1

CENTRAL PUBLIC HEALTH LABORATORY

Colindale Avenue, London, N.W.9

Lt.-Col. H. J. Bensted, O.B.E., M.C., M.R.C.P., R.A.M.C. (retd.) (*Director*)
J. D. Atkinson, F.I.M.L.T.
Mrs. J. M. B. Edwards, M.B. (*part-time*)
H. D. Holt, M.R.C.S., D.P.H., Dip. Bact.
K. Machacek, M.D., D.P.H.
H. M. Nevin, M.B., D.P.H., D.T.M. and H. (*until Sept.*, 1952)
Miss M. E. Rowatt, B.Sc. (*seconded to the Lister Institute*)
Miss M. E. M. Thomas (Mrs. Livingstone), B.Sc., M.B., D.P.H.
J. E. M. Whitehead, M.B.
Miss B. H. Whyte, M.A.

REGIONAL LABORATORIES

Cambridge: Public Health Laboratory, Tennis Court Road

R. M. Fry, M.R.C.S. (*Director*)
Miss J. M. Boissard, M.R.C.S.
C. H. Jellard, B.M., Dip. Bact.
J. McCoy, M.B., D.P.H. (*Director at Hull from May*, 1952)
A. M. McFarlan, M.D
P. J. Wormald, M.B.

Cardiff: Public Health Laboratory, Institute of Preventive Medicine, The Parade

Scott Thomson, M.D., M.R.C.P.E., D.P.H. (*Director*)
D. G. Davies, M.B., Dip. Bact. (*seconded to Welsh National School of Medicine*)
A. D. Evans, B.Sc., M.B., Dip. Bact.
R. W. S. Harvey, M.B., Dip. Bact.
J. Marks, M.D., Dip. Bact. (*until Feb.*, 1952)

Manchester: Public Health Laboratory, Monsall Hospital

M. T. Parker, M.B., Dip. Bact. (*Director*)
Miss M. O. Adams, M.B., Dip. Bact.
N. S. Mair, M.B., D.C.H., Dip. Bact. (*Director at Leicester from July*, 1952)
Miss J. M. Watkinson, B.Sc.

Newcastle: Public Health Laboratory, General Hospital, Westgate Road

A. I. Messer, M.B., D.P.H. (*Director*)
C. R. Peck, Member of Medical Faculty of Calcutta, Dip. Bact.
H. G. M. Smith, M.B., Ph.D., Dip. Bact

Oxford : Public Health Laboratory, Walton Street
R. L. Vollum, D.Phil. (*Director*)
G. T. Cook, M.D. (*Deputy Director*)
B. R. Frisby, M.B. (*on military service*)
W. H. H. Jebb, M.D., Barrister-at-Law
Miss H. K. Linn, B.Sc. (*until Feb.*, 1952)
A. M-M. Payne, M.D., M.R.C.P. (*seconded to W.H.O., Geneva*)
A. H. Tomlinson, B.A.

Sheffield : Public Health Laboratory, City General Hospital
L. G. Cook, M.B., D.P.H. (*part-time ; Acting Director ; until Jan.*, 1952)
E. H. Gillespie, M.B. (*Director*)
Miss M. Pownall, M.B., D.P.H., Dip. Bact.

AREA LABORATORIES

Aberystwyth : Public Health Laboratory, Cardiganshire General Hospital
Miss M. V. N. Sudds, M.B., D.T.M. & H. (*Director*)

Bedford : Public Health Laboratory, General Hospital, Kimbolton Road
W. F. Lane, M.B., D.P.H. (*Director*)

Birkenhead : Public Health Laboratory, 42 Hamilton Square
J. M. Ritchie, M.B., D.P.H. (*Director*)

Birmingham : Public Health Laboratory, 150 Great Charles Street
B. R. Sandiford, M.D. (*Director*)
Miss P. M. Congdon, M.D., D.P.H., Dip. Bact.

Bournemouth : Public Health Laboratory, Gloucester Road, Boscombe (*opened Oct., 1951*)
G. J. G. King, M.B., Dip. Bact. (*Director*)

Bradford : Public Health Laboratory, 16–18 Edmund Street
A. J. H. Tomlinson, M.B. (*Director*)
W. J. Ryan, M.B., D.P.H., Dip. Bact.

Brighton : Public Health Laboratory, Royal Sussex County Hospital
J. E. Jameson, M.R.C.S. (*Director*)

Carmarthen : Public Health Laboratory, Penlan Road
W. Kwantes, M.B., Dip. Bact. (*Director*)

Conway : Public Health Laboratory, " Bryn Hyfryd "
A. J. Kingsley Smith, B.M. (*Director*)

Coventry : Public Health Laboratory, Stoney Stanton Road
R. E. Jones, B.Sc., M.R.C.S., D.P.H. (*Director*)
R. M. Dowdeswell, M.D. (*until Sept.*, 1952)

Dorchester : Public Health Laboratory, Glyde Path Road
G. H. Tee, M.R.C.S. (*Director*)

Epsom : Public Health Laboratory, West Hill House, West Hill
Miss D. M. Stone, M.D., D.P.H. (*Director*)

Exeter : Public Health Laboratory, 7 Dix's Field
B. Moore, M.B. (*Director*)

Harrogate : Public Health Laboratory, Harrogate and District General Hospital (*opened Oct., 1951*)
L. A. Little, M.B., Dip. Bact. (*Director*)

Hereford : Public Health Laboratory, County Hospital
D. R. Christie, M.B., Dip. Bact. (*Director*)

Hull : Public Health Laboratory, 184 High Street
C. L. Greening, M.R.C.S. (*Director until June*, 1952)
J. McCoy, M.B., D.P.H. (*Director*)
Miss P. E. T. Forbes, B.Sc., Dip. Bact. (*transferred to Dysentery Ref. Lab.*)

Ipswich : Public Health Laboratory, Borough General Hospital, Woodbridge Road
P. H. Martin, B.M., F.R.C.P., D.T.M. & H. (*Director*)
J. A. Sykes, M.R.C.S., D.P.H., Dip. Bact.

Leicester : Public Health Laboratory, Isolation Hospital, Groby Road
E. H. Gillespie, M.B. (*Director ; appointed Director at Sheffield, May*, 1952)
N. S. Mair, M.B., D.C.H., Dip. Bact. (*Director*)
Miss R. C. J. James, M.B., Dip. Bact. (*transferred to Cambridge, Sept.*, 1952

Lincoln : Public Health Laboratory, St. Anne's Road
J. M. Croll, M.B., D.P.H. (*Director*)

London (Camberwell) : Public Health Laboratory, 134 Denmark Hill, S.E.5
G. W. J. Bousfield, M.D. (*part-time ; Director*)

London (Hither Green): Public Health Laboratory, Park Hospital, S.E.13
J. E. McCartney, M.D., D.Sc. (*part-time ; Director until Feb.*, 1952)
E. H. Bailey, M.R.C.S. (*part-time*)

Luton : Public Health Laboratory, Town Hall
J. H. C. Walker, M.B., D.P.H. (*Director*)

Middlesbrough : Public Health Laboratory, General Hospital, Ayresome Green Lane
A. R. Blowers, M.D., Dip. Bact. (*Director*)

Newcastle : Public Health Laboratory, Government Buildings, Ponteland Road
R. Norton, M.B., D.P.H. (*Director*)
Miss E. C. Armstrong, M.D., Dip. Bact.

Newport (Mon.): Public Health Laboratory, County Hall
R. D. Gray, M.D., D.P.H. (*Director*)

Northallerton : Public Health Laboratory, The Friarage Hospital
D. J. H. Payne, M.B. (*Director*)

Northampton : Public Health Laboratory, General Hospital
L. Hoyle, M.B. (*Director*)

Norwich : Public Health Laboratory, Isolation Hospital, Bowthorpe Road
Miss L. M. Dowsett, M.D. (*Director*)

Nottingham : Public Health Laboratory, 63 Goldsmith Street
G. B. Ludlam, M.B., D.T.M. & H., D.L.O. (*Director*)

Peterborough : Public Health Laboratory, Peterborough and District Memorial Hospital
C. C. B. Gilmour, O.B.E., M.B. (*Director*)

Poole : Public Health Laboratory, Municipal Buildings (*transferred to Bournemouth, Oct.*, 1951)

Portsmouth : Public Health Laboratory, " G " Block, Infectious Diseases Hospital
K. E. A. Hughes, M.B.E., M.R.C.S. (*Director*)
D. A. Skan, M.B.E., M.B., D.T.M. & H.

Reading : Public Health Laboratory, Battle Hospital
N. Wood, B.Sc., M.D. (*Director*)

Shrewsbury : Public Health Laboratory, Royal Salop Infirmary
A. C. Jones, M.B. (*Director*)

Southampton : Public Health Laboratory, The Health Centre, King's Park Road
Miss R. I. Hutchinson, M.D., D.P.H., D.T.M. (*Director*)

Southend : Public Health Laboratory, Westcliff Hospital, Balmoral Road
R. Pilsworth, M.D., Dip. Bact. (*Director*)

Stafford : Public Health Laboratory, Martin Street
R. N. Phease, M.B. (*Director*)

Sunderland : Public Health Laboratory, Infectious Diseases Hospital, Hylton Road
P. B. Crone, M.D., Dip. Bact. (*Director*)

Taunton : Public Health Laboratory, Musgrove Park Hospital
J. A. Boycott, D.M. (*Director*)

Truro : Public Health Laboratory, Royal Cornwall Infirmary
F. D. M. Hocking, B.Sc., M.B. (*Acting Director*)

Wakefield : Public Health Laboratory, County Medical Offices, Wood Street
Brig. H. T. Findlay, M.B., D.P.H., R.A.M.C. (retd.) (*Director*)
H. Fennell, B.Sc.

Watford : Public Health Laboratory, Peace Memorial Hospital
Mrs. B. H. E. Cadness-Graves, M.Sc., M.B. (*half-time ; Director*)
Mrs. C. B. Subramanian, B.Sc., Dip. Bact.

Winchester : Public Health Laboratory, Royal Hants County Hospital
R. D. Mackenzie, M.B., F.R.C.P.E., Dip.Bact. (*Director*)

Worcester : Public Health Laboratory, Royal Infirmary
R. J. Henderson, M.B. (*Director*)

REFERENCE LABORATORIES

Central Enteric Reference Laboratory and Bureau, Colindale
A. Felix, D.Sc., F.R.S. (*Director*)
E. S. Anderson, M.B., Dip.Bact. (*Deputy Director*)
Miss B. R. Callow, M.A.
Miss A. Fraser, B.Sc.

Dysentery Reference Laboratory, Oxford (*transferred to Colindale, Oct.*, 1952)
Mrs. K. Patricia Carpenter, M.B., Dip. Bact. (*Acting Director*)

Malaria Reference Laboratory, Horton Hospital, Epsom
Sir Gordon Covell, C.I.E., M.D., D.P.H., D.T.M.&H. (*Director*)
P. G. Shute, M.B.E. (*Assistant Director*)

Mycological Reference Laboratory, London School of Hygiene and Tropical Medicine, London, W.C.1
Mrs. J. I. J. Walker, Ph.D. (*Acting Director*)
Mrs. G. M. Colombo, B.Sc.

Salmonella Reference Laboratory, Colindale
Mrs. J. Taylor, B.Sc., M.B., D.P.H. (*Director*)
Miss S. H. Douglas, M.Sc.
Miss R. E. Hilton (Mrs. Charter), B.Sc.
Miss J. Matheson, M.H.Sc.
Mrs. A. Price, M.B., D.P.H.

Streptococcus and Staphylococcus Reference Laboratories, Colindale
R. E. O. Williams, B.Sc., M.D. (*Director*)
Miss J. E. Rippon, B.Sc., Dip.Bact.
Miss M. C. Holmes, Ph.D.
Miss S. J. McLean, M.Sc. (*until Aug.*, 1952)
W. R. Maxted, F.I.M.L.T.
Miss J. S. Stubbs, B.Sc.

Venereal Diseases Reference Laboratory, St. Peter's Hospital, Whitechapel, London, E.1
I. N. Orpwood Price, M.R.C.S., D.P.H. (*part-time ; Director*)
A. E. Wilkinson, M.R.C.S. (*part-time*)

Virus Reference Laboratory, Colindale
F. O. MacCallum, B.Sc., M.D. (*Director*)
B. E. Andrews, M.R.C.S., Dip.Bact.
A. P. Goffe, M.B., Dip.Bact.
G. Le Bouvier, M.B., Dip.Bact. (*seconded to the London School of Hygiene and Tropical Medicine until Oct.*, 1952)
A. D. Macrae, M.D., Dip.Bact.
B. P. Marmion, M.D. (*Rockefeller Travelling Fellowship in Medicine, Oct.*, 1951 *to Sept.*, 1952)
J. C. N. Westwood, M.B., Dip.Bact. (*seconded to University College Hospital, London until Sept.*, 1952)
Miss J. Beveridge, B.Sc.

SPECIAL LABORATORIES

Air Hygiene Laboratory, Colindale
R. E. O. Williams, B.Sc., M.D. (*Director*)
Miss A. P. Hirch, B.Sc. (*until Feb.*, 1952)
Miss A. Marsinghall-Thomas, B.Sc.
T. Nash, M.A., B.Sc., A.R.I.C.

Epidemiological Research Laboratory, Colindale
W. C. Cockburn, M.B., D.P.H. (*Director*)
I. A. Bolz, M.D., D.P.H. (*at Cardiff*)
J. C. McDonald, M.D., D.P.H., D.I.H.
Miss E. J. Simpson, B.Comm.

Epidemiological Research Unit, 86, Dyer Street, Cirencester
R. E. Hope-Simpson, M.B. (*part-time ; Director*)

Food Hygiene Laboratory, Colindale
Miss B. C. Hobbs, Ph.D., Dip.Bact. (*Director*)
Mrs. M. B. M. Furbank, B.Sc.

National Collection of Type Cultures, Colindale
S. T. Cowan, M.D., Dip.Bact. (*Director*)
Mrs. P. H. Clarke, B.A.
Miss M. G. Jennens, B.Sc.
Miss H. E. Ross, B.Sc.
Miss C. Shaw, M.Sc., Dip.Bact.
Miss J. M. Stitt, B.Sc.

Standards Laboratory for Serological Reagents, Colindale
Lt.-Col. H. J. Bensted, O.B.E., M.C., M.R.C.P., R.A.M.C. (retd.) (*Director*)
Mrs. N. Datta, M.D., Dip.Bact.
Miss M. W. Hully, B.Sc.
C. C. Spicer, M.R.C.S., Dip.Bact.

BACTERIOLOGISTS SECONDED TO DIPLOMA IN BACTERIOLOGY COURSE, 1951–2

| | |
|---|---|
| A. J. Beale, M.D. .. .. .. .. | London School of Hygiene and Tropical Medicine |
| A. Bernstein, M.B. .. .. .. .. | |
| Mrs. C. M. P. Bradstreet, M.B. .. .. | |
| Miss M. K. Herring, M.B., D.P.H. .. | |
| E. M. Mackay-Scollay, M.B. .. .. | |
| P. G. Mann, M.D. .. .. .. .. | |
| Mrs. H. J. Mair, M.D. .. .. .. | Manchester |

JUNIOR BACTERIOLOGISTS IN TRAINING (UNALLOCATED)

G. P. B. Boissard, M.B.
Mrs. S. R. Cavanagh, M.B. (*until June*, 1952)
P. Chadwick, M.B.
J. M. S. Dixon, M.B.
L. A. Hatch, M.B.
J. G. Howard, M.B.
Miss B. Hull (Mrs. Ivey), M.B.
J. C. Kelsey, M.B.
Miss J. J. Mackintosh, M.B.
J. Nagington, M.B., Dip.Bact. (*on military service*)
Miss P. M. Poole, M.B.
L. Robertson, B.M.
J. A. Rycroft, M.B.
K. R. Wallace, M.B.

The Public Health Laboratory Service in England and Wales is administered by the Council on behalf of the Ministry of Health, through which the necessary funds are provided. Originally introduced as a wartime emergency service, it was established on a permanent basis under the National Health Service Act, 1946. The detailed administration of the Service is delegated by the Council to the Public Health Laboratory Service Board.

In addition to six regional, forty-four area and eight associated laboratories, there are now eight reference and five special laboratories, most of which are housed at the main Central Laboratory at Colindale. Some of the reference and special laboratories also serve workers in the British Commonwealth and in other countries.

Investigations are undertaken not only on immediate problems of public health but also on fundamental problems of epidemiology and preventive medicine. The constitution of the Service is well-adapted to the organisation of group research, a particularly valuable method when data representative of the country as a whole may have to be collected rapidly. Moreover, by virtue of its close association with local medical officers, the Service is in a favourable position for carrying out controlled field trials of prophylactic agents.

*Summary of Research*

INFECTIOUS DISEASES

1. Anthrax :

   Cutaneous anthrax as a hazard in a gelatin factory handling large amounts of imported crushed bones

2. Cat-scratch fever :

   Preparation of an intracutaneous test antigen from material from human cases

3. Diphtheria :

   (1) Termination of the comparative trial of PTAP and APT prophylactics
   (2) Starch-fermenting, gelatin-liquefying corynebacteria and their differentiation from *C.diphtheriae gravis*

4. Dysentery :

   (1) Investigation of potential new members of the *Shigella* genus
   (2) The relative efficacy of culture media in the isolation of *Sh.sonnei*
   (3) The virulence of *Sh.sonnei* and factors affecting it
   (4) Continued study of the bacteriophage-typing of Sonne's bacillus

5. Enteric fever :
   (1) The Vi antigens of *Salmonella paratyphi A* and *B*
   (2) The serological classification of bacteriaceae
   (3) Variation in Vi-phage II of *Salmonella typhi*
6. Food poisoning and intestinal infections :
   (1) Continued investigation of the incidence and causes of outbreaks in England and Wales
   (2) Further study of the epidemiology of salmonella infection
   (3) The relationship of salmonellae in insects and domestic pets to human disease (in collaboration with Dr. James Mackey, Dar-es-Salaam)
   (4) A study of the factors which affect the growth of salmonella organisms on Wilson and Blair's bismuth sulphite agar
   (5) The properties of different *Salmonella* Vi antigens
   (6) The bacteriophage typing of *Salmonella typhi-murium*
   (7) The serology of heat-resistant strains of *Cl.welchii*
   (8) The diagnosis of intestinal infections
7. Glandular fever :
   Study of the Paul-Bunnell reaction
8. Hydatid disease :
   The comparative value of the Casoni test and the hydatid complement-fixation test
9. Infantile diarrhoea :
   (1) Continued study of strains, from this country and from abroad, of *Bact. coli* associated with infantile diarrhoea
   (2) A study of the infectivity of specific serological types of *Bact. coli* for children in residential institutions
10. Infective hepatitis :
    Trial of gamma globulin in the prevention of infective hepatitis
11. Influenza :
    (1) Study of the structure and intracellular growth of the influenza virus
    (2) The epidemiology and early diagnosis of influenza
    (3) Serological testing of volunteers inoculated with influenza
12. Malaria :
    (1) Studies in the transmission of *Plasmodium malariae* by anopheles mosquitoes
    (2) A study of human malaria oocysts as an aid to species diagnosis
    (3) The treatment of nephrosis by malaria therapy
13. Measles :
    (1) Follow-up study of the efficacy of gamma globulin or adult serum in the prevention and attenuation of measles
    (2) Continued study of the stability of dried and fluid gamma globulin
14. Mycological infections :
    (1) Survey of the dermatophytes and dermatophytoses of Nigeria (in collaboration with Dr. G. H. V. Clarke of the Nigerian Medical Service) ; a study of the growth factors of the different varieties of *Trichophyton rubrum* isolated
    (2) Investigation of gaseous methods for the sterilisation of Army footwear contaminated with ringworm fungi (in collaboration with the Pest Infestation Laboratory, Slough)
15. Pneumonia :
    Investigation of pneumococcal types in cases of chronic bronchitis and their family contacts (in association with Professor C. H. Stuart-Harris)

16. Poliomyelitis :
    (1) Continued investigation of cases which occur within three months after prophylactic inoculation
    (2) Continued inquiry into the role of activating agents such as trauma, surgical operations and all types of inoculation, with an attempt to measure the risk of paralysis following a single injection
    (3) Microscopical examination of the central nervous system of all monkeys inoculated with material from the sewer-swab survey, and attempted isolation of the poliomyelitis virus in tissue cultures of monkey testicle
    (4) Study, on a small scale, of the tissue culture technique in roller tubes and flasks (Through the kindness of Professor E. T. C. Spooner, this work was for a few months carried out at the London School of Hygiene and Tropical Medicine, but has now been transferred to the Virus Reference Laboratory.)
17. Q fever :
    (1) The incidence of *R. burneti* infection in dairy herds in certain parts of the country, including preliminary studies on the spread of infection within a herd (in collaboration with the Ministry of Agriculture and Fisheries' Veterinary Laboratory at Weybridge)
    (2) The detection of Q-fever antibodies in whey
18. Rubella :
    The use of gamma globulin, prepared from the serum of convalescent rubella patients, in the prevention of rubella
19. Staphylococcal infections :
    (1) Study of the bacteriophages of *Staphylococcus aureus*, with particular reference to spontaneous lysis, methods for detecting phage carriers, and analysis of bacteriophage patterns of staphylococci sent for routine typing from different diseases
    (2) Definition of a new serological group of *Staph. aureus* phages : Group G
    (3) General exploration of a standardised bacteriophage typing technique suitable for wider adoption
    (4) The classification of staphylococci
20. Streptococcal infections :
    (1) Streptococcal bacteriophages
        (*a*) Search for natural phages
        (*b*) Effect of exposure to phage on the M and T antigens of streptococci
        (*c*) Investigation of antisera to the bacteriophages
    (2) Use of bacitracin for the rapid recognition of strains of *Str. pyogenes*
    (3) Study of the T antigens of *Str. pyogenes* of Types 5, 11, 12, 27 and 44
    (4) Study of new types of *Str. pyogenes* ; definition of three provisional types known as " Corby," " Lily " and " Wakefield "
    (5) Modification of methods of extraction of type-specific M antigens from types of *Str. pyogenes* that have proved difficult to recognise by the precipitin method
    (6) Analysis of the distributions of serological types of *Str. pyogenes* recorded in the literature, and examination of 270 strains that had been found to be untypable by certain laboratories in the United States
    (7) Investigation of starch fermentation by streptococci and the inhibition by normal serum of this and other enzyme reactions
    (8) Comparison of *Str. pyogenes* isolated from throat and faeces of patients with scarlet fever

(9) Study of the epidemiology of upper respiratory tract infections with haemolytic streptococci in semi-closed communities of children
(10) Continued type distribution of *Str. pyogenes* in East Anglia and South Wales
(11) Investigation into the incidence of streptococcal infection of books used by patients suffering from scarlet fever

21. Tuberculosis :
(1) Investigation into the laboratory diagnosis of tuberculosis, with particular emphasis on evaluation of the relative efficacy of different media in common use for the cultivation of *Mycobacterium tuberculosis*
(2) Study of formaldehyde in the disinfection of contaminated articles
(3) Study of factors influencing the growth of tubercle bacilli in body fluids
(4) The incidence of tuberculosis in advanced lesions of pneumoconiosis
(5) Experimental work on the intrathecal tuberculin reaction
(6) Tuberculosis of the female genital tract

22. Venereal disease :
(1) The treponema immobilisation test for the diagnosis of syphilis
(2) Improvements in the technique of the complement-fixation test
(3) Further investigation of Kahn's Universal Reaction
(4) The specificity of cardiolipin antigen compared with crude heart extract in the Wassermann reaction

23. Whooping cough :
(1) Continued field and laboratory trials of vaccines made by British manufacturers according to an American formula
(2) Preliminary investigation of vaccines made from liquid media
(3) The serological study of antibody production in vaccinated children
(4) A controlled investigation into the value of antibiotics in the treatment of whooping cough
(5) Investigation of the nutritional requirements of *H. pertussis*, with special reference to the vitamin requirements of the organism
(6) The inability of the capsular material of *H. pertussis* to produce protective antisera

## SANITARY BACTERIOLOGY

1. Air hygiene :
(1) Continued investigation of the relation between chemical structure and aerial disinfectant power
(2) The use of particulate clouds of salts, recognised by flame photometry, for measurement of ventilation rates
(3) Study of the disinfectant power of formaldehyde, and of its reactivity under physiological conditions
(4) The use of glycollic and other simple α-hydroxy acids for rendering handkerchiefs self-sterilising
(5) Laboratory methods for measuring the efficacy of dust-laying treatment for floors
(6) Further attempts to determine the factors affecting the bacterial contamination of the air in schoolrooms, and its relation to the incidence of illness among the children
(7) Surveys of the spread of the common cold and other respiratory infections in offices in London and Newcastle (in association with Dr. O. M. Lidwell)
(8) The bacteriology of public telephones

2. Food hygiene :
   (1) Continued investigations into the growth of bacteria in synthetic cream
   (2) The bacteriology of frozen liquid egg
   (3) Bactericidal properties of detergents
   (4) A powder-dusting test for the control of dish-washing and the comparison of detergents
3. Ice-cream :
   (1) Investigation of the bacteriological grading and examination of ice-cream
   (2) The bacteriology of iced lollipops
4. Milk :
   (1) Study of the Ring Test for Brucella organisms in milk, and, in collaboration with the Ministry of Agriculture and Fisheries, of the potential usefulness of the test as a means of detecting infected animals
   (2) A study of the staphylococci found in pasteurised milk
5. Shell-fish :
   Investigation of the bacteriology of shell-fish
6. Water :
   (1) Investigation into the effect of storage, and of thiosulphate, on the coliform count of water samples
   (2) The bacterial flora of chlorinated swimming baths

MISCELLANEOUS

1. Continued investigation into the factors influencing the survival of bacteria in the dried state
2. Antibody formation in myelomatosis and other diseases with associated hyperglobulinaemia
3. Study of the reaction of isolated cells of sensitised animals to tuberculin
4. Construction of nephelometers for use in bacteriology
5. Development of electronic circuits for the stabilisation of readings taken with photomultiplier tubes
6. The use of mucin for unmasking latent infections in laboratory animals
7. Opacity standards for bacterial suspensions

# Institute of Cancer Research

## Royal Cancer Hospital, Fulham Road, London, S.W.3

### CHESTER BEATTY RESEARCH INSTITUTE

*Director*

Professor A. Haddow, M.D., D.Sc.

*Staff*

P. Alexander, Ph.D.
E. J. Ambrose, M.A.
R. N. Beale, Ph.D.
Professor F. Bergel, D.Sc., D.Phil.Nat., F.R.I.C.
M. S. C. Birbeck, M.A.
Miss M. J. Bird (Mrs. Fahmy), Ph.D.
Miss J. Booth (Mrs. Case), Ph.D.
Professor E. Boyland, D.Sc.
R. C. Bray, B.A., A.R.I.C.
Professor J. A. V. Butler, D.Sc., F.R.I.C.
D. J. Campbell, Ph.D.
R. A. M. Case, Ph.D., M.B. (*Association of British Chemical Manufacturers Research Fellow*)
Miss P. J. Caulfield, B.Sc.
Miss S. M. A. Charter, B.Sc.
B. E. Conway, Ph.D.
F. W. Cuckow, M.Sc., F.Inst.P.
D. A. Darcy, D.Phil.
W. Davis, Ph.D.
P. F. Davison, B.Sc.
G. C. Easty, Ph.D.
L. A. Elson, Ph.D., F.R.I.C. (*British Empire Cancer Campaign Fellow*)
J. L. Everett, A.R.I.C.
O. G. Fahmy, M.Sc., Ph.D.
D. G. I. Felton, D.Phil.
L. Foulds, M.D.
M. Fox, Ph.D.
D. A. G. Galton, M.B.
R. J. Goldacre, Ph.D.
Miss A. Greenwood, B.A.
Miss J. Harris, B.Sc.
R. J. C. Harris, Ph.D. (*British Empire Cancer Campaign Fellow*)
I. Hieger, D.Sc.
E. S. Horning, D.Sc.
Miss S. Howarth, B.Sc.
D. W. F. James, B.Sc.
R. J. King, M.Sc.
P. C. Koller, D.Sc.
A. Loveless, Ph.D.
D. Manson, B.Sc.
S. F. D. Orr, B.Sc.
T. S. Osdene, B.Sc.
Miss J. Pearson, B.Sc. (*Association of British Chemical Manufacturers*)
S. H. Revell, Ph.D.
J. J. Roberts, B.Sc.
Miss E. M. F. Roe, Ph.D.
W. C. J. Ross, D.Sc.
K. V. Shooter, Ph.D.
P. Sims, Ph.D.
K. A. Smith, Ph.D.
J. B. Solomon, B.Sc.
K. Stacey, Ph.D. (*Royal Cancer Hospital Research Fellow*)
J. A. Stock, Ph.D., A.R.I.C.
Mrs. M. Till, M.B.
G. M. Timmis, M.Sc.
Miss C. Waymouth, Ph.D.

*Attached Worker*

A. R. Gopal-Ayengar, M.A., M.Sc., Ph.D. (*Lady Tata Trust Fellow*)

### PHYSICS DEPARTMENT

*Director*

Professor W. V. Mayneord, D.Sc., F.Inst.P.

*Staff*

W. Anderson, Ph.D. (*Royal Cancer Hospital Fellow*)
E. H. Belcher, M.A., Ph.D.
Miss G. M. Clark, M.A.
H. D. Evans, Ph.D.
Miss H. Farran, B.Sc., M.S.R.
C. A. Greatorex, B.Sc.
Miss E. B. Harriss, M.Sc.
L. F. Lamerton, Ph.D., F.Inst.P.
D. A. Layne, B.Eng., Ph.D.
W. K. Sinclair, Ph.D.
G. Spiegler, Ph.D., F.Inst.P.
N. G. Trott, Ph.D.
R. C. Turner, Ph.D.
B. M. Wheatley, B.Sc.

## RADIOTHERAPY DEPARTMENT

*Director*
Professor D. W. Smithers, M.D., F.R.C.P., D.M.R.

*Staff*

Miss J. M. Arscott, B.Sc.
Miss V. M. Dalley, M.B., D.M.R.T.
Mrs. J. Durden Smith, M.B., D.M.R.T.
E. D. Jones, M.B., D.M.R.T.
E. J. Kaminski, A.I.M.L.T.
S. Kramer, M.B., D.M.R.T., F.F.R.
M. Lederman, M.B., D.M.R.E.
Mrs. E. M. Ledlie, M.B., D.M.R. (*Royal Cancer Hospital Fellow*)
J. M. Mallett, D.O.M.S. (*Joint research appointment with the Institute of Ophthalmology*)
P. M. Payne, B.Sc. (*Royal Cancer Hospital Fellow*)
Mrs. P. C. Rigby-Jones, M.B., D.M.R.
Mrs. N. I. Swift, B.Sc., M.B. (*Royal Cancer Hospital Fellow*)
Mrs. E. N. K. Wallace, M.B., D.M.R.
R. J. Walton, M.B., D.M.R. (*British Empire Cancer Campaign Junior Fellow*)

*Attached Workers*

C. F. Baxter, M.D. (*British American Exchange Fellow of the American Cancer Society*)
J. R. Bignall, M.D., M.R.C.P. (*Joint research appointment with the Institute of Diseases of the Chest*)
M. Thangavelu, M.D. (*Travancore-Cochin Medical College Scholar*)

The Council assumed the major responsibility for the Institute of Cancer Research from the beginning of the financial year 1951–2. The work of the Institute consists of the research activities of the Chester Beatty Research Institute and of the Departments of Physics and Radiotherapy of the Royal Cancer Hospital; these formerly constituted a school of the University of London and still retain a similar association through their recognition as an Institute of the British Postgraduate Medical Federation. The subjects under study at the Chester Beatty Research Institute include the mechanism of action of carcinogenic and mutagenic chemical agents, cytology and cytogenetics, control mechanisms in normal growth, the study of tumour viruses, and experimental chemotherapy. In the Physics and Radiotherapy Departments investigations are related mainly to the clinical use of radio-isotopes and high-energy radiations, the applications of electronic and other techniques in clinical measurements, tumour localisation and radiation protection, and the biophysics and biochemistry of irradiation generally.

*Summary of Research*

### CHESTER BEATTY RESEARCH INSTITUTE

1. New cytotoxic and radiomimetic agents:
   (1) Selective concentration, with special reference to molecules of anionic, cationic, lipophilic, and hydrophilic character
   (2) The influence of the enzymic constitution of the tissues
   (3) Physical properties and chemical reactivity, with special reference to the reaction of aromatic nitrogen mustards with phosphoric acid derivatives, chemical reactivity of the nitrogen mustards, the action of nitrogen mustards on desoxyribonucleic acid
2. The chemistry and physical chemistry of nucleoproteins, nucleic acids, and their degradation products
3. The " after-effect " of X-irradiation of desoxyribonucleic acid in oxygenated aqueous solution
4. Chemical effects of radicals produced photochemically from hydrogen peroxide and ultraviolet light on desoxyribonucleic acid and simpler analogues

5. The degradation of macromolecules by X-rays, ultrasonics, or mechanical action
6. Mode of action of chemical agents protecting against ionising radiation
7. Chemical mutagenesis in *Drosophila*, and its cytogenetic analysis
8. Cytological analysis of the chemical induction of chromosomal aberrations
9. Cytology of primary, transplanted, and ascites tumours in mice, rats and hamsters
10. The colloidal and molecular organisation of chromosomes
11. Production of renal hypertrophy by xanthopterin and other pteridines, and its relation to the function of xanthine oxidase
12. Induction of renal carcinomata in the golden hamster (*Cricetus auratus*) by stilboestrol
13. The antigenic composition of normal and tumour tissues : transplantation immunity
14. The metabolism of polynuclear aromatic hydrocarbons
15. Influence of purines and nucleic acid on the solubility of carcinogens
16. Physico-chemical studies of carcinogens of the aminostilbene series, in relation to their mode of action
17. Tests for carcinogenicity of lathosterol and a sterol diepoxide
18. The incidence and causation of papilloma and carcinoma of the bladder in industry
19. Properties of the causative virus of the Rous sarcoma and related avian tumours :
    (1) Concentration of the virus, with special reference to its physical and chemical properties
    (2) Electron microscopy of the sarcoma cell and virus
    (3) Comparative immunology of avian tumours and related normal tissues
20. Crystalline bacterial arrays and long-range forces
21. The energy requirements for differentiated and undifferentiated growth
22. The application of myleran (1 : 4-dimethanesulphonyloxybutane) in the treatment of chronic myelogenous leukaemia

## Physics Department

1. Radio-isotope Group :

   Clinical use of isotopes, with special reference to :
   (1) $^{32}P$ in the treatment of blood dyscrasias
   (2) $^{131}I$ in the diagnosis and treatment of thyrotoxicosis and the treatment of thyroid carcinoma
   (3) $^{82}Br$ solutions for the intracavitary irradiation of the bladder
   (4) Colloidal $^{198}Au$ for the palliative treatment of malignant effusions
   (5) Superficial beta applicators for irradiation of the cornea
   (6) $^{42}K$ in the localisation of brain tumours

   30 MeV. synchrotron : theoretical, experimental and applied work :
   (1) Physical studies of the production and absorption of high energy X-radiation
   (2) Design and operational characteristics of supervoltage accelerators
   (3) The treatment of selected cases of cerebral tumour

2. Photographic Group :
   Photographic dosimetry

3. Electronics Group :
   Clinical measurements using the probe-type dosage-rate meter in :
   (1) Carcinoma of the cervix
   (2) Carcinoma of the bronchus

   Indirect clinical applications :
   (1) Construction of a double-probe direct-reading percentage depth dose instrument, a wide-range beta meter, and an integrating dose instrument for use with the cyclotron
   (2) Radiation protection service and continuous monitoring systems

4. Research projects (Nuffield Foundation) :
   (1) Supersonic detection apparatus in the location of tumours
   (2) Statistical and medical study of blood count trends observed in the protection service

5. Scintillation counting :
   (1) Application of scintillation detection methods to radiation dosimetry
   (2) Scintillation counting in the standardisation of radioactive isotopes

6. Diagnostic Group (Nuffield Foundation) :
   (1) Reconstruction of a new scanner for studies of the distribution of radioactive isotopes
   (2) " Image amplification " in diagnosis
   (3) Low-energy gamma-ray-emitting isotopes in radiography

7. Biophysics Group :
   Effects of whole and partial body irradiation

8. Other investigations :
   (1) Chemi-luminescence in relation to carcinogenesis and other biological reactions
   (2) Uptake of radioactive iron as an index of whole-body X-irradiation
   (3) High-resolution autoradiography in the study of nucleic acid metabolism

### Radiotherapy Department

1. Clinico-pathological review of cancer of the breast
2. Intracavitary irradiation of cancer of the bladder
3. Clinico-pathological study of cancer of the lung
4. Localisation and treatment of cerebral gliomas
5. $^{32}P$ and $^{198}Au$ in carcinoma of the prostate
6. Carcinoma of the oesophagus and the Plummer-Vinson syndrome
7. Radioactive applicators in ophthalmology
8. Teleradium therapy of carcinoma of the larynx and laryngo-pharynx
9. Prognosis in the lymphadenopathies in relation to treatment
10. Radioactive isotopes in the palliation of malignant effusions
11. Biochemistry of general irradiation

# RESEARCH WORK AIDED BY GRANTS

During the period covered by this Report the Council have continued to make research grants to individual workers in aid of an extensive programme of clinical and laboratory investigations. A list of these grants, arranged according to the geographical location of the institutions in which they are held, is given below.

## ABERDEEN

UNIVERSITY OF ABERDEEN

*Bacteriology Department*

Mrs. D. Oxford—assistance by Dr. J. W. Porteous, and expenses : studies of actinomycosis in man and cattle

*Midwifery Department*

Professor Dugald Baird—assistance by Dr. W. A. Cramond and Dr. A. C. Turnbull : factors associated with disordered uterine action

*Physiology Department*

Dr. H. W. Kosterlitz—expenses : pharmacology of adrenaline and noradrenaline

Dr. M. H. L. Pirenne—expenses : studies of quantum phenomena in human vision

*Public Health Department*

Dr. I. M. Richardson—personal (*in Department of Social Medicine, Glasgow University, until Feb. 1952*) and expenses : studies of work and working capacity in old age

*Surgery Department*

Professor W. C. Wilson—assistance by Dr. Isabel E. James : biological actions of blood and tissue polypeptides

Mr. M. F. A. Woodruff—assistance by Miss T. Boswell : immunological behaviour and properties of homotransplants

## ASCOT, BERKS

HEATHERWOOD ORTHOPAEDIC HOSPITAL

Mr. G. P. Arden—expenses : physical properties and preservation of human bone graft material

## AYLESBURY, BUCKS

STOKE MANDEVILLE HOSPITAL

Dr. W. Ritchie Russell—assistance by Dr. A. B. Kinnier Wilson : clinical studies of poliomyelitis, with particular reference to the use of mechanical respirators (in association with Dr. R. B. Bourdillon, p. 70)

## BIRMINGHAM

QUEEN ELIZABETH HOSPITAL

Mr. W. Stirk Adams—expenses : radiation treatment in deafness

UNIVERSITY OF BIRMINGHAM

*Anatomy Department*

Professor S. Zuckerman—expenses : factors controlling the early development of germinal epithelium

Dr. E. M. B. Clements and others—personal and expenses : anthropometric studies (under the general direction of Professor Zuckerman)

*Bacteriology Department*

Dr. K. A. Bisset—assistance by Mr. E. O. Morris : bacteriology of dental caries

*Chemistry Department*

Professor M. Stacey—expenses : the chemical structure of bacterial nucleic acids and polysaccharides

*Pathology Department*

Professor J. R. Squire—(1) assistance by Dr. J. Hardwicke and Dr. Isobel Hinde : studies of allergic reactions and related problems ; (2) assistance by Dr. D. S. Rowe : transfusion of macromolecules in hypoproteinaemia

*Pathology Department (Cancer Research Laboratory)*

Dr. D. L. Woodhouse—expenses : for work on behalf of the Committee on the Carcinogenic Action of Mineral Oils

*Pharmacology Department*

Professor A. C. Frazer—assistance by Mr. J. W. Daniel, and expenses :
Dr. J. B. Finean—personal :
Dr. W. F. R. Pover—personal :
Dr. F. W. J. Teale—personal :
} studies of fat metabolism and absorption

*Physiology Department*

Dr. Margaret Beznák—personal and expenses : mechanism of cardiac hypertrophy, with particular reference to the role of hormones

*Social Medicine Department*

Dr. B. MacMahon—personal : studies of human congenital malformations

## BRISTOL

UNIVERSITY OF BRISTOL

*Anatomy Department*

Professor J. M. Yoffey—assistance by Mr. K. W. Keohane : use of the reflecting microscope in the study of steroid compounds (with Dr. C. R. Burch)

Dr. E. J. Field—expenses : mechanism of invasion of the central nervous system by neurotropic viruses

*Pathology Department*

Dr. D. H. Johnson—expenses : blood flow in the liver during shock

*Pharmacology Department*

Professor H. Heller—expenses : studies of liver function in malnutrition (at Makerere College, Uganda)

*Physiology Department*

Dr. J. Grayson—expenses : reflex mechanisms underlying circulatory changes in the colon

*Surgery Department*

Professor R. Milnes Walker—expenses : portal hypertension

STRANGEWAYS RESEARCH LABORATORY

Dr. Honor B. Fell and colleagues—expenses : studies of cell and tissue growth

Dr. J. Beattie—expenses : the effect of hypothalamic lesions on adrenal cortical function

UNIVERSITY OF CAMBRIDGE

*Chemical Laboratory*

Dr. F. G. Mann—assistance by Mrs. J. A. Reid, and expenses : synthesis of new compounds for testing as therapeutic agents in schistosomiasis and amoebiasis

*Colloid Science Department*

Professor F. J. W. Roughton—assistance by Mr. R. L. J. Lyster : gas absorption properties of haemoglobin

Dr. P. George—assistance by Mr. G. Hanania : mechanism of haemoprotein reactions

Dr. J. H. Schulman—assistance by Dr. A. V. Few : the use of surface techniques for the study of the mode of action of penicillin

*Pathology Department*

Dr. R. R. A. Coombs—expenses : haemolytic disease of the newborn

Dr. Dorothy H. Heard—personal : haemolytic disease of the newborn and related blood group problems

Dr. M. G. P. Stoker—expenses : Q fever antibodies in pigs

*Pharmacology Department*

Dr. F. Howarth—expenses : radioactive tracer studies of cerebral blood flow

*Physiological Laboratory*

Professor Sir Bryan Matthews—expenses : electrophysiology of the central nervous system

Dr. S. M. Hilton—personal and expenses : local peripheral vascular reactions during muscular work

Dr. Pamela M. Holton—expenses : chemical transmitter responsible for antidromic vasodilation

Dr. W. A. H. Rushton—expenses : electrophysiology of the retina

*Psychological Laboratory and Addenbrooke's Hospital*

Dr. Norma Kent—personal and expenses : the relation between educational backwardness and behaviour problems in children

*Radiotherapeutics Department*

Professor J. S. Mitchell—assistance by Mr. P. Schiøler : the effect of radiation on normal and malignant cells

*Sir William Dunn School of Biochemistry*

Professor F. G. Young—expenses : influence of pituitary hormones on metabolism

Dr. June D. Bell—personal : effect of adrenal cortical hormones on carbohydrate synthesis in liver tissue

Dr. M. Dixon—assistance by Miss B. A. Askonas and Miss J. Moyle : problems of enzyme chemistry

Dr. Dorothy Needham—personal and expenses : the effect of adrenal cortical steroids on carbohydrate metabolism

Dr. R. H. Smith—personal : physico-chemical studies of pituitary hormones

Dr. G. Weber—personal : studies of protein interaction

*Zoology Department*

Lord Rothschild—expenses : problems of fertilization and the physiology of spermatozoa

## CARDIFF

WELSH NATIONAL SCHOOL OF MEDICINE

*Pathology and Bacteriology Department*

Professor J. Gough—expenses : pathology of pneumoconiosis

*Pharmacology Department*

Dr. J. D. P. Graham—expenses : pharmacology of potential antihistaminic compounds (in association with Dr. N. B. Chapman, University of Southampton, p. 134).

WHITCHURCH HOSPITAL

*Neuropsychiatric Research Centre*

Dr. D. Richter—assistance by Mr. G. B. Ansell and Mr. M. K. Gaitonde, and expenses : studies of brain chemistry

## CROYDON, SURREY

MAYDAY HOSPITAL

Mr. A. F. Clift—assistance by Mr. J. Hart : physical properties of human cervical secretion

## DOWNE, KENT

BUCKSTON BROWNE RESEARCH FARM

Mr. W. J. Dempster—expenses : experimental studies on the transplanted kidney

## DUNDEE

UNIVERSITY COLLEGE

*Biochemistry Department*

Dr. R. P. Cook—(1) expenses : protein formation in *Penicillium notatum* ; (2) assistance by Mr. D. C. Edwards, and expenses : cholesterol metabolism

*Physiology and Biochemistry Department*

Professor G. H. Bell—expenses : physical properties of bone in relation to fluorosis

UNIVERSITY OF EDINBURGH

*Biochemistry Department*

Professor G. F. Marrian—assistance by Dr. J. Y. F. Paterson, and expenses : steroid metabolism

*Clinical Laboratory (Royal Infirmary)*

Dr. C. P. Stewart—assistance by Miss R. Renwick, and expenses : studies of adrenal cortical activity

*Department of Medicine (Royal Infirmary and Northern General Hospital)*

Dr. J. J. R. Duthie—assistance by Mrs. A. Crossland, and expenses : clinical and metabolic studies of rheumatic diseases

*Institute of Animal Genetics*

Professor C. H. Waddington—expenses : cytogenetic effects of low intensity radiation

*Pathology Department*

Dr. E. Geiringer—expenses : the effect of age on the functional activity of transplanted adrenal tissue

*Pharmacology Laboratory*

Dr. Regine Kapeller-Adler—expenses : histidine and histamine metabolism in pregnancy

Dr. Marthe L. Vogt—expenses : factors controlling the release of hormones from the adrenal cortex

*Physiology Department*

Professor D. Whitteridge—assistance by Miss J. Borragan, and expenses : the connections of the inferior olive in relation to the function of the cerebellum

Dr. A. D. Dewar—expenses : studies in the physiology of pregnancy

Dr. R. Passmore—expenses : metabolic efficiency during muscular work

*Surgery Department*

Professor Sir James Learmonth—(1) assistance by Dr. E. J. Delorme, Dr. I. D. E. Storey and Mr. D. C. Simpson, and expenses : problems of experimental surgery ; (2) assistance by Dr. G. I. C. Ingram : problems of blood clotting in thrombo-angiitis obliterans and related conditions

## GLASGOW

UNIVERSITY OF GLASGOW

*Anatomy Department*

Professor G. M. Wyburn—expenses : tissue grafts and homo-transplants

*Bacteriology Department (Western Infirmary)*

Professor J. W. Howie—assistance by Miss A. A. N. Keppie, and expenses : studies in experimental trypanosome infection

*Biochemistry Department*

Professor J. N. Davidson—expenses : studies in nucleic acid metabolism

Dr. H. N. Munro—expenses : studies of protein metabolism

*Chemistry Department*

Dr. P. A. Ongley—personal : preparation of new compounds for trial in the Clinical Chemotherapeutic Research Unit (under the supervision of Professor J. W. Cook)

*Genetics Department*

Dr. G. Pontecorvo—assistance by Mr. A. W. J. Bufton, and expenses : genetic control of extracellular enzymes in *Aspergillus nidulans*

*Materia Medica and Therapeutics Department*

Dr. A. Slessor—expenses : the role of adrenal hormones in water diuresis

*Pathological Biochemistry Department*

Dr. J. C. Eaton—expenses : hormone assay in diabetic pregnancy

## KINGSTON, SURREY

KINGSTON HOSPITAL

Dr. J. C. Lees—expenses : experimental studies of tumour growth rate and tumour inhibition by drugs

## LEEDS

UNIVERSITY OF LEEDS

*Bacteriology Department*

Professor J. W. McLeod—expenses : problems of bacterial metabolism

Dr. J. Gordon—expenses : studies of complement ; the resistance of bacteria to amino-acids

*Biochemistry Department*

Professor F. C. Happold—assistance by Mr. R. L. Noble, and expenses : carbohydrate metabolism in manic-depressive psychosis

*Clinical Pathology Department*

Dr. D. H. Collins—expenses : the effect of adreno-cortical hormones in experimental arthritis

*Medical Physics Department*

Professor F. W. Spiers—assistance by Mr. P. R. J. Burch, and expenses : measurement of the normal radioactivity of the human body

*Pharmacology Department*

Professor W. A. Bain—expenses : histamine and histamine antagonists

Mr. J. G. Dare—expenses : bacterial pyrogens

Mr. P. Hey—expenses ; structure-action relationships in choline derivatives

*Physiology Department*

Professor A. Hemingway—expenses : the effects of training on cardiac output and body metabolism

## LIVERPOOL

SCHOOL OF TROPICAL MEDICINE

Professor R. M. Gordon—(1) assistance by Mr. W. L. Nicholas, and expenses : the biology of *Culicoides* species, and their association with the spread of disease ; (2) expenses : problems of schistosomiasis and filariasis

UNIVERSITY OF LIVERPOOL

*Anatomy Department*

Professor R. G. Harrison—expenses : the functional anatomy of the vascular system of specific organs

*Biochemistry Department*

Professor R. A. Morton and others—expenses : chemistry of vitamin A and related topics

*Dental Surgery School*

Professor H. H. Stones—expenses : the effect of sugar on the incidence of dental caries in infants and children

Dr. R. L. Hartles—assistance by Miss N. MacDonald and Miss M. R. Wasdell : studies of saliva and the oral flora in relation to dental caries

*Physiology and Histology Department*

Professor R. A. Gregory—expenses : the physiology of the alimentary tract

*Surgery Department*

Professor C. Wells—assistance by Mrs. Dorothy Turnock : vitamin B absorption in the gut

*Zoology Department*

Dr. I. Chester Jones—expenses : functions of the adrenal cortex

## LONDON

BEDFORD COLLEGE FOR WOMEN

*Chemistry Department*

Professor E. E. Turner—assistance by Mr. R. F. Bird : synthesis of phenosafranine compounds in relation to the chemotherapy of filariasis

*Physiology Department*

Professor Margaret M. Murray—expenses : fluorosis and endemic goitre

BROMPTON HOSPITAL

Mr. W. P. Cleland, Mr. I. M. Hill and others—expenses : studies of benign thoracic tumours

CENTRAL MIDDLESEX HOSPITAL

*Gastroenterology Department*

Dr. F. Avery Jones—assistance by Miss B. White and Dr. Lorna Cooke, and expenses : studies of peptic ulceration

CHELSEA POLYTECHNIC

*Physics Department*

Dr. Mary P. Lord—expenses : studies of minute eye movements

GUY'S HOSPITAL MEDICAL SCHOOL

*Chemical Pathology Department*

Professor R. H. S. Thompson—assistance by Dr. G. Webster, and expenses : nature of cholinesterase activity

*Pathology Department*

Dr. J. Pepys—personal and expenses : factors concerned in local and general eosinophile responses ; problems of tuberculin sensitivity

*Pharmacology Department*

Professor J. M. Robson—expenses : pharmacology of sex hormones

*Physics Department*

Dr. C. B. Allsopp—assistance by Dr. J. Vance, and expenses : survey of radiation dosage received during routine diagnostic X-ray examinations

HAMMERSMITH HOSPITAL

*Radiotherapeutic Research Unit*

Dr. T. Alper—personal : effect of ionising radiations on bacteriophage

IMPERIAL COLLEGE OF SCIENCE

*Organic Chemistry Department*

Dr. L. N. Owen—expenses : chemistry of thiol compounds

*Physics Department*

Professor W. D. Wright—expenses : studies in colour vision

INSTITUTE OF OPHTHALMOLOGY

Sir Stewart Duke-Elder—assistance and expenses (from Alexander Pigott Wernher Memorial Trust funds) ; problems of glaucoma and myopia

Mr. E. Wolff and Mr. G. C. Penman—expenses : antomy of the peripheral retinal nerve fibres

KING'S COLLEGE HOSPITAL

*Chemical Pathology Department*

Professor C. H. Gray—(1) assistance by Miss P. E. Brockman, and expenses : studies of pigment metabolism ; (2) expenses : hormone excretion in diabetic pregnancy

*Ear, Nose and Throat Department*

Mr. T. Cawthorne—assistance by Dr. R. H. Harvey and expenses (from Alexander Pigott Wernher Memorial Trust funds) : clinical tests of bone-conduction hearing aids

LISTER INSTITUTE OF PREVENTIVE MEDICINE

The late Dr. P. Ellinger—expenses : problems of nicotinamide metabolism

Professor W. T. J. Morgan—assistance by Dr. Winifred M. Watkins : biochemistry of human blood group substances

Mr. A. F. D. Standfast—assistance by Dr. Jean Horton ; the " protective " antigen of *H. pertussis*

LONDON COUNTY COUNCIL INFANT WELFARE CLINICS

Dr. W. F. Dunham and Mrs. E. Collis—expenses : the early diagnosis and treatment of infantile cerebral palsy

LONDON HOSPITAL

*Medical Unit*

Dr. J. R. K. Preedy—personal : urinary oestrogens in liver disease and toxaemia of pregnancy

LONDON HOSPITAL MEDICAL COLLEGE

*Pharmacology Department*

Dr. M. Weatherall—expenses : pharmacological actions of dimercaprol (BAL) and related substances

MIDDLESEX HOSPITAL MEDICAL SCHOOL

*Courtauld Institute of Biochemistry*

Professor E. C. Dodds—expenses : synthetic oestrogens

NATIONAL HOSPITAL, QUEEN SQUARE

Dr. Margaret Reinhold—personal and expenses : disturbances of function in organic cerebral disease

POSTGRADUATE MEDICAL SCHOOL OF LONDON

*Biophysics Department*

Mr. D. K. Hill—assistance by Mr. W. K. T. Fowler, and expenses : development and construction of a mass spectrometer for cardio-respiratory research

*Department of Medicine*

Professor J. McMichael—expenses : cardiovascular, respiratory and other clinical studies

Dr. C. L. Cope—assistance by Miss B. Hurlock : adrenal function in conditions of physical stress

Dr. Russell Fraser—expenses : studies of iodine metabolism

*Pathology Department*

Professor E. J. King—assistance by Mrs. J. C. Dale, and expenses : studies of pneumoconiosis and experimental silicosis

Dr. D. A. Mitchison—expenses : studies of bacterial resistance in relation to the chemotherapy of tuberculosis

Dr. G. I. M. Ross—expenses : microbiological assay of vitamin $B_{12}$ in body fluids

*Surgery Department*

Mr. S. F. Taylor—expenses : studies of thyroid function with radioactive iodine

PUBLIC HEALTH DEPARTMENT, ST. PANCRAS

Dr. D. H. Geffen—expenses : factors influencing the activation of paralysis in poliomyelitis (with Dr. J. H. Paterson at the National Hospital, Queen Square, London)

QUEEN ELIZABETH COLLEGE

*Physiology Department*

Professor J. Yudkin—assistance by Dr. J. Mandelstam : studies in enzyme adaptation

QUEEN ELIZABETH HOSPITAL FOR CHILDREN, HACKNEY

Dr. B. Levin—expenses : studies of serum protein levels and serum protein fractions (with Dr. Helen Mackay), and of iron metabolism, in infants

ROYAL CANCER HOSPITAL

*Chester Beatty Research Institute*

Dr. B. Camber—personal : studies in steroid chemistry

ROYAL COLLEGE OF SURGEONS

Dr. S. Engel—personal and expenses : the comparative anatomy of the lung

ROYAL COLLEGE OF SURGEONS AND BUCKSTON BROWNE RESEARCH FARM, DOWNE, KENT

Professor A. Sorsby—assistance by Mr. J. P. Newhouse and Dr. D. Lucas, and expenses (from Alexander Pigott Wernher Memorial Trust funds): congenital and hereditary anomalies of the eye

ROYAL NATIONAL ORTHOPAEDIC HOSPITAL

Dr. W. J. W. Sharrard—personal: pathology of chronic poliomyelitis

Dr. J. T. Scales—expenses: the use of plastic materials as wound dressings and in orthopaedic surgery

ROYAL NORTHERN HOSPITAL

Mr. A. Green—assistance by Mr. B. Spicer: improved techniques in X-ray therapy

ST. BARTHOLOMEW'S HOSPITAL

*Pathology Department*

Sir Ernest Kennaway—expenses: studies of atmospheric pollution and other factors in relation to cancer of the lung

Dr. H. Lehmann—assistance by Mrs. E. Silk, and expenses: problems of haemorrhage

ST. BARTHOLOMEW'S HOSPITAL MEDICAL COLLEGE

*Biochemistry and Chemistry Department*

Professor A. Wormall—assistance by Miss N. Salaman and Miss D. E. Richards, and expenses: studies of nitrogen mustard compounds, trypanocidal drugs, and problems of immunity

*Physics Department*

Professor J. Rotblat—assistance by Miss G. B. Ward, and expenses: the use of nuclear research emulsions for the study of living tissues

*Physiology Department*

Dr. D. A. McDonald—expenses: high-speed cinematographic recording of the arterial blood velocity

ST. MARK'S HOSPITAL

Mr. H. R. Thompson and others—expenses: follow-up studies of rectal cancer

ST. MARY'S HOSPITAL MEDICAL SCHOOL

*Anatomy Department*

Professor F. Goldby—assistance by Mr. H. J. Gamble: the olfactory connections in the reptilian and mammalian brain

Dr. J. J. Pritchard—expenses: the mechanism of bone formation

*Biochemistry Department*

Professor R. T. Williams—expenses: metabolism of benzene derivatives

*Medical Unit*

Professor G. W. Pickering—assistance by Dr. G. S. C. Sowry: studies of the inheritance of essential hypertension

*Physiology Department*

Professor A. St. G. Huggett—expenses: studies of foetal and placental physiology

*Wright-Fleming Institute of Microbiology*

Professor R. Cruickshank—(1) assistance by Miss B. T. Wicks : methods for the laboratory diagnosis of tuberculosis ; (2) assistance by Dr. F. Brimblecombe and Miss D. Sanderson, and expenses : epidemiological studies of infections in infancy

ST. THOMAS'S HOSPITAL

*Sherrington School of Physiology*

Professor H Barcroft—expenses : studies of the peripheral circulation

SCHOOL OF PHARMACY

Professor G. A. H. Buttle—expenses : problems of chemotherapy ; pharmacology of substances simulating the action of cortisone (on behalf of the Council's Clinical Chemotherapeutic Research Unit, p. 69) ; experimental studies of poliomyelitis (with the late Dr. G. M. Findlay)

Professor W. H. Linnell—expenses : synthesis of analogues of the adrenal cortical hormones

Dr. K. R. Adam—expenses : biological testing of newly synthesised dithiols

Dr. Eleanor J. Zaimis—expenses : mechanism of neuro-muscular transmission

UNIVERSITY COLLEGE

*Biochemistry Department*

Dr. A. L. Greenbaum—expenses : the effect of growth hormone on fat metabolism

Dr. F. L. Warren—assistance by Miss I. B. Ainsworth, and expenses : biochemical processes in foetal and reproductive tissues, with special reference to the part played by steroid hormones

*Biometry, Eugenics and Genetics Department*

Dr. H. Grüneberg—assistance by Dr. Gillian M. Truslove, and expenses : the pathology of inherited disease in animals

*Biophysics Department*

Professor B. Katz—assistance by Dr. P. Fatt : mechanism of neuromuscular transmission

Mr. B. C. Abbott—expenses : studies of the physiological cost of " negative " work

Dr. E. J. Harris—assistance by Miss P. A. Wills : tracer studies of equilibrium transfer phenomena between cells and their environment

*Botany Department*

Dr. G. E. Fogg—assistance by Miss D. M. Collyer : fat production by algae

*Pharmacology Department*

Dr. S. E. Dicker—expenses : metabolism of posterior pituitary secretions in relation to renal function

*Pharmacology and Psychology Departments*

Miss H. Steinberg—personal and expenses : the effect of drugs on quantitatively measurable performance in man

*Physiology Department*

Professor G. L. Brown—assistance by Miss B. R. Bigland, and expenses: studies in neuromuscular physiology

Dr. M. de Burgh Daly and the late Dr. A. Schweitzer—assistance by Mr. P. G. Wright, and expenses: respiratory reflexes

Dr. H. E. Lewis—expenses: the electrical conductivity of healthy and oedematous lung tissue

*Zoology Department*

Professor P. B. Medawar—(1) expenses: problems of transplantation immunity; (2) assistance by Mr. G. Szabo: studies of skin pigmentation

UNIVERSITY COLLEGE HOSPITAL

*Clinical Pathology Department*

Professor M. Maizels—expenses: studies of red cell metabolism

*Obstetric Hospital*

Dr. Helen Payling Wright—expenses: measurement of the rate of venous blood flow

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL

*Bacteriology Department*

Professor Wilson Smith—assistance by Miss M. Edney, and expenses: studies of the influenza group of viruses

*Biochemistry Department*

Dr. C. E. Dent—assistance by Mr. D. F. Evered: chromatographic isolation and identification of amino-acids in human body fluids

*Medical Unit*

Professor M. L. Rosenheim—assistance by Dr. M. Harington: pharmacology and clinical effects of methonium compounds

Dr. B. Senior—personal: studies of cystinuria and cystine stone formation

*Morbid Anatomy Department*

Professor G. R. Cameron—expenses: effect of cortisone and related substances on tissue repair

*Surgical Unit*

Dr. B. G. B. Lucas—expenses: experimental studies of the effect of anoxia on the brain (with Dr. Dorothy H. Strangeways, Department of Physiology, Queen's University, Belfast)

WEST LONDON HOSPITAL (AND OTHER CENTRES)

Dr. W. S. C. Copeman, Professor E. C. Dodds, Dr. P. M. F. Bishop, Dr. A. S. Paterson and Dr. O. Savage—expenses: the treatment of rheumatoid arthritis with steroid compounds related to cortisone

WESTMINSTER MEDICAL SCHOOL

*Chemical Pathology Department*

Professor N. F. Maclagan—assistance by Mr. W. E. Sprott, and expenses: the mode of action of anti-thyroxine substances

UNIVERSITY OF MANCHESTER

*Department of Education of the Deaf*

Professor A. W. G. Ewing—(1) assistance by Mrs. J. D. Midgley, and expenses ; (2) assistance by Miss D. M. Gutteridge and Mr. D. C. Kendall, and expenses (from Alexander Pigott Wernher Memorial Trust funds) : educational treatment of deafness in children

*Haematology Department (Royal Infirmary)*

Dr. J. F. Wilkinson—expenses : studies of blood disorders

*Occupational Health Department*

Dr. R. S. F. Schilling—expenses : studies of byssinosis among cotton operatives

## NEWCASTLE UPON TYNE

GENERAL HOSPITAL

Dr. V. R. Pickles—expenses : the estimation of mammary blood flow in relation to clinical problems of lactation (with Mr. Linton Snaith)

ROYAL VICTORIA INFIRMARY

Dr. C. C. Ungley—assistance by Mrs. L. Raine, and expenses : studies of megaloblastic anæmias

UNIVERSITY OF DURHAM (KING'S COLLEGE)

*Botany Department*

Dr. J. W. Hughes—personal : nutritional requirements of the pathogenic fungi *M. audouini* and *M. canis*

*Chemistry Department*

Dr. J. Weiss—expenses : radiation chemistry of sterols

*Physiology Department*

Dr. J. A. Saunders—assistance by Mr. C. M. Dowse : studies of fat digestion

Dr. B. Schofield—expenses : experimental studies of gastric secretion

*Surgery Department*

Professor F. H. Bentley—expenses : the pattern of blood vessels in the stomach in normal and diseased conditions

## OXFORD

UNIVERSITY OF OXFORD

*Biochemistry Department*

Professor Sir Rudolph Peters—expenses : (1) physico-chemical studies of proteins with the ultra-centrifuge ; (2) studies of the vitamin B complex

Dr. P. W. Kent—assistance by Mr. P. F. V. Ward : the structure of natural products of immunological importance

Dr. A. G. Ogston—assistance by Miss J. Stanier : the physical properties of synovial fluid

Dr. L. A. Stocken—assistance by Miss M. G. Ord : the biochemical effects of radiation

*Botany Department (Mycology Laboratory)*

Dr. W. H. Wilkins—expenses : the production of antibiotic substances from fungi

*Chemistry Department*

Dr. G. T. Young—assistance by Mr. D. A. Rowlands, and expenses : the synthesis of peptides containing glutamic acid (on behalf of the Council's Chemical Microbiology Research Unit, p. 85)

*Clarendon Laboratory and Radcliffe Infirmary*

Dr. K. A. G. Mendelssohn—expenses : the application of physical methods to medical treatment

*Human Anatomy Department*

Dr. R. Barer—assistance by Mr. K. Ross : the biological action of radiations on living cells

*Institute of Experimental Psychology*

Mr. J. A. Deutsch—expenses : studies of auditory perception

Dr. F. J. Langdon—personal and expenses : studies of space and form perception

*Institute of Social Medicine*

Dr. Alice M. Stewart—assistance and expenses : (*a*) epidemiological studies of tuberculosis ; (*b*) the use of Civilian Medical Board records for the study of morbidity statistics ; (*c*) the Oxford Child Health Survey

*Laboratory of Human Nutrition*

Dr. J. R. Marshall—personal and expenses : the rôle of trace elements in health and disease

*Nuffield Institute for Medical Research*

Dr. G. S. Dawes—expenses : experimental studies of the neo-natal circulation

Dr. J. G. Widdicombe—personal : studies of cardiovascular and respiratory reflexes

*Nuffield Laboratory of Ophthalmology*

The late Dr. J. W. Waters—expenses : the effect of neutron irradiation on the metabolism of the lens (with Mrs. A. Pirie)

*Pharmacology Department*

Dr. Janet Vaughan—assistance by Miss B. Kidman and Miss B. Rayner, and expenses : metabolism of strontium

*Physiology Laboratory*

Dr. F. P. Glees—assistance by Mr. J. W. Cole, and expenses : the effect of cerebral lesions on function and behaviour

Mr. E. H. Leach—expenses : histological studies of normal, diseased and transplanted skin

*Radcliffe Infirmary*

*Clinical Biochemistry Department*

Mr. E. J. Butler—personal and expenses : the rôle of trace elements in chronic disease of the nervous system (under Dr. J. R. P. O'Brien)

*Neurology Department*

Dr. W. Ritchie Russell—expenses : follow-up studies of head injuries (at the Head Injuries Bureau, Military Hospital, Wheatley, Oxford)

*Nuffield Department of Medicine*

Professor L. J. Witts—expenses : the metabolism of folic acid and vitamin $B_{12}$ in macrocyctic anæmia

Dr. L. P. R. Fourman—expenses : studies of potassium metabolism

*Nuffield Department of Surgery*

The late Professor Sir Hugh Cairns—assistance by Dr. Margaret Taylor : the use of tuberculin combined with streptomycin in the treatment of tuberculous meningitis and other forms of tuberculosis (with Dr. Honor Smith)

*Pathology Department*

Dr. R. G. Macfarlane—expenses : studies of blood disorders, with particular reference to problems of coagulation

*Sir William Dunn School of Pathology*

Professor Sir Howard Florey—assistance by Dr. H. S. Burton and Dr. G. G. F. Newton, and expenses : antibiotics produced by bacteria and fungi

Mrs. K. Crawford—personal and expenses : antibacterial substances occurring in natural sources (under the supervision of Sir Howard Florey)

Dr. D. Kay—personal : the phage-bacterium relationship (under the supervision of Sir Paul Fildes)

*Zoology and Comparative Anatomy Department*

Dr. F. S. Billett—personal and expenses : enzyme activity associated with cytoplasmic constituents (under the supervision of Dr. J. Baker)

## PORTSMOUTH

CENTRAL LABORATORY

Dr. E. M. Darmady—assistance by Miss P. Loud and Miss M. Hawkins, and expenses : the pathology of acute renal failure

## READING

UNIVERSITY OF READING

*Psychology Department*

Professor R. C. Oldfield—expenses : the recording of fluctuations in sensory threshold and other psycho-physical variables

## RUNWELL, ESSEX

RUNWELL HOSPITAL

Dr. H. Weil-Malherbe—assistance by Dr. J. Stern, and expenses : use of the hexokinase reaction for the study of hormonal changes in normal and psychotic subjects

## ST. ALBANS

HILL END HOSPITAL

Dr. S. Caterall—expenses : the clinical effects of brief-stimulus, non-convulsive therapy

## SHEFFIELD

UNIVERSITY OF SHEFFIELD

*Bacteriology Department*

Professor C. P. Beattie—expenses : studies of the aetiology and treatment of toxoplasmosis

*Dental School*

Mr. J. J. Hodson—expenses : the pathology of dental caries

*Department of Medicine*

Professor C. H. Stuart-Harris—assistance by Miss C. Allott, and expenses : studies of respiratory infections

*Pathology Department*

Professor H. N. Green—expenses : studies of nucleotide metabolism (with Dr. H. B. Stoner, p. 104)

*Pharmacology Department*

Dr. D. R. Wood—expenses : experimental studies of gastric secretion

*Social and Industrial Medicine Department*

Professor W. Hobson—expenses : studies of industrial pneumoconiosis

## SOUTHAMPTON

UNIVERSITY OF SOUTHAMPTON

Dr. N. B. Chapman—assistance by Mr. J. F. A. Williams, and expenses : synthesis of potential antihistaminic compounds

## TAPLOW, BERKSHIRE

CANADIAN RED CROSS MEMORIAL HOSPITAL

Dr. E. G. L. Bywaters and Dr. L. E. Glynn—assistance by Miss W. M. Stanier : chemical changes in connective tissue in rheumatic fever

# RESEARCH FELLOWSHIPS AND SCHOLARSHIPS

## Fellowships

### ROCKEFELLER TRAVELLING FELLOWSHIPS IN MEDICINE

The Council have once more to record their gratitude to the Rockefeller Foundation of New York for a further generous allocation of funds for the award of medical travelling fellowships. These fellowships are intended for graduates resident in this country who have had some training in research work in clinical medicine or surgery or in some other branch of medical science, and who are likely to profit by a period of work at a centre in the United States, or elsewhere abroad, before taking up positions for higher teaching or research in the United Kingdom.

The following appointments were made by the Council for the academic year 1951–2 :—

Mr. W. Burnett (Department of Surgery, University of Aberdeen)—for work on methods of studying liver function, under Professor C. J. Watson in the Department of Medicine, University of Minnesota, Minneapolis.

Dr. O. Garrod (Department of Medicine, Postgraduate Medical School of London)—for work on the hormonal factors regulating water metabolism, under Professor Robert F. Loeb in the Department of Medicine, Columbia University, New York.

Dr. J. N. Hunt (Physiological Laboratory, Guy's Hospital, London)—for work on problems of gastric function, under Dr. J. P. Quigley in the Department of Physiology, University of Tennessee ; under Dr. L. R. Dragstedt in the Department of Surgery, University of Chicago ; and under Dr. F. Hollander at the Mount Sinai Hospital, New York.

Dr. G. C. Kennedy (National Institute for Medical Research, London)—for work on problems of clinical endocrinology, under Dr. Lawson Wilkins at the Johns Hopkins Hospital, Baltimore.

Dr. B. P. Marmion (Virus Reference Laboratory, Colindale)—for work on problems of virus infection, under Professor Sir Macfarlane Burnet at the Walter and Eliza Hall Institute of Medical Research, Melbourne.

Mr. J. H. Peacock (Department of Surgery, University of Bristol)—for work on peripheral vascular disease, under Dr. F. A. Coller in the Department of Surgery, University of Michigan.

Dr. S. W. Stanbury (Department of Medicine, Royal Infirmary, Manchester)—for work on cellular metabolism, under Professor Robert F. Loeb in the Department of Medicine, Columbia University, New York.

Dr. E. M. Vaughan Williams (Department of Pharmacology, University of Oxford)—for work on the use and applications of neurophysiological methods, under Dr. S. W. Kuffler at the Wilmer Institute, Johns Hopkins Hospital, Baltimore.

### DOROTHY TEMPLE CROSS RESEARCH TRAVELLING FELLOWSHIPS IN TUBERCULOSIS

These fellowships, which were established under a generous endowment by the late Mrs. Odo Cross, are open to suitably qualified British graduates who intend ultimately to devote themselves to the advancement by teaching or research of the curative or preventive treatment of tuberculosis in any of its forms.

The following awards were made for the academic year 1951–2 :—

Mr. R. W. Baldwin (Department of Chemistry, University of Birmingham) —for work on antibodies in tuberculous human serum and on the fractionation of tuberculin proteins, under Dr. F. B. Seibert at the Henry Phipps Institute, University of Pennsylvania ; and on the mechanism of antigen-antibody reactions, under Dr. J. W. Williams in the Department of Chemistry, University of Wisconsin, Madison.

Dr. G. J. Cunningham (Department of Pathology, St. Bartholomew's Hospital, London)—for work mainly on the pathology of tuberculosis of the lung, at the Massachusetts General Hospital, Boston, and in the Department of Pathology, University of Wisconsin, Madison, under the direction of Dr. D. M. Angevine.

### KATHLEEN SCHLESINGER RESEARCH FELLOWSHIP

This fellowship, which was endowed by the late Mr. and Mrs. Eugen M. Schlesinger in memory of their daughter, is intended for research on cysts of the brain and allied conditions. During the period under review the award was held by Dr. Helen T. Morgan for work on the pathology of post-partum necrosis of the anterior pituitary gland, under the supervision of Professor H. L. Sheehan in the Department of Pathology, University of Liverpool.

### MAPOTHER BEQUEST RESEARCH FELLOWSHIP

This fellowship is provided from a benefaction by the late Dr. and Mrs. Edward Mapother for research in psychiatry. The first holder of the fellowship, Dr. O. E. Pratt, who was appointed in 1950, has continued to work on the histochemistry of the nervous system under the direction of Professor A. Meyer and Dr. H. McIlwain at the Institute of Psychiatry, Maudsley Hospital, London.

### ALEXANDER PIGOTT WERNHER MEMORIAL TRUST :

### TRAVELLING AWARDS IN OPHTHALMOLOGY AND OTOLOGY

These awards are provided from a special fund placed at the disposal of the Council by the trustees of the late Lady Ludlow under the terms of a bequest in memory of her son, to be used " towards the prevention and cure of blindness and deafness in the United Kingdom and the British Empire, and in particular research in connexion therewith by financing medical men and students within the Empire to study methods and practices in all countries of the world." Reference is made elsewhere (pp. 75–77, 103, 126, 128) to the provision made by the trustees for the support of research in ophthalmology and otology at centres in this country under the Council's auspices.

The following awards were made under this scheme for the academic year 1951–2 :—

Travelling Grant in Otology

Dr. Patricia R. Davey (Sydney, Australia)—to study methods and facilities for the investigation and treatment of hearing defects in children at centres in the United Kingdom and the United States.

Travelling Fellowship in Otology

Dr. R. N. Misra (Medical College, Lucknow, India)—to study surgical techniques and practice in otology under Mr. T. E. Cawthorne at King's College Hospital and the National Hospital, Queen Square, London, and at other centres in the United Kingdom.

Provision is made for these awards under an arrangement with the Centre National de la Recherche Scientifique for the interchange of French and British research workers in medical science (excluding clinical medicine). The scheme allows for the exchange of two workers from each country annually. The following appointments were made for the academic year 1951–2 :—

(*a*) French Scholars nominated by the C.N.R.S.

Mme. F. Charconnet-Harding—for work on the metabolism of tryptophane, under Dr. A. Neuberger at the National Institute for Medical Research, London.

M. Jean Lecocq—for work on the synthesis of nucleotides, under Professor A. R. Todd in the University Chemical Laboratory, Cambridge (for a second year).

(*b*) British Scholars nominated by the Council

Mr. S. V. Boyden (Department of Animal Pathology, University of Cambridge)—for work on adsorption phenomena in relation to problems of immunity, under Dr. P. Grabar at the Pasteur Institute, Paris.

Dr. J. L. Gowans (Sir William Dunn School of Pathology, University of Oxford)—for work on the mode of action of leucocytes, under Dr. P. Grabar at the Pasteur Institute, Paris.

## Clinical Research Fellowships

The first awards for preparatory training under this new scheme, to which detailed reference was made in the Introduction to the Council's Report for 1950–51, were made for the academic year 1951–52, as follows :—

Dr. A. S. Douglas (Department of Medicine, Royal Infirmary, Glasgow)—to work under Dr. R. G. Macfarlane in the Department of Pathology, Radcliffe Infirmary, Oxford.

Dr. A. I. I. Klopper (Institute of Gynaecology and Obstetrics, Postgraduate Medical School of London)—to work under Professor J. M. Robson in the Department of Pharmacology, Guy's Hospital, London.

Mr. T. P. S. Powell (Department of Human Anatomy, Oxford University)—to work under Professor W. E. Le Gros Clark in the Department of Human Anatomy, Oxford University.

Dr. A. N. Smith (Department of Surgery, Glasgow University)—to work under Dr. W. S. Feldberg at the National Institute for Medical Research, London.

Dr. C. W. M. Wilson (Gastro-Intestinal Unit, Western General Hospital, Edinburgh)—to work under Professor J. H. Gaddum in the Pharmacological Laboratory, Edinburgh University.

## Scholarships for Training in Research Methods

These awards are intended for recent medical and scientific graduates of special promise who desire to prepare themselves for future work in some branch of medical research. Thirty-six new appointments were made for the academic year 1951–2, and the total number of awards in being at the end of the period was ninety-four.

# LIST OF PUBLICATIONS BY MEMBERS OF THE COUNCIL'S STAFF

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The mechanism of amide formation from acids and urea. *ibid.*, 1951, p. 3509.

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A. BOZZO—
Studies of the antigenic composition of influenza B viruses. *Bull. World Hlth Org.*, 1952, **5**, 149.

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### WHITE MEMORANDA

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Treatment of Hypertension with Rice Diet.

# BENEFACTIONS RECEIVED BY THE MEDICAL RESEARCH COUNCIL

during the period covered by the present Report,
1st October, 1951–30th September, 1952

GRANTS

| | | |
|---|---|---|
| Rockefeller Foundation, New York, U.S.A. | $25,000 | Travelling Fellowships in medicine, awarded by the Council. |
| Eli Lilly & Company, Indianapolis, U.S.A. | $16,000 | Travelling Fellowships in medicine over a period of three years, awarded by the Council. |
| Rockefeller Foundation, New York, U.S.A. | $38,000 | Available for a period which ended on the 30th April, 1952, for the purchase of scientific apparatus in the U.S.A. |
| Eli Lilly & Company Indianapolis, U.S.A. | $20,000 | Available for a period of two years ending 31st December, 1953, for the purchase of scientific apparatus in the U.S.A. |
| Alexander Pigott Wernher Memorial Trust | £27,000 | For research on blindness and deafness. |

BEQUESTS

| | | |
|---|---|---|
| The late Mr. & Mrs. J. A. Hopps .. | £21,224 | Bequest of residuary estate for research on cancer. |
| The late Mr. H. E. Suffling .. | Residuary legatees, subject to three life interests | For research into the cause, cure, and relief of asthma. |

DONATIONS

Amounts under £50 :—Mrs. A. J. Dods, Tunbridge Wells (further donation for research on rheumatism) ; Mr. and Mrs. D. J. Couch, Norwich (further donation in memory of their son, Robert, for research on poliomyelitis) ; Miss R. Abbott, London (further donation) ; Staff and girls of the Burnley High School (further donation for research on poliomyelitis) ; Mrs. M. Vale, Kingswinford (for research on tuberculosis) ; Mr. W. Busbridge, Edgware (for research on tuberculosis) ; Mrs. E. Wood, Woking (for research on disseminated sclerosis) ; Walthamstow and District Football Charity Competition (for research on tuberculosis) ; Swansea and District National Union of Miners (for research on pneumoconiosis) ; Mr. W. A. Coleman, Hounslow (for research on cancer) ; Mr. G. T. Jeaffreson, Thornton Heath (for research on tuberculosis) ; Stand Grammar School for Girls, Whitefield (for research on poliomyelitis) ; Mrs. A. L. Knudson, Enfield (donation in memory of the late Mr. A. E. Brewster).

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