

besides studies on virus purification, extensive work on amino-acid analogues continued with particular emphasis on determining whether the analogues are contained in radically different molecular species or in proteins similar to those normally synthesized.

Measurements in the Department of Plant Biology on the derivative absorption spectra of chlorophyll in numerous algae and other plants suggest that there are more than two forms of chlorophyll *a*. Further investigation on the photochemical formation of chlorophyll in leaves from its precursor photochlorophyll gave yields of about 0.5–0.7 molecule of chlorophyll formed per quantum of light absorbed, suggesting that two quanta of light may produce one molecule of chlorophyll. A study of the reversible oxidative bleaching of chlorophyll by chemical treatment and by light in several species of photosynthetic bacteria showed that the chemical properties of the pigment are markedly influenced by its incorporation in natural structures, the form absorbing light at the longest wave-length (890 m μ) being the most active. A number of climatic races of *Mimulus* plants are being grown for laboratory studies of the way their rates of respiration respond to variations of temperature and intensity of light, and studies have been commenced on the germination of seedling populations of contrasting parental and hybrid lines of *Mimulus* under crossed gradients of controlled temperature and light intensity.

In the Department of Embryology, studies of the molecular basis of rhythmic motility in spermatozoa indicated that the mechanisms of contractility and co-ordination can be disengaged experimentally. Important findings are reported in work on the development of the adrenals and sympathetic paranglia in insectivores, and studies on the synthesis of the muscle proteins actomyosin and myosin in the regenerating limb of the salamander continued. Other work was concerned with differentiation and morphogenesis in the human embryo, the neural

crest and its derivatives, the chemical basis of morphogenetic movements, the acquisition of biological specificity, the effect of hormones in developmental systems, and the anatomy and physiology of the uterus and the placenta.

In the Department of Genetics, studies with maize clarified an obscure aspect of the suppressor-mutator system of control of gene action, and analyses of biological ultrastructure by methods combining cytochemistry and electron microscopy offered new evidence that the chromosomes in actively dividing cells contain ribonucleic acids at all stages of the mitotic cycle. Studies of the intracellular deoxyribonucleases were concentrated on ascertaining the best procedures for extracting and purifying the intracellular deoxyribonuclease of salmon testes. Further studies of the properties of phage *T2*, which grows on strain *B* of *Escherichia coli*, suggest that phage particles are made from at least two protein sub-units, each containing a large fraction of the total phage sulphur. Studies of bacterial genetics with *Salmonella typhimurium* and *Escherichia coli* support the assumption that recombination among five genetic markers in the former is accomplished through a 'copy-choice' mechanism governing the exchange of characters between a recipient chromosome and a transducing element, and that the frequency of 'switchovers' in this process depends on the genetic constitution of the chromosome regions. Evidence has been obtained that transduction by bacteriophage lambda of loci concerned with galactose utilization in *E. coli* is a matter of lysogenization by a new type of genetic structure, which is part phage and part bacterial in origin.

The Department of Archæology completed its work during the year, and both the departmental and the presidential reports review broadly its work over more than fifty years. Some notes on ceramic studies in Yucatan and a ceramic technology are included in the departmental report.

THE NATIONAL RESEARCH DEVELOPMENT CORPORATION

REPORT FOR 1957-58

THE report of the National Research Development Corporation for the year ended June 30, 1958*, records a revenue from inventions of £174,242, notably from triiodothyronine, Prof. R. L. Wain's phenoxybutyric acid weed-killers, the Bailey bridge, the Royal Aircraft Establishment fire and heat detector and gyroscopic control apparatus for aircraft, the Ministry of Supply electrical ignition system and exploder, anti-thyroid compounds, the Hutchinson-Scarrott pulse height analyser, hecogenin from sisal, the Denny-Brown ship stabilizer control gear, nisin and anti-tumour agents of the nitrogen mustard type, on which all significant expenditure has ceased. Further reference is made to the Corporation's part in the development of electronic digital computers, including a project for the development of a large business-type computer and data-processing system of advanced design and performance, making extensive use of transistors, and two projects for mag-

netic type equipment for use with digital computers, but progress with the development of a very high-speed computer has been slow. An agreed programme of research and development of computer-controlled machine tools was initiated at the Manchester College of Science and Technology in January 1956, and interesting results are being obtained on the performance of slideways and on the cutting forces occurring during contour milling operations. Work continues on the development of high-performance drive systems, but the Corporation now considers that the time has come to withdraw its financial support.

Work at the National Physical Laboratory on Sir Thomas Merton's diffraction grating inventions is proving important in unexpected ways, and the Corporation's intervention in the development of printed electrical circuits has also been fully justified by results. The Corporation has now been able to retire from the collaborative effort it initiated seven years ago, leading to the collection of pituitary gland and production of adrenocorticotrophic hormone on a commercial basis. Development of a process for

* National Research Development Corporation. Report and Statement of Accounts for the year 1st July, 1957, to 30th June, 1958. Pp. ii + 28. (London: H.M. Stationery Office, 1958.) 1s. 6d. net.

producing aldosterone in significantly greater quantities from adrenal glands, including a limited amount of aldosterone and other adrenal hormones labelled with tritium, is also being financed, as well as a project for the isolation from *Pueraria mirifica*, from Thailand, of the oestrogenic substance, 'mir-oestrol', and elucidation of its structure, with the view of ultimate synthesis and medical use.

The four prototype groundnut harvesters shipped to East Africa in the spring of 1958 operated well on the true bunch varieties for which they were designed, but some difficulties were encountered in handling semi-bunch varieties, and commercial applications have been established for flexible barges of 40 to 1,000 tons capacity for transporting oil and other liquids by water. Among the new projects, some of which the Corporation proposes to attack under the extended powers confirmed by the 1954 Act, are a cotton-spinning project at the British Cotton Industry Research Association; a continuous-flow laundering project at the British Launderers' Research Association; a programme on ferroelectric ceramics

at the Battersea College of Technology; the development of Prof. J. McGee's new form of image intensifier at the Imperial College of Science and Technology; the National Institute of Agricultural Engineering's jute ribboner; and an ultrasonic flow-meter at the British Scientific Instrument Research Association.

Government departments and research councils assigned patent rights in 86 cases compared with 105 in 1956-57, 49 of the total of 147 coming from the universities and eight from private firms and individuals in the United Kingdom, compared with 26 and 3, respectively, out of 148 in 1956-57. Of 612 inventions communicated to the Corporation during the year, compared with 631 in 1956-57, 231 were from Government departments and research councils, 13 from official organizations, four from charitable organizations and 286 from private firms and individuals, 265 in the United Kingdom. Holdings of British and foreign patent applications totalled 2,930, including 370 United Kingdom applications and 595 granted patents, 975 overseas applications and 990 granted patents.

FIGURAL AFTER-EFFECTS

PETER McEWEN'S monograph supplement to the *British Journal of Psychology*, entitled "Figural After-effects" (Monograph Supplement 31; 1958), is a timely summary of research and theorizing in a rapidly growing field of experimental psychology. The fundamental facts are relatively simple and universally accepted; they were first observed by the American psychologist, J. J. Gibson, who found that subjects who had inspected a curved line for some time would afterwards see a straight line as curved in the opposite direction. This discovery aroused relatively little interest until it was taken up by one of the great figures of psychology, Wolfgang Köhler, who had been one of the founders of the *Gestalt* school. He showed in a wealth of detail that almost any kind of visual or tactual perception produced certain effects of a relatively lasting character, effects which would change subsequent perceptions and which could be measured by the amount of such change induced. Most of his work was concerned with visual stimuli, but he also initiated experiments in kinesthetic figural after-effect, and other sense modalities have also been studied since. It was Köhler who coined the term 'figural after-effects' by which these phenomena are now known.

Köhler did more than this, however. He proposed a physiological theory of the origin of these phenomena, making use of the concept of electrotonus, and deducing the observed phenomena from this theory. In recent years this has led him right over into the physiological field, where his vigorous and unorthodox approach has caused a good deal of discussion and criticism. Within the psychological field, however, he did one further great service by pointing out that his general theory could serve to explain many previously unrelated phenomena, such as the disappearance of certain visual illusions with time, and by suggesting that there were certain very striking similarities between the satiation process, which he believed to underlie figural after-effects, and certain inhibitory phenomena well known in the field of learning and conditioning. Köhler's theory therefore holds out an exciting prospect of unification

of large areas of psychology which hitherto had been treated as quite separate from each other; this fact alone would justify the great amount of work that has gone into the testing of his hypotheses.

Dr. McEwen traces all this work, both on the experimental and theoretical level, in a painstaking, accurate and detailed account which is always judicious and remains close to the facts. He shows how much of the work that has been reported suffers from being purely phenomenological rather than quantitative, and how this lack of quantification has made any decisive type of experimentation or theorizing extremely difficult. To take but one example, after-effects are sometimes said to disappear after a few minutes, while at other times they are said to last for days or even months. McEwen also shows very clearly how complex the phenomena under consideration are, and how many of them require *ad hoc* hypotheses to be brought under the wing of Köhler's theory—or indeed that of the only rival theory, advanced by Osgood and Heyer.

It would probably be true to say that concentration on *apparently* unimportant issues and laboratory investigations of problems of theoretical interest characterize a maturing science, whereas exclusive preoccupation with direct practical questions is often characteristic of a pre-scientific stage. Similarly, the emergence of broad general theories covering a large amount of ground, and unifying many diverse phenomena, is also characteristic of a stage of relative maturity in a science, as compared with the purely empirical *ad hoc* investigation of unrelated phenomena. Learning theory was the first part of psychology to achieve such a level of maturity, and Köhler's work may now be said to have achieved the same status for perception. Indeed, the fact that he was able to point to very striking similarities between phenomena in perception and in the learning field suggests that an even greater unification may be in prospect. The whole situation is an exciting and promising one, and inevitably reminds one of those halcyon days in atomic research when interest was