The tube is held in a water-bath, the temperature of which is raised ¼ deg. C./min. The method has the advantage of simplicity, thus enabling many variables to be studied. The main contribution of the paper was to show in which conditions the period of maturing of a gel has the most marked effect on its structure as shown by the melting point. If the gelatine solution is rapidly cooled, and then matured at a temperature of 0–10° C., the maturing, after the first hour, has no effect on the melting point, except for the most dilute gels where the setting takes an appreciable time. In contrast, at the higher maturing temperatures (20–25° C.) a marked increase in melting point may be secured by prolonged maturing. These differences in behaviour are presumed to arise from greater powers of re-orientation into stable aggregates at the higher temperature.

Interesting results were obtained by successive maturing at two temperatures. Whereas the melting point characteristic of high-temperature maturing was not changed when this maturing was followed by a further maturing period at a low temperature, the same was not true when the temperatures were reversed. High-temperature maturing could cause a rise in melting point even when it succeeded low-temperature maturing.

The formation of aggregates on cooling gelatin solutions to temperatures above their setting point can be detected by viscosity measurement. In addition, aggregates formed at 25° C. can persist for appreciable times even at 40° C. This work has a bearing on many uses of gelatine and glue, as well as on gel structure.

A. G. WARD

[1] Doty, P., and Nishihara, T., "Recent Advances in Gelatine and Glue Research", edit. by G. Stainsby, 92 (Pergamon Press, 1958).
[2] Russell, G., *Nature*, **181**, 102 (1958).
[3] Maron, N., "Recent Advances in Gelatin and Glue Research", edit. by G. Stainsby, 221 (Pergamon Press, 1958).

NATIONAL RESEARCH COUNCIL OF CANADA

REPORT FOR 1957–58

THE forty-first annual report of the National Research Council of Canada, covering the year 1957–58*, includes the report of the president, Dr. E. W. R. Steacie, the financial statement, and the annual report of Canadian Patents and Development Ltd. Although the latter company shows a slight loss for the year, the prospects of increasing revenue from licences for oil additives, the crash position indicator, the multiple core yarn and the sedimentation device are stressed. During the year the Council provided 3·6 million dollars in support of pure research in the universities by way of 305 scholarships and fellowships, and its 583 scientific research staff (including 142 post-doctorate fellows), 854 technical and 888 general service and administration staff answered 9,500 technical inquiries from Canadian industries. For 1958–59 the Council has recommended that the support given to the universities should be increased to 6 million dollars, but continued growth of government research laboratories is also essential in view of certain limitations on research in industry in Canada.

In 1956, Dr. Steacie points out, Canadian secondary industries, which contribute 22 per cent of the net output and employ 20 per cent of civilian labour, spent about 80 million dollars on research, an increase of 20 per cent on 1955, but 65 per cent of this expenditure was made by a relatively few large companies. Compared with the United States or Great Britain expenditure on research by industry is relatively low.

A major effort is needed to bring about the type of expansion required, and the maintenance of a supply of competent scientists is a reason for ensuring that every encouragement is also given to research in the universities and in Government laboratories.

The Division of Applied Biology has undertaken fundamental work on the effects of irradiation on the development of rancidity in bacon and continued its investigation of railway refrigerator cars. Studies of the structure and development of plant cells and their constituents with the electron microscope were extended, and an improved assay procedure was developed for the toxin-neutralizing substance discovered in culture filtrates of *Penicillium cyanofulvum*, while conversions of up to 50 per cent of sugar to citric acid have been obtained by submerged fermentation of blackstrap molasses. The Atlantic Regional Laboratory completed a systematic survey of the composition of peat in seven large bogs in the Maritime Provinces and its further studies on laminarin sulphate as a blood-anticoagulant have shown that with large doses over a prolonged period this substance tends to be more toxic than heparin. The Prairie Regional Laboratory has developed special columns for the rapid analysis of components of vegetable oils by gas – liquid phase chromatography, and promising yields of lysine and ergot have been obtained by careful study of fermentation conditions, while a new method was developed for the direct separation of starch and gluten from wheat flour.

In the Division of Applied Chemistry, a silver catalyst was used in studying the oxidation of ethylene and propylene, and high-pressure work has included the conversion of gaseous and liquid aldehydes to solids, the measurement of rates of selected reactions as a function of pressure and the determination of changes in the physical properties of gases when highly compressed. The molecular weights of chemical compounds and polymers in the range 40,000–100,000 have been determined and the oxidation-rates of iron and its alloys measured over a range of temperatures by following the gain in weight and by cathodic reduction of the oxidation products. An extensive study was made of the kinetics of polymerization of styrene and α-methylstyrene initiated by sodium naphthalene and much work was done on the fabrication of silver alloys for oxidation catalysts.

In the Division of Pure Chemistry, work continued on the development of suitable methods for deuterating organic compounds, and a study was made of the

* Forty-first Annual Report of the National Research Council of Canada, 1957–58, including the Annual Report of Canadian Patents and Development Limited. Pp. 54. (N.R.C. No. 4783.) (Ottawa: Queen's Printer, 1958.)

instrumental conditions to be met to obtain infra-red spectra that are true physical constants of the absorbing compounds. Comprehensive measurements are being made of the specific heat of elements of the diamond structure (diamond, silicon and germanium) in the temperature region 2°–300° K. and a Calvet type microcalorimeter is being constructed. The study of the influence of surface forces on the rates of flow of fluids through capillary systems and of the nature of the forces responsible for the sorption of acids and dyes by textile fibres continued.

In its work on the control of noise, the Division of Applied Physics gave some attention to communication in high ambient noise. The process of establishing Canada's standards in electricity and mechanics is approaching completion. Temperature measurements of very high precision are being made to determine some of the limits of accuracy of the International Temperature Scale and to investigate the possibility of replacing later some of its fixed points. Besides work on the redefinition of the international metre, comprehensive studies on aerial triangulation continued, and detailed studies by the photometry laboratory should lead to an improved primary standard of light.

The Division of Pure Physics reports important advances in studies of the interaction of energetic μ-mesons with carbon nuclei; an extensive experimental study of the transition metals was completed; a new theory of the processes of strain hardening has been developed and a new type of phase transition in solids discovered. The structures of propiolic aldehyde and vinyl cyanide were determined in the microwave laboratory. A new approach to the general theory of relativity has been formulated on the basis of a new principle of observation.

In the Division of Mechanical Engineering, a very thorough investigation was made into the status of production, research and development in non-metallic structural materials in Canada, and work was almost completed on several projects for the St. Lawrence Seaway. Besides problems related to the design and powering of ships, substantial work was undertaken on the examination of aircraft turbo-jet and turbo-propeller engines under simulated icing conditions. Work is in progress on the aerodynamic problems of aircraft capable of vertical take-off and short take-off, and on techniques for measuring the dynamic characteristics of aircraft at high speeds. An emergency radio beacon, simple and light in weight, was developed by the Radio and Engineering Division to survive aeroplane crashes, as well as a device using transistors to switch off electric buoy lights during daylight and a photoelectric control which puts the diesel-electric plant at Pelee Passage lighthouse into operation between dusk and dawn. Microwave equipment is being developed to provide accurate fixes of position for hydrographic vessels, and a method was devised for measuring the gradient of voltage across each unit of a high-voltage suspension insulator string. Daily observations of 10-cm. radio-emission from the Sun were continued at the Radio Astronomy Observatory, and completion of the Springhill Meteor Observatory provided a new headquarters for meteor research, while auroral radar units are being operated continuously at four stations.

ACTION OF LIGHT ON VISUAL PIGMENTS

from

THE BIOLOGICAL LABORATORIES, HARVARD UNIVERSITY

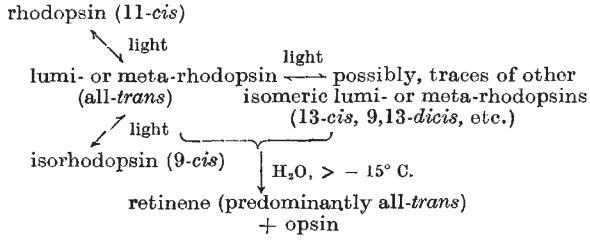
Vertebrate Lumi- and Meta-rhodopsins

By Dr. RUTH HUBBARD, PAUL K. BROWN and Dr. ALLEN KROPF*

RHODOPSIN, the red photosensitive pigment of rod vision, consists of the colourless protein, rod opsin or scotopsin, carrying neo-*b* (11-*cis*) retinene as chromophore. In the light, rhodopsin bleaches through orange-red intermediates (lumi- and meta-rhodopsin) to the yellow mixture of all-*trans* retinene and opsin.

The bleaching of rhodopsin proceeds in three steps, the first photochemical, followed by two thermal reactions[1]. Light initiates this reaction sequence by isomerizing the *cis* chromophore of rhodopsin to the all-*trans* configuration, so converting rhodopsin to the all-*trans* chromoprotein, lumirhodopsin[2,3]. Below about −40° C. lumirhodopsin is stable[1]; above this temperature it changes in light or darkness to a second all-*trans* chromoprotein, metarhodopsin[1–3]. Below about − 15° to − 20° C. metarhodopsin is stable[1]. At higher temperatures, all known vertebrate meta-rhodopsins hydrolyse spontaneously in the dark to all-*trans* retinene and opsin. Only this last reaction entails a major change in colour, that is, bleaching. Visual excitation, however, is so rapid as to leave time only for the first or second step, and must therefore precede bleaching[1,2].

Light, having isomerized the *cis* chromophore of rhodopsin to the all-*trans* configuration (lumi- or meta-rhodopsin), can go on to isomerize this to *cis* configurations, thus forming rhodopsin (11-*cis*), and isorhodopsin (9-*cis*). In conditions under which lumi- or meta-rhodopsin are stable, prolonged irradiation therefore always yields stereoisomeric mixtures of lumi- or meta-rhodopsin with photo-regenerated rhodopsin and isorhodopsin. This situation can be summarized as follows[2,3]:



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