

ABSTRACTS

(Papers read before the Institute but not published in the Proceedings.)

SULFATED DERIVATIVES OF LAMINARIN. A. N. O'NEILL AND W. W. HAWKINS. (Read November 12, 1956.) The polysaccharide, laminarin, was prepared from the marine alga, *Laminaria digitata*, and was sulfated with chlorosulfonic acid in pyridine and in liquid sulfur dioxide at temperatures below 0°. Derivatives containing both O-sulfate and N-sulfate groups were prepared by sulfating B-aminoethyl ethers of laminarin obtained by the reaction of laminarin with ethylenimine. These derivatives were found to act as anticoagulants for blood *in vitro*. The preparations with highest sulfate were most active and for equivalent sulfate that with both O-sulfate and N-sulfate groups was more active than the one containing only the former.

BUCKLING OF A REINFORCED PANEL. J. L. CUTCLIFFE AND H. S. HEAPS. (Read November 12, 1956.) There have recently appeared a number of papers concerned with theoretical prediction of the critical loads required to produce buckling of plane rectangular panels. In some instances the panels have been supposed to be strengthened by the addition of stiffeners connected continuously across the panel. In actual construction it is often convenient to join the stiffeners to the panel at isolated points only. The present paper considers the buckling of a long rectangular panel reinforced by struts that are spot connected to it. The analysis involves a determination of the panel deflection in terms of the unknown reactions at the spot connections. Equations for the reactions are found to be consistent only for certain values of applied load. These discrete values are the buckling loads which may then be shown graphically as a function of the elastic properties of the panel and stiffeners for various spacings and number of connections to the panel.

THE FORMAL TOTAL SYNTHESIS OF LANOSTEROL AND AGNOSTEROL. D. A. J. IVES. (Read November 12, 1956.) Lanosterol (I) and agnosterol (II) occur in the unsaponifiable fraction of wool fat in concentrations of about 12% and 1% respectively. Starting material was lanost-8-enol (III) previously synthesized from cholesterol by Barton and Woodward and their co-workers. Lanost-8-enol acetate was oxidized to lanost-8-ene-7:11-dienol acetate trisnoracid (IV) in about 4% yield, the material being identical in physical constants with an authentic specimen. The two oxygen functions were removed by a modified Wolff-Kishner reaction and the resulting acid (V) reacted with iso-propyl magnesium bromide. Two methods of converting the ketone (VI) to lanosterol were attempted but failed. The acid (IV) was then converted to the next higher homologue using the Arndt-Eistert reaction and the product reacted with excess methyl magnesium iodide. Attempted dehydration of the resulting alcohol gave a mixture of products. The same series of reactions on lanost-8-ene-11-enol acetate trisnoracid furnished lanost-8:24-diene-11-enol acetate (VII) which was converted readily to lanosterol. Reduction of VII followed by dehydration gave agnosterol acetate identical with an authentic specimen.

AN IMPROVED CERAMIC FOR THE GENERATION OF ULTRASONICS. D. SCHOFIELD AND R. F. BROWN. (Read December 10, 1956.) Recently, ferroelectric ceramics with piezoelectric properties have been used extensively in electromechanical transducers. Of these ceramics, barium titanate has found the most widespread application. However, its use

in high power underwater projectors has been limited by the large dielectric loss it exhibits in high exciting fields. It is shown that the addition of small quantities of cobalt to barium titanate ceramics produce a large reduction in the loss in high fields without significantly affecting the piezoelectric properties of the polarized ceramic.

THE RECIPROCAL ACTION OF H^+ AND K^+ ON THE METABOLISM OF THE LIVING YEAST CELL. J. G. ALDOUS AND GEORGE C. JOLLYMORE. (Read December 10, 1956.) When fluoroacetic acid is used to inhibit the reactions of the Krebs cycle and K^+ is used to stimulate glucose metabolism, it can be shown that K^+ and H^+ act in a reciprocal manner on these processes. This action is not a simple antagonism, however, since H^+ appears to determine the basic metabolic pattern upon which K^+ exerts its effect.

THE SEA BREEZE HODOGRAPH AT HALIFAX. R. V. DEXTER. (Read January 14, 1957.) The surface winds at Halifax, N. S., are averaged vectorially for each hour by months over a period of sixteen years. The end points of the resultant wind vectors are plotted to show the average daily hodograph for each month during the sea breeze season, i.e. from May to September, inclusive. The hodographs do not conform to accepted theory in that they are not ellipses. Reference is made to the topography of Halifax in an attempt to explain a persistent departure from elliptical shape. The magnitude of the average sea breeze at Halifax is discussed and a probable maximum value determined. This value is so small that the application of the hodographs to the problem of forecasting the sea breeze in a particular synoptic situation is difficult.

FLUORESCENCE SPECTROMETER FOR BECKMAN DU. J. A. McCARTER (Read January 14, 1957.) The fluorescence spectra of substances in solution can be determined using a simple attachment for the Beckman DU spectrophotometer. This attachment makes use of a standard hydrogen lamp back-plate assembly for the spectrophotometer. A cuvette is substituted for the hydrogen lamp and a hole is cut in the back-plate so that the cuvette can be illuminated from without by a filtered source of ultraviolet radiation. A focussing device, filter-holder, shutter and lamp housing containing a high pressure mercury arc lamp complete the attachment. Its construction and the manner of using it will be described.

COMPARATIVE STUDY ON THE DISTRIBUTION OF MORPHINE AND LEVORPHAN. J. C. SZERB. (Read January 14, 1957.) The synthetic analgesic Levorphan is about five times as potent as morphine, has a longer duration of action and is very effective after oral administration. The solubility of Levorphan base in non-polar solvents is much higher. The hypothesis was tested that the greater potency of Levorphan is due to its higher concentration in brain. After the intravenous injection to rats of morphine sulfate or Levorphan tartrate in a dose equivalent to 30 mgm./kgm. free base, Levorphan disappeared from blood much faster than morphine, the concentration of Levorphan being 40% of that of morphine ten minutes after the injection, and staying low at 60 and 180 minutes. Brain levels of Levorphan were 40-60% higher (highly significant) at 10, 60, and 180 minutes. The concentration of bound Levorphan was only 20% of that of morphine. Liver contained twice as much Levorphan as morphine at 10 and 60 minutes, while there was no difference

in muscle and kidney. Fat tissue contained only traces of both drugs. After i.v. injection only free Levorphan was excreted into the gastroduodenal contents while morphine appearing in the same amount was distributed about equally between free and bound form. There was no significant difference in the plasma levels one hour after the administration of the drugs (30 mgm./kgm.) by stomach tube, although rats receiving Levorphan showed much stronger narcotic effects. It appears that the higher potency of Levorphan is at least partially due to its better penetration into brain tissue, while the long duration of action is explained by the fast uptake and slow release of the free drug by the liver and gastrointestinal contents. The oral potency of Levorphan is not due to its greater absorption but probably to the higher CNS concentrations at low blood levels.

THE DEVELOPMENT OF THE BLUEBERRY SEED. HUGH P. BELL. (Read February 11, 1957.) Seed development was followed from fertilization to maturity. Pollen tubes required about four days to grow from stigma to ovule. In some plants, particularly bagged ones, nucellar cells remained alive and contents of the embryo sac degenerated. Many ovules did not develop. Seeds were counted and sorted in a random representative collection of 1075 berries. The average number of seeds per berry was 64.2. Of these 49.9 (or 77.7%) were imperfect. More complete pollination increased the percentage of normally developing ovules. Development of perfect seeds followed a familiar pattern. Unfamiliar features were noted as follows: 1. Degeneration of cells at both micropylar and chalazal ends resulted in a homogenous plasma. This plasma formed strands across haustoria and almost completely surrounded the zygote. 2. Micropylar endosperm cells formed a dense plug. Developing embryos may have had difficulty in penetrating this plug. 3. Many embryos had died at some stage of development. 4. A conspicuous integumentary tapetum was present until the endosperm was about half its final size. Embryo development was the "soland" type. Mature seeds were "axile linear". Imperfect seeds were chiefly of two types: (a) medium sized and solid with middle integumentary layers lignified, or (b) small and collapsed with all tissues inside seed coat disintegrated. No imperfect seed had an embryo.

SODIUM FLUX IN MAMMALIAN MUSCLE. HUGH McLENNAN. (Read February 11, 1957.) The kinetics of loss of Na ions from mammalian muscle will be described. Following the rapid movement of the extracellular Na, the remainder is extruded with a time constant of 1.59 hr^{-1} at 20°C . Determination of the temperature coefficient for the process suggests that the rate limiting step is a physical desorption of the ions. Na efflux is affected by the concentrations of both Na and K in the bathing solution, and K uptake by the muscles is conversely dependent on the presence of Na. The results suggest that the two processes are linked together in such a way that two Na ions are extruded for every K ion taken up.

NUCLEAR METALLURGY. R. L. CUNNINGHAM. (Read February 19, 1957.) A brief review was given of the discovery of the splitting of uranium in which fission products, heat and neutrons are produced. Under suitable conditions these neutrons can be used to sustain a controlled chain reaction in a reactor or pile in order to produce plutonium, heat for power production and isotopes for research in medicine, physics,

chemistry, biology and metallurgy. The importance of neutron economy and the limitations that this imposes on the metallurgist in the selection of metallic elements was discussed. Materials used for protecting the uranium fuel elements from corrosion must have low ability to capture neutrons and should not react with the metallic uranium nor suffer serious corrosion under the specific operating conditions. The characteristics of aluminum, magnesium and zirconium alloys, and stainless steels were discussed for this application. The dimensional stability of uranium fuel elements was shown to be a most important problem. In radiation, the accumulation of fission products, particularly the gaseous ones, and thermal cycling were all shown to produce gross dimensional changes and the steps taken to minimize these effects were briefly outlined. Finally a brief discussion of thorium and plutonium metal and their uses was given.

SOME PHYSICAL AND CHEMICAL PROPERTIES OF ICHTHYOCOL. E. GORDON YOUNG AND H. N. ASTRUP. (Read March 11, 1957.) Ichthyocol has been prepared from the swim bladder of the cod (*Gadus morrhua*) by extraction with citrate solutions at pH 3 - 4. At pH 3 it was homogeneous both in the ultracentrifuge and by electrophoresis. It became heterogeneous at higher pH levels. The isoelectric point was found to be at pH 5.4. The distribution of 18 amino acids in ichthyocol has been determined. The level of hydroxyproline N was found to be 4.5 per cent of the total N in confirmation of the lower level previously observed in the collagenous proteins of fish. With this exception ichthyocol is strictly comparable with "procollagen" of mammalian connective tissue.

THE PRODUCTION OF XANTHURENIC ACID FROM TRYPTOPHAN IN PREGNANCY AND IN VARIOUS STATES OF NITROGEN BALANCE. W. W. HAWKINS, VERNA G. LEONARD AND CAROL M. COLES. (Read March 11, 1957.) It is known that in vitamin B₆ deficiency there is a disturbance in tryptophan metabolism which results in the production of abnormally large amounts of quinolinic compounds, including xanthurenic acid. The results of tests on pregnant rats showed that late in pregnancy and early in the *post-partum* period there is typically an abnormally large excretion of xanthurenic acid when test doses of tryptophan are given. The administration of extra vitamin B₆ or of other B vitamins had no effect. When the nitrogen balance in rats was suddenly increased by increasing the intake of protein after a period on a low-protein diet, there was a tendency for more xanthurenic acid to be excreted after test doses of tryptophan. These results suggest that, outside of vitamin B₆ deficiency, the production of xanthurenic acid from tryptophan tends to be high when the retention of nitrogen is high.

CIRCULATION ON THE SCOTIAN SHELF DETERMINED BY DRIFT BOTTLES. R. E. BANKS. (Read April 18, 1957.) The surface circulation on the Scotian Shelf has been investigated by means of 827 drift bottles released in August, 1954. Information has been returned from 83 bottles, 70 of which were recovered in Nova Scotia and on Sable Island, and 13 of which crossed the Atlantic to the Azores, France, the British Isles and Norway. The study suggests a cyclonic circulation centered in the vicinity of Sable Island but with the eastern part incompletely determined by the results. Calculated speed of drift varies from 0.11 to 0.15 knots.

RADIATION-INDUCED MORPHOLOGICAL AND GENETIC CHANGES IN APPLES. C. J. BISHOP. (Read April 8, 1957) Following a brief survey of the history of using radiation to induce morphological and genetic changes in agricultural crops, work at Kentville using X-rays and thermal neutrons* on apples was discussed and summarized. About 13,000 dormant scions have been treated and then grafted into grown trees by the framework method. Dosages ranged from 3500 to 5000 roentgens of X-rays and 4 to 6×10^{12} thermal neutrons per cm^2 . Morphological effects in growth from scions of the variety Cortland included distorted leaves, splits in leaf shape and veining, bifurcations of growing shoots and giant size of the first fruits. The latter may have been a physiological effect due to the grafting procedure. Genetical changes observed included frequent sectorial chimaeras in skin color, either of increased or decreased red color, and rarely complete dark red sports. The latter were very distinctive in the shade of red being as dark in color as the variety Macoun. It was suggested that the results obtained indicate that artificial radiation may become an important tool in apple breeding research.

*Treatments carried out at Brookhaven National Laboratory, Upton, N. Y.

THE REACTION OF ACTIVE NITROGEN WITH HYDROGEN BROMIDE. BERNADINE M. MELANSON. (Read May 16, 1957.) The reactions of organic compounds with active nitrogen have been studied quite extensively but as yet little information has been obtained on the reactions of inorganic compounds. Hydrocarbons and alkyl halides give hydrogen cyanide as the main product and proceed by complete consumption of the reactant present in lesser amount. The hydrogen bromide reaction has been investigated by conventional methods in a fast flow system. Bromine is the main product of the reaction with some ammonium bromide forming as a salt deposit on the reaction vessel walls. Both the bromine and ammonium bromide recovery rates increase with increasing hydrogen bromide flow rates at low input rates and level off in a plateau at high hydrogen bromide flow rates. A temperature rise of about 30°C occurs in the reaction vessel during the reaction at room temperature. The reaction studied at 360°C shows a linearly increasing rate of bromine production with increasing rate of hydrogen bromide input. At this temperature ammonium bromide formation is negligible and occurs only on the cool portion of the reaction system. A plausible mechanism involves the initial attack of a nitrogen atom on a hydrogen bromide molecule to form the imine radical, $-\text{NH}$.

ASPECTS OF P^{32} METABOLISM IN LAKES. JOHN PHILLIPS. (Read May 6, 1957.) The problem with which this work is ultimately concerned is the assigning of productivity indices to lakes. The rate of exchange of radiophosphate between mud and water in artificial systems of eight Nova Scotian lakes under oxidized and reduced conditions, with and without bacterial activity is observed. Bacteria rather than mud potential appear to be the controlling factor of P^{32} concentration in lake waters. This control is effected by a rapid uptake of radiophosphate by bacteria and conversion to organic radiophosphorus. A study of the importance of aquatic plants versus bacteria on the quantities of P^{32} in lake waters indicates bacteria again are most important.

DETERMINATION OF THE COEFFICIENT OF LINEAR EXPANSION AT LOW TEMPERATURES USING MICROWAVES. J. R. KEYSTON, E. W. GUPTILL AND J. D. MACPHERSON. (Read May 6, 1957.) No simple method of measuring absolute changes of length at low temperatures has previously been devised. Since the velocity of electromagnetic waves is independent of temperature it provides a good standard with which to measure length and changes of length at low temperatures. The sample under consideration is formed into a cylindrical coaxial cavity. If high frequency waves are fed into such a cavity the lowest mode of resonance occurs when the wavelength is twice the length of the cavity. By recording resonant frequencies at different temperatures the coefficient of linear expansion can be calculated. Preliminary measurements have been taken using a brass sample. The temperatures used were in the range of 80°K to 380°K. Temperature differences of about 5°, corresponding to a change of length of 0.2 thousandths of an inch, were measurable.

POSSIBLE IMPORTANCE OF SOME TERPENES AS STARTING MATERIALS FOR THE SYNTHESIS OF CERTAIN PHYSIOLOGICALLY-ACTIVE COMPOUNDS. ERIK HANSEN. (Read at Valley Chapter Meeting.) The resin acids are a particular group of the general class of compounds known as terpenes. Several of the resin acids have molecular structures reminiscent of the steroidal compounds and so are of interest as cheap and abundant starting materials for the synthesis of a steroidal structure. Some of the intermediate compounds arising from such a synthesis may also be physiologically active and worth evaluating. The successful synthesis of a steroidal molecule from a resin acid has yet to be done, but in view of some recent developments in this field of chemistry, the future looks very promising.

STUDIES CONCERNING THE EFFECTS OF CULTURE FILTRATES OF *Fusarium lycopersici* ON THE TOMATO. C. L. LOCKHART. (Read at Valley Chapter Meeting.) Culture filtrates were prepared by Seitz filtering cultures of *Fusarium oxysporum* f. *lycopersici* (Sacc.) Snyder and Hansen, on the modified Richard's, Czapek's, Toehinai's, and Home and Mitter's nutrient solutions. The culture filtrates were found to induce wilting of cut tomato shoots, decrease the oxygen uptake of tomato leaf tissue and dissolve the middle lamella of cells of leaf tissue. Their wilting ability was affected by the age of culture and composition of the different culture medium. The filtrate activity on respiration of tomato leaf tissue was affected by pH, age of culture, diluting with phosphate buffer, stage of plant development and composition of the media used to grow the isolate, whereas, heat, Seitz filtering, infiltration of the leaf tissues with water and adding iron had no effect. Toxins were also found in the mycelial extracts. There was evidence that the wilting and respiratory inhibiting effects were not due to the same toxin(s).

THE ROLE OF WOODPECKERS IN THE NATURAL CONTROL OF THE CODLING MOTH. C. E. MACLELLAN. (Read at Valley Chapter Meeting.) The Hairy Woodpecker and the Downy Woodpecker are important in the control of the codling moth in Nova Scotia. In the years 1950 to 1956 these birds reduced the overwintering larval population of tree trunks by 52 per cent. Woodpeckers find codling moth larvae by sight and touch. Searching is done at random, the bird either looking for likely cocooning spots or locating the exact spot by tapping with the beak. After finding the larva, the woodpecker either drills a hole through the bark into the cocoon and withdraws the larva with its barbed tongue, or flicks the bark off with its chisel-shaped beak and feeds on the exposed larva.

INTERIM REPORT OF INVESTIGATIONS IN NOVA SCOTIAN GLACIAL GEOLOGY. R. H. MACNEILL. (Read at Valley Chapter Meeting.) This paper, on the work started in 1949 by the Nova Scotia Research Foundation, is presented in view of the interest shown in the investigation by both Nova Scotians and geologists from other parts of Canada and U.S.A. The Land Use map prepared from aerial photographs under the direction of H. L. Cameron, the Tectonic Map of Nova Scotia compiled by H. L. Cameron, and the Pleistocene Geology Map all have elicited interest, and they may be used as mutual overlays to study the relationship between the Land-in-Use, the Glacial Geology, and the Tectonics of Nova Scotia. Most of the Western end of the Province has been studied and only the final check work remains to be done on many of the map sheets. Several are now ready for preliminary publication. Pictou County has been mapped by W. A. Hogg but is not yet plotted for preliminary publication. The Truro-to-Cape Chignecto region has been worked and only requires final checking before preliminary plotting. The glacial deposits in the Eastern Shore region have been plotted from aerial photographs, but the area remains to be checked. H. L. Cameron is working on the glaciation in Cape Breton. Tentative conclusions have been drawn with regard to the Pleistocene History of Nova Scotia and these will be substantiated, disproved, or modified by the reports on the glacial geology of N. B. and P.E.I. and future work in Nova Scotia.

ACCELEROMETER PROBLEMS. J. G. TILLOTSON. (Read at Valley Chapter Meeting.) The design of low natural frequency accelerometers is discussed and the basic operating mechanism outlined. It is seen that there are many ways in which a practical instrument can deviate from the ideal outlined in the first part of the paper. The use of the electrical analogue method of studying these deviations from ideal behavior is briefly outlined.

AN ANALYSIS OF THE FOREST SUCCESSION IN ALGONQUIN PROVINCIAL PARK, ONTARIO. N. D. MARTIN. (Read at Valley Chapter Meeting.) Study plots of about 25 acres each were laid out in each of the major forest types of Algonquin Park, and the vegetation was sampled on 5 percent of the area of each plot. Although there is a great diversity in the tree species composition of the forest, there is a general pattern of forest succession. There is a hydrosere on wet ground and xerosere on uplands. In the hydrosere, primary succession following Pleistocene glaciation is from bog to *Picea mariana* forest to *P. mariana*—*Thuja occidentalis* forest and finally to bottomland forest (*Abies balsamea*—*Alnus*). In the xerosere, primary succession, according to pollen analysis, is from *Abies balsamea*—*Picea glauca* forest to *Pinus strobus* to hardwoods (*Acer saccharum* and *Betula lutea*) and *Tsuga canadensis*. Secondary succession, following cutting and fire in the xerosere, is from a pioneer forest of either *Betula papyrifera*—*Populus tremuloides* or *Pinus banksiana* to a secondary forest of either *Abies*—*Picea* or *Pinus strobus* to a subclimax of hardwood and then to a climax of *Tsuga*. The time after a fire required for *Tsuga* to become primary dominant is estimated at 1100 years. The most important factors in succession on wet ground may be lowering of the ground-water level and build-up of organic soil. In the xerosere, primary succession may be influenced mostly by changes of micro-climate and by differences in the shade tolerance of tree species. Secondary succession in the xerosere may result from the operation of seed source, soil properties, species growth rate, and shade tolerance.