

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

EXCHANGE OF MATERIALS IN A LAKE AS STUDIED BY THE ADDITION OF RADIOACTIVE PHOSPHORUS. C. C. Coffin, F. R. Hayes, L. H. Jodrey, and S. G. Whiteway, Depts. of Chemistry and Biology, Dalhousie University, Halifax, N. S. (Read November 8, 1948.) One hundred millicuries of radioactive phosphorus,  $P_{32}$  were added to the surface of an acid bog lake in Halifax County, of area 0.8 acre and depth 20 feet. The lake had a well developed zone of cold, stagnant water at the bottom with a thermocline above. Within a few hours the phosphorus was taken up strongly by the sphagnum, which made up most of the lake margin, by the floating plankton, and by sponges. Within a few days it was observed in the bodies of fishes (*Fundulus* and *Notemigonus*), and within a fortnight had accumulated in their skeletons and viscera. Uptake by bottom rooted forms such as the yellow lily (*Nuphar*), and marginal rooted forms such as the cranberry (*Vaccinium*), was by comparison extremely slow. Penetration of the added phosphorus into the lake depths was very slow, and even at the end of eight weeks the material was only doubtfully detected at the bottom. Uptake by bottom mud was correspondingly delayed.

A NEW METHOD FOR MEASURING THE ANALGESIC POWER OF DRUGS IN HUMAN SUBJECTS. J. G. Aldous and M. G. Whillians, Dept. of Pharmacology, Dalhousie University, Halifax, N. S. (Read November 8, 1948.) In view of the fact that relatively complicated procedures are needed for quantitating the pain-obtunding properties of analgesic drugs, the need has long been felt for a simpler method of obtaining this information. Although primarily designed for use in laboratory courses in Pharmacology, there is no reason why the device described can not be refined to produce a useful research tool. Pain in the form of heat, is delivered to the subject's skin by means of a stimulator which consists of a thermometer whose bulb is surrounded by a small glass water jacket. The point at which the subject's sensation changes from pain to heat is read in degrees centigrade from the thermometer and is referred to as the pain threshold. The ability of certain analgesics to raise the pain threshold has been measured and the results obtained are highly significant when analyzed according to the  $t^2$  method of Fisher.

THE STIMULATING ACTION OF ANESTHESIA ON GASTRIC SECRETION. M. Schachter, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read December 6, 1948). Chloralose, and particularly chloralose-urethane have long been the anaesthetics of choice for the study of gastric secretion under conditions of acute experimentation. Despite their frequent use there never has been any mention in the literature of the influence of these or other forms of anaesthesia on the gastric secretory process. Our studies on dogs have shown that chloralose, and chloralose-urethane anaesthesia result in a marked secretion of very acidic gastric juice in dogs previously with gastric fistulae and not subjected to any trauma at the time of anaesthesia. Urethane, pentothal and to a much lesser degree nembutal anaesthesia also resulted in the secretion of varying amounts of gastric juice of high acidity under similar conditions. Under chloralose or chloralose-urethane anaesthesia dogs occasionally secreted as much as 80 ccs. of highly acidic gastric juice within an hour. In general the gastric juice during active secretion contained very little

pepsin or visible mucus. In all instances this secretion was completely or almost completely arrested by subcutaneous administration of 1.5 or 2 mgm. of atrophine sulfate. The chloralose-urethane secretion was regularly found to approach a  $p^H$  of 0.9 and to possess minimal amounts of pepsin and visible mucus. It was completely abolished by the traumatic procedure of preparing the gastric fistula at the time of the experiment and was at times completely prevented by slight mechanical manipulation of the vagi in the neck. In those instances where the phenomenon was not abolished by exposure of the crevical vagi, it was immediately arrested following acute vagal section. The secretion returned to full intensity within a few days after vagal section only to almost completely disappear again as time for nerve degeneration elapsed. The secretion is not associated with a reduced blood sugar level. In view of the histamine-like nature of the secretion possibility of histamine liberation at the vagus nerve endings is raised. Also the degree of inhibitory activity associated with trauma or manipulation of the vagus nerve suggests the possibility of an inhibitory function of the vagus nerve directly on the secretory cell.

**HEPARIN AND LIPEMIA.** C. B. Weld, Physiology Dept., Dalhousie University, Halifax, N. S. (Read January 17, 1949). The changes (previously reported) in the optical density of lipemic plasmas following intravenous heparin are transient and are accompanied by a parallel change in chylomicron count. During lipemia before heparin is given the prevailing chylomicron particle is large and bright, while after heparin it is very minute in size, many being barely visible at 1300 diameters under dark field illumination. Actual counts show both large and small particles to be reduced in numbers by heparin. Immediately after the heparin is given there is a variable amount of clumping of chylomicrons, especially of the larger ones. The clumps disappear within a few minutes. The possibility that this is the mechanism by which heparin clears the lipemia is not probable because (a) careful histological search of many tissues has failed to reveal these clumps and (b) the lipid content of the plasma is unchanged. The heparin is effective *in vivo* in the intact animal; but not *in vitro* in plasma. It is partially effective in whole blood incubated at 37°C the number of both large and small particles being slightly reduced. A tenfold dilution of lipemic plasma reduces the count of both large and small particles one quarter. These facts indicate that the degree of dispersion of the lipid particles during lipemia is readily variable and suggest that intravenous heparin increases the dispersion. It is thought that many of the particles become so small as to become invisible even under dark field illumination.

**A METHOD FOR STUDYING THE SPECIFICITY OF METABOLIC INHIBITORS IN INTACT CELLS.** J. G. Aldous, Dept. of Pharmacology, Dalhousie University, Halifax, N. S. (Read January 17, 1949). The question of whether a metabolic inhibitor has any specificity associated with its action upon the enzymes in a cell has largely been obscured by the techniques used to obtain the desired information. In order to demonstrate an appreciable reduction in activity of an isolated preparation, the concentration of inhibitory agent needed is often ten, sometimes one hundred times greater than that required to suppress the same activity in the intact cell. The present method seeks to obviate this difficulty by exposing the intact cell to the action of the inhibitory agent and to pro-

ceed then to an evaluation of the various enzymic constituents of the cell. Although its field of usefulness is confined to changes brought about by irreversible inhibitors, the procedure offers an advantage over older methods in that one is observing the action of the inhibitory agent under in vivo conditions.

AN ATTEMPT TO POISON COARSE FISH IN A LAKE WHILE LEAVING TROUT UNHARMED. D. A. Livingstone, Biology Dept., Dalhousie University, Halifax, N. S. (Read January 17, 1949). Derris root dust in the proportion of one part to two million water, was added to the shallow part of Copper Lake, Nova Scotia, i.e. to the 10 foot zone. Copper Lake is known to contain trout together with an abundance of coarse fish. In August, when the lake was poisoned, the trout might be expected to be in the cool waters 20 to 30 feet down. Fish began to die shortly after poisoning, and were counted as they drifted ashore. Applying a customary factor for the ratio of fish ashore to the total fish dead it would appear that about 40,000 to 50,000 fish were killed, of which about 10 were trout.

THE CYTOLOGY OF THE REPRODUCTIVE ORGANS OF CERTAIN LAND MOLLUSCA OF NOVA SCOTIA. Anne H. G. Watts and Muriel J. Ord, Biology Dept., Dalhousie University, Halifax, N. S. (Read February 14, 1949). This paper deals with chromosome counts of the germ cells in the ovatestes of five species of land Mollusca of the families Arionidae and Limacidae, in addition to a description of the morphology of the sperm of each species. The information has been obtained from permanent smears of parts of the reproductive systems of these animals. Photographs of the chromosomes, and camera lucida drawings of both chromosomes and sperm are shown.

CHEMICAL ESTIMATION OF REDUCING STEROIDS IN THE ADRENAL OF THE RAT. R. W. Begg, Cancer Research Laboratory, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read February 14, 1949). The method of Heard and Sobel for the estimation of reducing steroids in the urine has been adapted to an adrenal extract prepared by the technique of Cartland and Kuizenga. The ultraviolet absorption curve of the adrenal extract resembles that of desoxycorticosterone acetate. The values for reducing steroids in the adrenals of normal and tumor-bearing rats follow the expected pattern of adrenal activity as compared with histochemical studies with Sudan IV and dinitrophenylhydrazine, and by chemical estimation of cholesterol and ascorbic acid.

GLACIAL GEOLOGY OF THE YARMOUTH-PUBNICO AREA, NOVA SCOTIA. H. L. Cameron, Geology Dept., Acadia University, Wolfville, N. S. (Read February 14, 1949). The area includes the southwest tip of Nova Scotia. Bedrock is granite and sediments of the Meguma Series which outcrop on the coast and infrequently on lakes and rivers. The entire area is mantled with glacial drift and the drainage is poor and disorganized with many swamps and barmens. A submergent coast line results in many long inlets and shallow swampy bays. The numerous islands are drowned drumlins or remnants of the drift mantle. All types are represented from well formed uneroded drumlins, to submerged reefs which are the rock bases from which all glacial material and soil have

been removed by the sea. The drumlins are of economic importance as they represent a high percentage of the arable land. Eskers are very frequent and attain lengths of several miles. Those in the Wedgeport area are described in some detail with aerial and terrestrial photographs.

**THE INFLUENCE OF RELAXATION TIMES ON NUCLEAR PARAMAGNETISM.** A. T. Stewart, Physics Dept., Dalhousie University, Halifax, N. S. (Read March 14, 1949.) This paper reports a study of the influence of dissolved ferromagnetic ions on the time required for the paramagnetism associated with nuclear spin (in this case, of protons in liquid water) to reach equilibrium in a magnetic field. This time is commonly called the relaxation time.

**THE EXCHANGE OF  $Ag^+$  IONS BETWEEN AQUEOUS SOLUTIONS AND SURFACES OF METALLIC SILVER.** C. C. Coffin and I. I. Tingley, Chemistry Dept., Dalhousie University, Halifax, N. S. (Read March 14, 1949.) The exchange of  $Ag^+$  ions between solutions of silver nitrate and surfaces of metallic silver is being studied with a radioactive isotope ( $Ag^{110}$ , half-life 225 days). On the basis of measured areas etched and polished surfaces of annealed silver foil exchange with 0.1N  $AgNO_3$  solutions to depths of about 10 and 100 atomic layers respectively. Inactive crystalline (etched) surfaces pick up their maximum activity from stirred oxygen-free active (40,000 counts per minute per ml.) solutions in a matter of seconds; under the same conditions polished surfaces acquire about 90% of their final equilibrium activity in 24 hours. Polished surfaces made active in this way and immersed in nonactive solutions lose about 25% of their activity at roughly the same rate as they had acquired it. No decrease in the remaining activity occurs during a week's stirring in the non-active solution. Under similar conditions crystalline surfaces appear to retain their entire activity which, however, is so low (10-20 counts above background) that the experimental results are highly uncertain.

Etched surfaces of unannealed foil, or of annealed foil that has been cold-worked in various ways, show visually distinct patterns of crystalline and "noncrystalline" metal. The latter appears as light smooth streaks or patches on the uniformly dark grey crystalline metal. Such mixed surfaces although they may be largely crystalline pick up activities commensurate with those acquired by highly polished surfaces (100-200 counts per min. per sq. cm.) and give autoradiographs showing that this activity is largely confined to the crystalline areas. This means that crystalline silver which by itself shows little tendency to exchange with ions in solution receives a deposit of metal when it is mixed with non-crystalline silver. This must be the result of an electrolytic action in which ions enter the solution from the anodic worked areas and deposit from solution on the cathodic crystalline surface. However many attempts to increase the activity takeup of an etched annealed foil by connecting it electrically with a polished foil in the same solution have been fruitless. It would seem that the potential differences involved are so small that they are effectively short-circuited by imperfections in the polish layer.

The fact that polished surfaces slowly acquire a partially removable activity and that considerable activity is picked up by the smooth anodic areas of a mixed surface suggests that two exchange mechanisms are

involved. One, the electrochemical, accounts for the greater part of the activity acquired by the crystalline areas of a "mixed" surface. The other, kinetic in nature, is responsible for the activity taken up by polished surfaces and the anodic noncrystalline areas of cold worked specimens. The enhanced reactivity and solvent properties of metals brought about by polishing and cold working are well known and it is probable that such surfaces would take part in exchanges that are impossible for crystals. Preliminary experiments on the pretreatment of surfaces in nonactive solutions indicate that it is possible to separate these two effects.

**A NEW METHOD FOR DETECTING NUCLEAR MAGNETISM.** E. W. Guptil, A. T. Stewart and W. J. Archibald, Physics Dept., Dalhousie University, Halifax, N. S. (Read March 14, 1949). The amplitude of oscillation of an oscillator is dependent upon the fractional part of its output energy which is returned to its input. This electrical coupling is ordinarily achieved by the presence of inductances in the output and input circuits which are near each other. This coupling can be altered by a change in the geometrical position or by any alteration of the magnetic properties of the material inside the coils. This latter characteristic has been successfully used to determine the frequencies at which the nucleus of the matter inside the coils undergo resonant vibrations.

**THE CHEMICAL COMPOSITION OF MARINE ALGAE.** M. G. MacPherson and E. G. Young, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read April 11, 1949). Fourteen species of the commoner marine algae of Nova Scotia have been analyzed for their content of water, nitrogen, ash, calcium, phosphorus and iron. These algae were remarkable for their consistently high ash content. The minimum value was 14.5 per cent in *Eucus serratus* and the maximum 45.4 per cent in *Enteromorpha intestinalis*. The average content was 24.9 per cent. Differences in composition have been observed between the green, red and brown classes of algae.

**SENSITIZATION OF THE GASTRIC GLANDS TO HISTAMINE AFTER COMPLETE VAGOTOMY.** M. Schachter, Dept. of Physiology, Dalhousie University, Halifax, N. S. (Read April 11, 1949). Complete cervical vagotomy was performed on 6 dogs whose gastric secretory response to histamine had been determined previously. Three dogs died after vagotomy before their gastric secretory responses to histamine could be determined. Of the 3 surviving animals one is still alive 4 months after vagotomy, another was sacrificed after 11 weeks and a third survived 26 days. The 3 surviving animals showed a persistent sensitization of the gastric response to histamine and the total acid secreted after vagotomy increased by 315%, 210% and 55% in each animal respectively. These findings are in accord with Cannon's law of sensitization after denervation but are at variance with Dragstedt's conclusion that the response of the gastric glands to histamine is materially decreased by vagotomy.

**THE ALLEGED SYNTHESIS OF PROTEIN FROM AN INORGANIC MEDIUM IN THE PRESENCE OF IRON.** E. G. Young and J. A. Ryan, Dept. of Biochemistry, Dalhousie University, Halifax, N. S. (Read April 11, 1949). Attempts have been made to repeat the work of Francis in which it was claimed that microscopic particles of protein were synthesized from Liescke's medium in the presence of iron. The appearance of particles which were

colored by microchemical tests for protein was confirmed under these conditions. They are interpreted as artifacts due to the fortuitous occurrence of glass films or other particles in the preparations. The suitability of the different microchemical tests for protein has been examined critically and shown to be susceptible to fallacious results.

**SOME EFFECTS OF TEMPERATURE ON THE EMBRYONIC DEVELOPMENT OF THE SALMON (SALMON SALAR).** Marjorie Smith, Biology Dept., Dalhousie University, Halifax, N. S. (Read May 9, 1949). During the years 1947, '48, and '49, experiments were carried out to observe the effects of temperature, which were within the survival limit, on the development of salmon embryos. The investigation involved attempts to determine whether the order of appearance of morphological features could be altered by the use of different developmental temperatures. Observations and recordings were made of the times when different morphological features made their appearance. It became evident from the beginning that certain morphological features, such as pigment in the eyes, and bile in the lumen of the gut, made their appearance in eggs at 14°C on the same day. However by the time these two features appeared in eggs at cold temperatures, the presence of pigment in the eyes had overtaken the presence of bile in the gut. This is one of the cases of dissociation which was observed and investigated. From the studies made, dislocations in the order of differentiation are possible with a change in temperature at which development takes place.

**THE PHASE CONTRAST PRINCIPLE IN MICROSCOPY.** D. H. Rogers, Physics Dept., Dalhousie University, Halifax, N. S. (Read May 9, 1949). The phase contrast microscope has been applied to the study of pleochroic haloes, the interpretation of the image is discussed.

**A DYNAMICAL MODEL OF CRYSTAL STRUCTURE.** D. W. Wylie, Physics Dept., Dalhousie University, Halifax, N. S. (Read May 9, 1949). An array of atoms is simulated by an assemblage of bubbles floating on the surface of a solution composed of sugar dissolved in Aerosol. The bubbles were blown from a fine jet beneath the surface of the solution which was held in a rotation tray at a slight angle to the horizontal. All experiments were performed on a two dimensional raft held together by surface tension. The various properties of crystal structure as, grain boundaries, dislocations, slippage planes and the processes of recrystallization and annealing were demonstrated. Also compressional forces were applied to the raft in an attempt to measure Poisson's Ratio.