

ABSTRACTS

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

RESORCINOL REAGENT FOR THE DETERMINATION OF FRUCTOSE. By W. Yaphe, Atlantic Regional Laboratory. (Read October 19, 1959). The conditions which affect the development of colour in the reaction of fructose with resorcinol have been investigated. It has been shown that (1) the stability of the colour is dependent upon the time of heating at 80°C, (2) the peak of maximum absorption is shifted from 520 mu to 550 mu with increase in the time of heating or the concentration of hydrochloric acid, (3) an impurity is present in commercial glacial acetic acid which affects the reaction, (4) the presence of ferric ions increases the absorption in the spectral region of 400 to 540 mu but has no effect at 550 mu.

A modified procedure for the determination of fructose is proposed.

THE STIMULATION OF GROWTH OF FUNGI ISOLATED FROM PULP MILLS BY "WHITE WATER". By D. Brewer, Atlantic Regional Laboratory. (Read October 19, 1959). In a basal medium which supported good growth of two species of fungi, incorporation of "white water" was found to increase their rate of growth. Preliminary efforts to separate the active agent have been carried out, and the presence of at least two substances has been demonstrated. One of them stimulated the growth of an isolate of *Phialophora fastigiata*, whilst the other stimulated the growth of an isolate of *Phoma sp.* The implications of the presence of these two substances in "white water" are considered.

ON THE MECHANISM OF INTESTINAL SECRETION, THE ENTEROLIPOMICRON. By C. B. Weld, Dalhousie University. (Read December 14, 1959). In previous communications it has been shown that the enterolipomicron is a minute particle found in the intestinal lumen of the jejunum but not of the ileum, during secretory activity, and not while the intestinal loop is at rest. It differs markedly from the chylomicron in composition in that it contains much less lipid and more protein than the chylomicron particle. On the basis of this and on the enzyme activity of the particles, it was suggested that the particles are of intracellular or cytoplasmic origin.

The present study involves histological investigation using quick freeze methods of preservation before normal sectioning and also electron microscope studies of the intestinal wall. Specimens were taken during the resting period, during stimulation, and after stimulation. During the resting phase particules in the cytoplasm were seen by the electron microscope which were similar in every respect with the enterolipomicron in appearance. These particles disappeared from the cells within a very few minutes during stimulation. It thus appears that the enterolipomicrons consist of secretory granules and other particulate material in the cytoplasm and that they appear in the lumen of the intestine as part of a secretory mechanism. It is not clear how these particles are expressed from the cell but it would seem that there must be a major rupture of the cell wall and an evacuation of a large part of the cytoplasmic material. Our experiments suggest that the evacuation of these cytoplasmic particles into the lumen of the gut is part of a normal secretory process and should be so considered rather than as wear and tear of cells. As it is known that in some areas of the small intestine mucosal cells are regenerated every few hours, this would not be an unexpected finding.

THE NATURE OF THE PROTEINS OF FISH MUSCLE. By J. R. Dingle, Fisheries Experimental Station. (Read December 14, 1959). The results of a program for the investigation of the nature of fish muscle proteins, undertaken at the Halifax Technological Station of the Fisheries Research Board of Canada, are reviewed. Most of this work has dealt with cod. Some progress has been made in the fractionation of the mixture of saracoplasmic proteins and certain enzymic activities associated with them have been studied. Extracts containing the myofibrillar proteins have been studied under various conditions by means of the analytical ultracentrifuge, to reveal dissociations and/or associations of the component proteins. Of these components, tropomyosin, actin, and myosin have been isolated, apparently in fairly pure states. Some of their properties, physical and enzymic, have been investigated.

THE COMPARATIVE BIOCHEMISTRY OF SOME SUBTROPICAL MARINE INVERTEBRATES. By P. H. Odense, Fisheries Experimental Station. (Read January 11, 1960). In recent years it has not been surprising to find creatine present among the invertebrates. In the present study creatine was found in nine of seventeen gorgonian species examined. Three species appeared to contain traces of glycoeyamine, a precursor of creatine. No other guanidine bases were detected and it can be concluded that if the gorgonians contain a phosphagen, it must be creatine phosphate.

Arginine was found in the echinoderms and the one tunicate species examined. The presence of arginine in the siphon muscles of the tunicate examined conflicts with other work on this group and stresses the necessity of making many comparisons before stating a generalization.

The pigments present in these marine invertebrates were also examined. A red pigment occurring in the siphons of a tunicate acted as a natural pH indicator. Two carotenoid pigments, mutatochrome and antheraxanthin, were found to occur in several of the gorgonians examined. A porphyrin, pheophytin *a*, was found in the pentane extract of nearly all the gorgonians. It could not be shown whether or not these pigments, normally found in plant materials, were normal constituents of the gorgonians or were derived from the zooanthellae which dwell symbiotically with the gorgonians.

Extraction of the gorgonians with organic solvents yielded large amounts of organic material, including oils, waxes and some crystalline non-lipid compounds. One compound was obtained in relatively large quantities from pentane extracts of the gorgonian *Eunicea mamosa*. It is an optically active, unsaturated compound behaving like a lactone, with the empirical formula $C_{16}H_{22}O_3$. Other similar compounds have been isolated from other gorgonians. Some have been shown to possess antibiotic activity.

WATER CONDUCTION IN LARGE WOODY STEMS. By K. N. H. Greenidge, Dalhousie University. (Read January 11, 1960). Studies in the water relations of forest trees have been continued in Nova Scotia for a period of several years. Emphasis has been concentrated thus far on the mechanism of moisture movement in large woody stems. The rates and patterns of moisture movement in normal trees, and in individuals afforded drastic surgical treatment of conducting tissues have been investigated, and the results reviewed within the framework of current concepts of moisture movement in large plants.

SOME ANABOLIC ASPECTS OF PROTEIN METABOLISM IN RIBOFLAVIN DEFICIENCY IN THE RAT. By W. W. Hawkins and S. Mookerjee, Atlantic Regional Laboratory. (Read February 8, 1960). In four experiments young rats were deprived of riboflavin. Depending upon the experiment, in 45-76 days their mean body weights were 10-15% lower than those of controls which had received the same amount of food, with riboflavin. The concentrations of blood haemoglobin, plasma protein, and liver nitrogen did not differ from those of the food controls. In the riboflavin-deficient animals the mean ratios of liver weight to body weight were 113-136% of those in the food controls, and the liver nitrogen as a proportion of the body weight was correspondingly 102-132%.

When the rats were subjected to protein depletion, then fed a diet high in protein, the concentrations of blood haemoglobin, plasma protein, and liver nitrogen fell and were restored approximately to the same extent and at the same rate regardless of the state of riboflavin nutrition. Even under these conditions the livers of the riboflavin-deficient rats tended to assume a greater proportion of the body weights. The mean ratios after protein repletion were 115-124% of these in the food controls, the liver nitrogen as a proportion of the body weight being correspondingly high.

The results of these experiments provided evidence that riboflavin deficiency in the rat does not impair the maintenance and synthesis of some of the most metabolically important proteins of the body, and tends to enhance the synthesis of liver protein.

DETERMINATION OF OXYGEN IN IRON AND STEEL BY ISOTOPE DILUTION. By M. L. Pearce and C. R. Masson, Atlantic Regional Laboratory. (Read February 8, 1960). The method of isotope-dilution, first applied to the determination of oxygen in metals by Grosse and his co-workers, has been refined and extended to the determination of oxygen in iron and steel over a wide range of concentrations. The results are consistently higher than the values obtained by the standard vacuum-fusion method, the discrepancy increasing as the oxygen content decreases. It has been shown conclusively that the results obtained by vacuum-fusion are in error, due probably to the adsorption of carbon monoxide by iron films. All results can be explained on the basis that 5.85×10^{-5} gm. oxygen per gm. of sample are lost by adsorption in each vacuum-fusion determination.

ELAIDINIZATION OF OLEIC ACID WITH SELENIUM. By R. G. Ackman, Fisheries Experimental Station. (Read February 8, 1960). The preparation of elaidic acid by simply heating oleic acid with selenium was introduced comparatively recently, superceding the classic preparation with oxides of nitrogen. It can be demonstrated, however, that the selenium procedure produces positional isomers whereas the oxides of nitrogen method produces a homogeneous elaidic acid.

CORROSION OF ALUMINUM IN HIGH TEMPERATURE WATER. By D. F. Maclennan, Naval Research Establishment. (Read March 14, 1960). A number of aluminum alloys have been corroded, in high purity water, at 300°C for short periods of time. The corrosion products have been examined by means of optical microscopy and electron microscopy. Results show that corrosion resistance is associated with the distribution

of second phase particles in the alloys. The alloy, which has the best corrosion resistance, contains the most uniform distribution of cathodic second phase particles, and the corrosion product film of this alloy contains a corresponding distribution of irregularities. It is suggested that the second phase particles modify the film in such a way as to increase its protective qualities.

SEMICONDUCTOR PROPERTIES OF SOME NATURAL SULPHIDES. By G. A. Collins, Nova Scotia Technical College. (Read March 14, 1960). A study has been made of the semiconductor properties of naturally occurring sulphides. Specifically the conductivity, thermoelectric power and Hall coefficient have been measured of pyrite, chalcopyrite, galena, acanthite-argentite, chalcocite and covellite. All observations can be quantitatively accounted for by modified presently accepted semiconductor theory.

Auxiliary investigations have shown that the thermoelectric voltage of a sulphide is a function of maximum temperature of annealing or formation and sulphur pressure of the environment of formation or annealing. The silver content of galena is indicated by the magnitude of a positive thermoelectric voltage or positive Hall mobility. Non-argentiferous galena is a n-type semiconductor.

The Hall mobility has been found to be an excellent indicator of the environmental history of a sulphide specimen.

BACTERIAL EFFECT AND RADIOPHOSPHORUS ASSIMILATION IN ORGANIC AND INORGANIC STATES IN SALMON. By P. N. Srivastava, Dalhousie University. (Read March 14, 1960). The effect of bacteria on radiophosphorus metabolism in yearling salmon was studied. In the first set of experiments two groups of fishes were maintained. To one the antibiotic tetracycline was added so that the P^{32} put in them remained in inorganic form because of the inactivation of bacteria. In the other group, which served as control, three-fifth of P^{32} was either ingested or transformed into organic form by the bacteria. In the treated set the percentage of radiophosphorus absorbed was 39.6 whereas in control it was only 27.5. The turnover time for water and fish came to 116.1 hours and 54.7 hours in treated and 142.2 and 71.4 hours in control respectively.

In another set of experiments fishes were kept in different aquaria containing P^{32} in exclusively organic and inorganic forms. Fishes kept with inorganic radiophosphorus could utilize phosphorus more easily and rapidly than the fish maintained in organic P^{32} . In 144 hours fish could absorb only 24.5 per cent of radiophosphorus in organic form whereas in inorganic state they utilized 43.0 per cent. The turnover time for water and fish came to 156.0 hours and 82.6 hours for fishes maintained in organic P^{32} and 107.5 and 51.8 hours for fish kept in inorganic P^{32} .

The conclusion arrived at is that fishes have a tendency to absorb selectively inorganic salt from water which supports the assumption of Krough (1937, 1939). But at the same time if they are forced to remain with salts in organic form, they can assimilate the salts but the rate and amount of assimilation are very much reduced.

ACTIVITY OF JUVENILE CHUM SALMON (*Oncorhynchus Keta*) DURING ADAPTION TO SEA WATER. By A. H. Houston, Dalhousie University. (Read April 11, 1960). Transfer from fresh water into sea

water produced an immediate and marked depression in the cruising speed of juvenile chum salmon. Despite considerable recovery from this initial effect the fish exhibited a continuing, but much smaller depression in cruising speed over the entire experimental period (80 hours). Variations in total body levels of chloride and water were significantly correlated with variations in cruising speed, suggesting a relationship between activity and the process of osmoregulatory adaptation to sea water. Possible mechanisms underlying this effect are discussed.

THE ECONOMICS OF ANAEROBIC YEAST GROWTH. By J. G. Kaplan, Dalhousie University. (Read April 11, 1960). Monod and Hinshelwood have shown that the final mass of bacteria yielded in a growth experiment is directly proportional to the concentration of carbon source in the medium. The stoichiometric relation between energy source and protoplasm can be expressed as a molar growth yield (MGY: mg. protoplasm/mM. substrate). The work of Werkman and of Bauchop and Elsdon suggests that the stoichiometry might rather be between growth and number of moles of ATP formed per mole of substrate fermented (by several species of bacteria using various pathways of fermentation). I have determined the MGY for aerobically and anaerobically grown yeast to see if such a relation exists; in addition to measuring glucose consumption in the medium, determinations of intracellular carbohydrate were performed in case a large oxidative assimilation of glucose were occurring in the aerobic cells. MGY values of aerobic cells were four times higher than for anaerobic cells. However, the net yield of ATP per mole glucose dissimilated is approximately 20 times higher for the aerobic than for the anaerobic yeast. Thus from the energetic point of view, the growth of anaerobic yeast would appear an astonishingly economic process.

ON THE RELATIONS OF PERIDOTITE AND DUNITE OF TABLE MOUNTAIN, WESTERN NEWFOUNDLAND. By D. Hope-Simpson, Saint Mary's University. (Read April 11, 1960). The Table Mountain pluton is nearly midway up the west coast of Newfoundland, just south of the entrance to Bonne Bay.

The topographic features of the region include a summit peneplain surface at about 2200 feet elevation; deeply incised V-shaped and U-shaped valleys; cirques, fiords and finger lakes; and a post-glacial beach raised 100 feet above the present mean sea-level.

The crystalline massif of the Long Range trends north-east parallel to the west coast for 140 miles. From Bonne Bay south for 80 miles there is a broad re-entrant in the Long Range mountain front. A section perpendicular to the coast at that latitude shows the gneisses and schists of the Long Range faulted against Cambrian sediments. Westward in stratigraphic succession are limestones and dolomites overlain by clastic sediments of the Humber Arm group all of Ordovician age. In the upper part of the Humber Arm group, volcanic rocks abound, and these are intruded by the ultra-basic and gabbroic intrusions of the Bay of Islands complex. A thickness of from three to five miles of Cambro-Ordovician sediments and volcanics are intruded by sheets that individually may exceed five miles in thickness.

The Bay of Islands complex is a peridotite-dunite-pyroxenite-gabbro complex that outcrops in four major and several minor detached

plutons in a belt sixty miles long and ten miles wide. The Table Mountain pluton is the northernmost.

The plutons are banded subparallel to their floors and in this resemble banded gabbro-peridotite plutons in other parts of the world. Some usual features of compositional variation seem to be lacking so that hypotheses of origin often suggested elsewhere scarcely seem applicable. The objective of the study, of which this paper is a progress report, is to study the zones of contorted banding where the relation of dunitite to the banding is clearest in order to throw light on that problem.

THE SOLUBLE COLLAGEN OF COD. By E. G. Young and J. W. Lorimer, Atlantic Regional Laboratory. (Read May 9, 1960). A comparison has been made of the collagen extractable at 4° with citrate buffer of pH 3.4 from the skin and the swim bladder of the Atlantic cod. The collagen was recovered as needle-like fibrils, about 50 x 0.6 μ , with characteristic transverse bands. The collagens from skin and swim bladder contained respectively 18.2 and 18.4% N, 8.0 and 8.4% hydroxyproline, 0.06 and 0.12% hexosamine. The distribution of amino acids was quantitatively identical. Some physical constants determined were $[\alpha]_D^{25} - 349 \pm 50^\circ$, $[\alpha]_{-20, w}^{25} 3.17 \pm 0.10$ S, $[\eta] 12.8 \pm 0.3$, mol. wgt. 280,000 $\pm 20,000$ for skin collagen; and $[\alpha]_D^{25} - 385 \pm 6^\circ$, $[\alpha]_{-20, w}^{25} 4.03 \pm 0.05$ S, $[\eta] 17.2 \pm 0.1$, mol. wgt. 480,000 for collagen from swim bladder. The two collagens thus appear to be very similar, if not identical, chemically but differ in their physical properties.

UTILIZATION OF CALCIUM AND IRON BY THE RAT DURING ADMINISTRATION OF ETHYLENEDIAMINETETRAACETATE. By W. W. Hawkins and B. A. Larson, Atlantic Regional Laboratory, (Read May 9, 1960). Young rats were divided into five groups, and disodium ethylenediaminetetraacetate (EDTA) was given to them as follows: 0; 0.5 and 3.0 mg. per day intraperitoneally; 0.3 and 1.5% in the diet. The basal diet in the amounts eaten supplied each animal with 140-210 mg. of calcium and 3-5 mg. of iron per day. The diets to which it was added supplied 30-45 and 150-225 mg. of EDTA per rat per day.

After 110 days calcium was determined in 24-hr. outputs of urine and faeces, and in the blood serum and the right femur. Iron was determined in the blood serum, and the liver and spleen.

The rate of growth, relative weights of femur, liver, and spleen, the excretion of calcium, and its concentration in serum and femur did not differ among the various groups of animals.

The intraperitoneal injection of EDTA did not affect the concentration of iron in the blood serum, but its presence in the diet at both levels was associated with concentrations of iron in the serum about 40% higher than those in the other groups. The concentration of iron in the liver was different in only the groups fed the larger amount of EDTA, where it was reduced by about 65%. The intraperitoneal injection of the larger amount of EDTA and its ingestion at both levels were associated with decreases in the concentration of iron in the spleen, the average levels being 20-40% below that in the control animals.

It is noteworthy that these amounts of EDTA had no apparent effect upon calcium metabolism. It is known that under similar conditions the urinary excretion of iron is increased. Apparently this occurs in conjunction with depletion of iron stores, the level in blood serum being high because of its intermediary role.

SOME METABOLITES OF FLUOROACETIC ACID IN YEAST CELLS. By J. G. Aldous, Dalhousie University. (Read May 9, 1960). Resting suspensions of yeast cells exposed for 30 minutes at pH 2.2 to 5×10^{13} M monofluoroacetic acid present many of the signs of fluorocitrate poisoning, i.e., reduced ability to oxidize acetate or glucose, accumulation of citric acid, etc.

Extracts of the metabolite of fluoracetate were found to be toxic in rats and to give rise to citric acid accumulation in the heart, liver and kidney. The toxic principles were finally isolated and partially separated by silicic acid chromatography. Two of the three fluorine-containing materials were fatty acids, provisionally identified as fluoro-butyric and fluoro-hexanoic acids, and the third substance proved to be a small amount of unmetabolized fluoroacetic acid.