

tion of two or more enzymes for a common substrate. Measurements in several tissue homogenates and in artificial mixtures in pure state of the enzymes pyruvate kinase, enolase, and alkaline phosphatase lead to identification of enzyme competition (G. Siebert, University Hohenheim, Stuttgart-Hohenheim, Germany). With an injection technique, glycolytic oscillations can be induced in yeast extract with hexoses, glucose-6-phosphate, fructose-6-phosphate, but not fructose-1,6-diphosphate, with an average rate corresponding to a respiratory quotient for glucose of 70 (per intact cell) (B. Hess, Max-Planck-Institut, Dortmund, Germany).

Glucokinase, citrate cleavage enzyme, and glucose-6-phosphate dehydrogenase may be induced by protein and glucose in the intact rat, but require glucose and insulin in the diabetic. Animals fed a high-protein diet show marked increases in serine dehydrase and ornithine transaminase which is not affected by the chronic administration of insulin (H. C. Pitot, University of Wisconsin School of Medicine). D-Fructose-6-phosphate aminotransferase in rat liver is inhibited by *N*-acetyl-6-diazo-5-oxo-L-norleucine (Duazomycin), and injection of glucosamine with Duazomycin A completely protects the enzyme against inactivation (R. E. Handschumacher, Yale University School of Medicine).

Levorphanol, a synthetic morphine, specifically inhibits the nucleolar ribosomal RNA synthesis in rat liver, but does not affect messenger, transfer, nor any other nucleolar RNA synthesis (Y. Miura, Chiba University, Chiba, Japan). Qualitative estimates were made of the relative amounts of active complexes of RNA polymerase and DNA, of ribosomal RNA cistrons, and of other DNA templates in rat liver and Novikoff tumor nuclei and nucleoli (R. B. Hurlbert, M. D. Anderson Hospital and Tumor Institute).

Evidence for the existence of at least two different cytochrome P450's concerned with corticosteroid hydroxylation was presented by B. W. Harding (University of Southern California). In bovine adrenal cortex mitochondria, the source of reduced nicotinamide-adenine dinucleotide phosphate for mixed-function oxidation is the mitochondrial malic enzyme activity, implying a specific evolutionary development to meet the requirements of steroidogenesis (R. W. Estabrook, Southwestern Medical School at Dallas).

Late fetal rats and early metamorphic tadpoles accumulate glycogen in their

livers which is then depleted immediately after birth and during the last stages of metamorphosis, respectively. In fetal rats, as in tadpoles, thyroxine enhances the formation of glucose-6-phosphatase and of arginase (O. Greengard, Harvard Medical School and New England Deaconess Hospital).

Evidence was presented that the decarboxylation of L-ornithine by a specific, soluble, pyridoxal phosphate-dependent enzyme is the principal pathway for the biosynthesis of putrescine in the prostate. Enzymes degrading putrescine, spermidine, and spermine could not be demonstrated in rat ventral prostate. Large, rapid increases in the activity of both ornithine decarboxylase and the putrescine-dependent *S*-adenosylmethionine-decarboxylating system occur during the early phases of prostatic growth induced by testosterone in orchietomized rats (H. G. Williams-Ashman, Johns Hopkins University School of Medicine). The five isoenzymes of brain aldolase have an ascending sequence of the substrate ratios of fructose-1-phosphate to fructose-1,6-diphosphate, which suggests a four-subunit structure for these aldolases. Rat testes and ovaries have only four aldolases, a fact more conveniently explained on the basis of a three-subunit structure. Immunological studies suggest that there are two muscle aldolases, with possibly a compartmental distribution (D. N. Baron, Royal Free Hospital of Medicine, London, England).

A quantitative and reproducible system for obtaining carcinogenesis in vitro with carcinogenic hydrocarbons in cell cultures derived from adult C3H mouse ventral prostate was described by C. Heidelberger (McArdle Laboratory for Cancer Research). Shields Warren (Harvard Medical School and New England Deaconess Hospital) reviewed the relationships of form and function in neoplastic cells.

The aminoacyl transfer RNA patterns in normal rat liver and Novikoff ascites tumor cells were almost identical with respect to the amino acids threonine, histidine, methionine, glutamic acid, and tyrosine. Minor deviations in the aminoacyl transfer RNA patterns of the two cell types were seen in the valine series and with serine (A. C. Griffin, M. D. Anderson Hospital and Tumor Institute). Changes in enzymes of thymidine triphosphate metabolism noted during 3'-dimethylaminoazobenzene carcinogenesis might reflect shifts in liver cell populations rather than altered regulation of enzyme activity or

synthesis. A theoretical model incorporating this concept was presented by V. R. Potter (McArdle Laboratory for Cancer Research) and discussed with respect to the metabolic diversity of hepatomas.

As usual, the Special Symposium Lecture of Sir Hans Krebs (Radcliffe Infirmary, Oxford, England) provided a climax and highlight of the symposium. Sir Hans described the equilibrium relations between pyridine and adenine nucleotides and their roles in the regulation of metabolic processes. The network of near equilibria in which the pyridine and adenine nucleotides participate is likely to be a fundamental component of the energy-transforming mechanisms in the liver cell. It establishes a basic level of the redox states of the two pyridine nucleotide couples in the two main cell compartments where the energy-transforming mechanisms are located and it links the redox states to the supply of ATP. It sets the cytoplasmic level of the NAD-couple to be suitable for both glycolysis and gluconeogenesis. Furthermore, it sets the cytoplasmic redox state of the NAD-couple at a much more reduced level so as to be effective in reductive synthesis such as that of fatty acids.

The symposium was sponsored by Indiana University School of Medicine, Burroughs Wellcome and Co., Hoffmann-LaRoche, Eli Lilly and Co., Merck Sharp & Dohme, Squibb Institute for Medical Research, and Upjohn Company. The full text of the papers, edited by the chairman of the conference, George Weber, will be published in the spring of 1969 as volume 7 of *Advances in Enzyme Regulation* (Pergamon Press, New York and Oxford).

GEORGE WEBER

Pharmacology Department, Indiana University School of Medicine, Indianapolis 46202

Seaweed

The study of seaweed as a natural resource is becoming increasingly important. Accumulated knowledge was reviewed, and current research problems were discussed at the 6th International Seaweed Symposium at the University, Santiago de Compostela, Spain, from 9 to 13 September 1968.

The manurial value of liquid seaweed products was discussed by E. Booth (Scotland) both as to manufacture and some unusual properties, such as

enhanced absorption of nutrients and germination of seeds, and increased resistance to frost and to phytopathological fungi and insects.

The possible effects on the algal flora of a region in which a discharge of heated water from a nuclear reactor was taking place were described by W. J. North (United States) for Morro Bay, California. The biota of the area was greatly modified. The dominant flora in the discharge canal consisted of symbiotic algae living within the tissues of sea anemones. Beyond the canal the biota was luxuriant and normal to a distance of 150 m. Closer to the canal the distribution of species changed and organisms unable to tolerate undiluted effluent disappeared. This zone was favorable to fishes.

Some algal constituents appear to be able to lower the level of blood cholesterol and of blood pressure in animals and man as reported by Tsuchiya (Japan). Experiments were performed on rats, rabbits, chicks, and humans. Numerous green, brown, and red algae appear to contain this hypocholesterolemic factor. It was located in different fractions obtained from the seaweeds and has only been partially identified as a nitrogenous base given the name of laminine. The common fucosterol in brown seaweeds caused a diminution in the concentration of plasma cholesterol in chicks but not in rats. Carrageenan from *Chondrus* was effective in preventing experimental hypercholesterolemia in rabbits, as were thyroxine and diiodotyrosine in the alkaline hydrolysates of the proteins from *Heterochordaria* in rats. The field holds promise in the treatment of human atherosclerosis and there was a special session under the leadership of S. Skoryna (Canada) on medical applications of algal constituents.

Much interest was shown in the work of Johnston and McCandless (Canada) on the immunochemistry of the carrageenans. Specific antibodies have been obtained to κ and λ carrageenans. Neither antibody reacted with its heterologous antigen which confirms structural differences supported by chemical evidence. Quantitative differences in cross-reactivity to antisera of λ carrageenan from *Chondrus crispus* by fractions from several species of *Gigartina* are taken to indicate structural specificities.

There were several communications on other algal polysaccharides, such as fucoidan from *Pelvetia*, mannan and xylan from *Codium* and *Penicillus*, agaroses from *Gracilaria*, alginic acids from

Ascophyllum, *Laminaria*, *Eisinia*, and *Ishige*, and sulfated esters in some South African Grateloupiceae. It appears possible that the composition of alginic acids may vary in continuous spectrum from polymannuronic acid to polyguluronic acid.

In invited lectures Feldmann (France) drew attention to some of the outstanding problems in the reproductive cycle of marine algae, and Levring (Sweden) stressed the importance of the spectral composition of light in relation to growth of sublittoral plants. It was suggested by den Hartog (Holland), in a discussion of the littoral environment between sea and land and between sea and fresh water, that salinity is one of the major factors in controlling zonation.

An unsuspected sensitivity of *Jania rubens* to a relatively high concentration of phosphorus has complicated efforts by von Stosch (Germany) to culture this alga. Germeling gametophytes developed well and fruited abundantly but attempts to effect fertilization artificially between clones has been unsuccessful. In contrast gametophytes of *Corallina officinalis* produced conceptacles with difficulty and have fruited only rarely.

Magne (France) has found that reduction division occurs in formation of the conchospores, and that the leafy thallus of *Porphyra* is the gametophytic stage. However, Dixon (United States) suggested that the basal portions may remain *in situ* after the thallus has disappeared, and that species of *Porphyra* and *Bangia* can perennate in this manner and need not go through the conchocelis phase. In addition *P. sanjuanensis* apparently forms "carpospores" only, and Krishnamurthy (India) reported that these spores give rise directly to the leafy thallus.

Experimentally induced regenerative buds of *Fucus vesiculosus* appeared to arise from the wounded surface in the region of the midrib, and Fulcher (Canada) suggested a correlation between regenerative ability and the concentration of primary and secondary filaments.

Norton (Scotland) has observed that development of the sporophytes of *Saccorhiza polyschides* occurred whenever conditions were favorable. Development could be inhibited by reducing the light intensity similar to those recorded in the *Saccorhiza* zone during the winter. Low temperatures and short days apparently do not prevent development of new sporophytes during this season.

As in previous symposia there were a number of communications on the

growth, regrowth, and distribution of the genus *Laminaria*.

The proceedings will be published in Spain (R. Margalef and J. Seoane-Camba, Eds.). Direct inquiries to O. Rodriguez, Direccion General de Pesca Maritima, Ruiz de Alarcon 1, Madrid 14, Spain. The 7th symposium is scheduled for Japan in 1971.

E. GORDON YOUNG

J. L. McLACHLAN

National Research Council of Canada,
Halifax, Nova Scotia

Calendar of Events

Contract Research Program

The Center for Population Research of the National Institute of Child Health and Human Development wishes to identify potential contractors who have interest and capability in participating in a long-term program for the development of a variety of new methods of fertility regulation.

Solutions to worldwide and national problems related to excessive population growth are exceedingly complex but it is generally agreed that the development of new contraceptives is an indispensable adjunct to such solutions. The ideal contraceptive is effective, safe, inexpensive, and acceptable to various population groups. No presently available method fulfills all these criteria. The goal of this new research and development program is the production of a variety of methods which do fulfill these criteria.

The administrators of the program in contraceptive development expect to support scientists from the several disciplines already engaged in this endeavor, including reproductive biologists, biochemists, and pharmacologists. They also intend to involve scientists from disciplines not previously heavily engaged in this field, such as molecular biologists, bioengineers, and systems analysts, since it is recognized that the development of effective new contraceptives will require the attention of many disciplines.

At the present time certain subjects of special interest have been identified. These topics are subject to change and represent selections which are of necessity in part arbitrary. It is important to emphasize that this is not an inclusive list; research in other subject areas directed toward new forms of fertility regulation may be undertaken. The Center is interested primarily (though not exclusively) in studies in the following four areas: (i) maturation and fertilizing capacity of spermatozoa, (ii) oviduct and gamete transport, (iii) function of the corpus luteum, and (iv) biology of the preimplantation ovum.

Interested sources who believe they are qualified to perform this work are invited to submit the following information:

1) Any broad technical approaches which may now be available (but this is not a prerequisite for consideration as a source) and the reason for their selection