fatty acids was calculated by multiplying the difference between the initial (pre-incubation) and the final (post-incubation) concentration of fatty acids by the volume of the incubating medium. The free fatty acid concentration was measured by the method of Dole.

The results indicate that dogfish liver contains a lipoprotein lipase. Lipoprotein lipase activity was also detected in heart muscle and gill tissue. On the other hand, neither skeletal muscle, nor plasma of freshly caught fish had detectable lipoprotein lipase activity. Starvation of the fish for at least 2 weeks increased lipoprotein lipase activity in heart muscle and gill tissue and led also to the appearance of measurable amounts of lipolytic activity in skeletal muscle and plasma. Plasma lipoprotein lipase activity could also be increased by the intravenous administration of 10 mgm heparin.

The enzyme can be crudely purified by acetone extraction and maintains its activity if stored at 4°C. The activity of the enzyme obtained from acetone-extracted liver homogenate is optimal at 37°C, despite the fact that these cold blooded animals ordinarily live at much lower temperatures. The activity of the enzyme in the liver is not affected by starvation, or by the in vitro addition of either heparin, or epinephrine. However storage of the crudely purified liver enzyme at 4°C will increase the activity progressively, suggesting the presence of an inhibitor with a more rapid decay rate. Attempts to identify such an inhibitor have so far failed.

The free fatty acid content of plasma was determined in 10 dogfish. The average concentration was 757 uM/L (range 655 to 1083 uM/L). No consistent change was noted on repeat determinations after varying periods of fasting. Intravenous administration of heparin and forced feeding with either dogfish egg yolk, or a coconut oil emulsion (Ediol) did not change the plasma free fatty acid concentration within 5 to 180 minutes.

Current studies are being directed first to clarify the effect of time on the lipoprotein lipase activity of the acetone-extracted liver tissue and second to purify the enzyme from liver tissue.

The Electrolyte Metabolism of the Swimbladder and Gastric Mucosa.[1]

C. Adrian M. Hogben
The George Washington University

In 1922, J. S. Haldane proposed that gas was secreted into the swimbladder as a result of acidification of the blood bathing the gas gland epithelium. The resultant changes of pH, P_{CO2} and P_{CO2} were thought to be sequestered from the general circulation by counter-current exchange in the "rete mirable". Even though this has been the only credible explanation for gas secretion, no evidence had been provided either *in vitro* or *in vivo*. The isolated gas gland epithelium of the pollack was found to selectively secrete hydrogen ion into the solution bathing its serosal surface. This paves the way for identifying the acid secreted and clarifying the enigma-

tic role of carbonic anhydrase. ("The Telcostean Swimbladder", Nature, in press.)

In recent years considerable emphasis has been placed upon the association between the transepithelial electrical potential difference and the secretion of acid by the gastric mucosa. The isolated gastric mucosa of elasmobranchs, dogfish and skate, was found to secrete acid but without generating a significant potential difference. The marine and freshwater teleostean (pollack, tomcod, longhorn sculpin, winter flounder, eel and catfish) gastric mucosae generated a potential difference of more than 15 mV and is thus similar to the amphibian and mammalian stomach. The elasmobranch and teleostean gastric mucosae are histologically similar. ("The Electrophysiology of the Elasmobranch Stomach", submitted to Science, December, 1958.)

1) Assisted by Miss Anita Blanchard and a grant from the American Institute of Biological Sciences.

1. *The acidification mechanism of the swimbladder gas gland epithelium.* As a continuation of work undertaken in the Summer of 1958, we attempted to identify the metabolic acid released by the gas gland formation of lactic acid. Lactic acid was released in amounts equivalent to epithelium. Following up an observation of Ball, we determined the rate of the rate of H^+ production previously determined. Unfortunately, we were not able, in the summer of 1959, to reproduce the selective extrusion of H^+ ion. It was impossible to obtain pollack of sufficient size directly from the bay. In spite of many maneuvers directed at transporting fish from elsewhere, the mucosae were inactive and the rate of lactate production diminished rapidly after isolation. The failure of isolated tissue to survive when taken from fish when transported fram a distance has been observed by others.

2. *The role of active transport of chloride in the formation of dogfish cerebrospinal fluid.* This study was conducted in collaboration with Drs. Per Wistrand and Thomas Maren. A significant steady state or D. C. potential difference exists between the cerebrospinal and extracellular fluids of the anestetized dogfish. Since the cerebrospinal fluid is negative with respect to the extracellular fluid and the chloride concentration is greater in cerebrospinal fluid, the formation of cerebrospinal fluid must involve at least one process: active transport of Cl^-. While acetazolamide modifies the composition of dogfish cerebrospinal fluid and retards its formation in man, its administration to the dogfish did not demonstrably change the potential difference. Though the active transport of Cl^- is clearly part of the process of cerebrospinal fluid formation, it is probably only part of the progress. No potential difference was observed between dogfish aqueous humor and extracellular fluid. This work is being prepared for submission to the *American Journal of Physiology.*

Investigation of the transfer of Cl^-, Br^- and I^- across the isolated gastric mucosa of *Squalus acanthias* (see Science 129: 1224, 1959) revealed that these monovalent anions are actively transported from serosa to mucosa between identical solutions and in the absence of a significant transepithelial potential. The relative rates of transfer are very similar to those previously observed for *Rana catesbiana* though there is less discrimination between Cl^- and I^- in the case of Squalus. Unlike the case for *R. Catesbiana,* the mucosa to serosa flux of Cl^- was not substantially greater than the D. C. conductance (previously determined). Confirming an earlier suspicion, it was definitely determined that it is necessary with this isolated tissue to work at a lower ambient temperature (15° C).

The flux of urea across the isolated uterine epithelium of *Squalus* was determined in collaboration with Dr. Bodil Schmidt-Nielsen. There was no evidence of active transport. The permeability to urea was so low (1.10^{-6} cm. sec. $^{-1}$) that the low urea concentration of dogfish uterine fluid could be explained on this basis.

Further attempts to obtain a viable preparation of the pollack gas gland epithelium were unsuccessful.

The Metabolism of Aminobenzoic Acid Isomers in Marine Fishes

K. C. Huang
University of Louisville

The conjugation and excretion of three aminobenzoic acid isomers (p, m and o) were studied in three types of marine fishes (Dogfish, flounder and goosefish). The *in vivo* studies showed that all these 3 types of fishes can conjugate the aminobenzoic acid into acetyl, glycyl and glucuronyl products. In dogfish the glucuronides of the 3 isomers were excreted in greater amounts than the glycinates; while in flounder the glucuronide of the meta isomer excreted was less than that of the glycinate. The *in vitro* studies with kidney slices technique have shown that both dogfish's and goosefish's kidney can form acetyl and glycyl products from the three aminobenzoic acid isomers; while the flounder kidney synthetized the glycyl product, but not the acetyl form.

Effects of Agents Used in Cancer Chemotherapy on the Echinoderm Embryo

D. A. Karnofsky
Sloan-Kettering Institute, New York

Chemicals inhibiting tumor growth usually modify the growth of certain normal tissues. Chemicals of interest in cancer chemotherapy were studied on the sand-dollar embryo (Echinarachnius parma). Each egg, in