ing out the pituitary lobes with a mouth syringe. Hypophysectomy was confirmed by visual observation of removed lobes and by decrease in pigmentation of the skin within two hours. A number of hypophysectomized dogfish were also perfused with 100 IU of human chorionic gonatropin (Ayerst) and 500 mg of bovine follicle-stimulating hormone (NIH) dissolved in 10 ml of dogfish intracellular Ringer solution. The total amount of gonadotropins was injected slowly at 20 min intervals into the dorsal aorta over a two hour period. Table 2 shows the results of studies with the hypophysectomized and gonadotropin-treated dogfish. There was a marked drop in activities of all dehydrogenase enzymes by four hours. Infusion of gonadotropins over a two hour period restored enzyme activities. It is not known whether this response to gonadotropins represents enzyme induction or activation of existing enzymes. It is interesting, however, that the enzymes of the dogfish ovary responded to gonadotropins from a mammalian source. Skin pigmentation was also largely restored by the infusion of the gonadotropin preparation which, no doubt, represents contamination of the preparations with melanophore hormone (MSH).

Ovarian tissue was also extracted before and after incubation with various substrates such as glucose-6-phosphate and isocitrate and analyzed by thin-layer chromatography by methods described by K. W. McKerns (Chapter 12 in Functions of the Adrenal Cortex, K. W. McKerns, editor, Appleton Century Crofts). Large amounts of cholesterol were found, in addition to four unknown steroids which have not, as yet, been characterized. The unknown steroids did not correspond in thin-layer chromatography systems to any of the known androgenic, progestational, or estrogenic steroids of mammalian endocrine tissues.

In summary, it was found that dehydrogenase enzymes corresponding to those found in mammalian systems exist in the ovary of the dogfish. These enzymes regress rapidly on removal of the pituitary and are synthesized or activated rapidly by the administration of mammalian gonadotropins.

1967 #23

THE ACTION OF EPINEPHRINE ON GASTRO-INTESTINAL MOTILITY IN THE SPINY DOGFISH

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It is known that epinephrine has an inhibitory or relaxant effect on the gastrointestinal motility of mammals. In elasmobranchs, epinephrine is stimulatory to the smooth muscle of the GI tract. This effect has been demonstrated both in isolated strips of gastrointestinal smooth muscle and in the living animal (Nicholls, J.V.V., Proc. Soc. Exptl. Biol. and Med. 30:54-56, 1932; Hiatt et al., Bull. M.D.I.B.L. 6:22-23, 1966).

Experiments in the living dog have shown that epinephrine exerts its inhibitory effect in mammals through alpha and beta receptors apparently located in the smooth muscle of the gut (Levy and Ahlquist, Ann. N. Y. Acad. Sci. 139, 781-87, 1967). The possibility that similar receptors mediate the stimulatory response of epinephrine in Squalus acanthias was explored. Eighteen female dogfish, average weight 3.5 kg, were used. A balloon was inserted in the lumen of the distal stomach of the dogfish and the pressure measured by a saline column. The average increase in pressure in response to epinephrine, IV, 10-100 μg/kg, was 25 cm water. The alpha

and beta blocking agents, Dibenzyline (phenoxybenzamine) and Inderal (propranolol), 0.5-4 mg/kg, were given IV and the response to epinephrine was tested at times ranging from ten minutes to three days after blockade with one or both of the blocking agents. It was found that the fish given blocking agents did not differ in their response to epinephrine from the fish given saline controls regardless of variation in dosage, time of challenge with epinephrine or blocking agent(s) used.

In a further attempt to define alpha and beta receptors, phenylephrine, isoproteronol, norepinephrine and dopamine, 10-100 μg/kg were given IV to female dogfish. The dogfish gut was unresponsive to isoproterenol, norepinephrine, and dopamine. Phenylephrine had a stimulatory action on the distal stomach similar to that of epinephrine and this response was not blocked by the alpha blocking agent, phenoxybenzemine. From these experiments, it seems that the excitatory action of epinephrine on the GI tract of Squalus acanthias is not mediated by receptors analogous to the alpha and beta receptors which mediate the inhibitory response of epinephrine in the mammal.

An interesting aspect of the action of epinephrine on the dogfish gastrointestinal tract is that if a second equivalent dose of epinephrine is given 30 to 45 minutes after the initial dose, the second dose elicits a much smaller or at times, a negative response. One hypothesis which could explain this phenomenon is that after the initial stimulation, the smooth muscle may become hyperpolarized and therefore refractory to excitation by epinephrine. The energy for this "hyperpolarization" may come from an epinephrine-induced increase in the rate of glycogenolysis. Since theophylline also acts to increase glycogenolysis by its phosphodiesterase inhibition, one would expect that the gastrointestinal tract would become "hyperpolarized" or refractory to epinephrine after theophylline.

To test this hypothesis, aminophylline (25 mg/kg) was given to eight dogfish both male and female. Epinephrine (100 ug/kg) was given IV 30 to 50 minutes later. Aminophylline had no excitatory action itself on the gastrointestinal tract but it did totally inhibit the excitatory response to epinephrine.

From these preliminary experiments, we would like to suggest that the tachyphylactic response to epinephrine described above may be due to a hyperpolarization of the smooth muscle. The energy for the hyperpolarization may be derived from the increased glucose oxidation and ATP production secondary to an epinephrine-induced increase in the rate of glycogenolysis.

1967 #24

CATION TRANSPORT IN THE ERYTHROCYTE OF THE HARBOR SEAL (Phoca vitulina)

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Eadie and Kirk (Austral. J. Sc. 15:26, 1953) reported that potassium concentration in the seal erythrocyte is low. A preliminary study in three harbor seals confirmed this finding showing little chemical concentration difference for K^+ or Na^+ between red cell water and plasma water and stimulated a more detailed study of cation transport in the erythrocyte of this species. The small differences in red cell and plasma Na^+ and K^+ concentrations minimizes the error produced by trapping and provides a model that can be studied with less artifact produced by