phosphate excretion in this fish but no definite conclusions can be drawn at present.

THE SIZE AND HEMOGLOBIN CONTENT OF THE RED CORPUSCLES OF TELEOSTS, ELASMOBRANCHS, AND CYCLOSTOMES

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As part of an investigation of the size and hemoglobin content of vertebrate red corpuscles, the blood of 18 species of teleosts, 5 species of elasmobranchs, and 1 cyclostome was examined. In each instance erythrocyte counts, hemoglobin, hematocrit and icterus index determinations, diameter measurements of the red cells and calculation of the mean volume, thickness, hemoglobin and hemoglobin concentration of the red corpuscles were carried out. A total of 41 specimens was thus studied.

These observations revealed a great difference in the volume of the erythrocytes of elasmobranchs and cyclostomes as compared with that of teleostean red corpuscles, the former being much larger. The hemoglobin content of these erythrocytes tended, on the whole, to vary directly with their size so that the mean corpuscular hemoglobin concentration was essentially constant. The greatest difference in the volume of the red cells was 15:1. The maximum variation in mean corpuscular hemoglobin concentration was 1.5:1.0. These findings correspond with observations in amphibia, reptiles, birds and mammals and suggest, as studies in human beings have already indicated, that there is an optimum concentration of hemoglobin in the red corpuscle.

On the whole, variations in red cell size occurred in inverse ratio to variations in erythrocyte count, so that the red cell mass tended to vary much less than the wide differences in the erythrocyte counts of various fish would indicate. Nevertheless red cell mass was much less constant than mean corpuscular hemoglobin concentration.

THE REACTION OF THE OVIDUCT OF SKATES TO CERTAIN AUTONOMIC POISONS

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Studies of the effects of well known autonomic poisons on the heart and gastro-intestinal tract of skates have already been reported by a number of investigators. However, a rather careful search of the literature has led to the conclusion that the oviduct of the skate has never been made the subject of an investigation of this kind. The desirability of extending such studies to the oviduct of the skate became apparent.

The herein described study was carried out on three species of

skates, Raia erinaceae, 4 individuals; R. diaphenes, 3 individuals; and R. stabuliforis, 8 individuals.

The oviduct may be divided roughly into three distinct portions, (1) the cephalic portion or funnel located near the base of the liver; (2) the shell gland situated at about the middle of its length, which is an expansion of the tube and which serves to make a shell for the fertilized egg; (3) the remainder or lower part which possesses a greater muscular development than the remaining portions and whose extreme lower portion is known as the uterus. In many respects the oviduct of the skate is similar to the oviduct of the common bird, *Gallus domesticus*, and probably functions in much the same way, namely, the upper part above the shell gland being the albumin secreting portion which secretes the "white" or albumin of the egg, the shell gland which supplies the shell and the lower portion being the chief motor mechanism which expels the fully formed egg, as well as coating it with a glue-like substance that protects the fertilized egg from losing its water content.

The method for carrying out this study was exceedingly simple. Briefly the set up consisted of a one gallon glass tank containing an inner chamber of glass having a capacity of about 125 cubic centimeters. The inner chamber is wide mouthed at the top and constricted at the bottom. The constricted portion is run through a rubber stopper which is inserted in a hole at the bottom of the tank so as to drain fluid from the inner chamber independently of the tank. The oviduct or its segment is placed in the inner chamber and one end of the organ tied to a bent glass tube through which oxygen may be supplied to the inner chamber, the other end tied to a light Harvard heart lever. A record of the movements of the organ was then obtained by means of the lever writing on a moving smoked surface. The temperature of the bath is kept constant. The temperature at which the herein results were obtained varied in the several experiments from 12 to 21 degrees centigrade. However, in most experiments the range extended from 15 to 17 degrees which seemed to be the most desirable range.

The saline or Locke-Ringers solution employed for bathing the suspended organ differed in the various experiments. Although no ideal solution was found, the one which seemed to give the best result consisted of sodium chloride 1.5 per cent; urea, 2 per cent; potassium chloride, 0.04 per cent; calcium chloride and magnesium chloride each 0.03 per cent; sodium acid phosphate, 0.01 per cent and sodium bicarbonate, 0.05 per cent; distilled water (Barnstead still) was used. The pH of the solution thus made was almost always 7.55.

The reactions noted when obtained in the above described manner have led to the following conclusions: (1) the oviduct of skates, *Raia crinaceae*, *R. diaphenes, and R. stabuliforis*, is highly reactive to epinephrine, a sympathetic mimetic acting poison but only moderately sensitive to pilocarpine and atropine which are para-sympathetic mimetic acting poisons. (2) Epinephrine produced pure relaxation in R. crinaceae and R. stabuliforis; contraction or relaxation in R. diaphenes. The greatest sensitivity was found in the last species, which gave an increase in tone in as high a dilution as one in one hundred million. (3) Pilocarpine produced contraction in all species, but it usually required a concentration higher than 1 in 100,000 to obtain this effect. The segments were often non-reactive to the drug. (4) Atropine relaxed the segment contracted by means of pilocarpine. It required an equal quantity of each to produce an equal degree of antagonism. (5) Post-Pituitary solution (fresh) 1 to 1 million and 1 to 100,000 produced relaxation in R. erinaceae, thus simulating epinephrine in this species; one-tenth of a unit of obstetrical postpituitary solution (Swann-Myers) produced contraction, whilst pitocin, Kamm, and fresh post-pituitary solution were inactive in R. stabuliforis. (6) Histamine, 1 to 1 million and 1 to 100,000, stimulated tone and contractility in R. erinaceae and stabuliforis. (7) Ergotoxine, 1, to 100,000 had no effect on R. erinaceae. (8) Potassium chloride 1 to 300, caused an increase in tone and contractility in R. erinaceae.

EFFECTS OF CERTAIN BARBITURATES ON THE HEART OF ELASMOBRANCHS

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A study of the relative depressant effects of nembutal, amytal, luminal and veronal, was made on the isolated heart preparation (sino auriculo-ventricular) of the spiny dogfish (*Squalus acanthias*) and the barndoor skate (*Raia stabuliforis*). The heart preparation was suspended in a balanced saline solution which was constantly oxygenated and whose temperature was maintained at 10° C.

The balanced saline was made up according to the following fornula: sodium chloride, 15 grams; urea, 20 grams; potassium chloride and sodium chloride, each 400 milligrams; magnesium chloride, 1 gram; sodium bicarbonate, 500 milligrams; sodium acid phosphate, 100 milligrams; distilled water to make 1,000 cc. When freshly distilled water was used (Barnstead still), the pH of this solution was 7.55.

Graphic records, obtained by means of a light heart lever, were then taken from the isolated, rhythmically beating heart preparation, and after a maximum rhythm was attained, 50 milligrams of each of the above named barbiturates (as the sodium salt) was added to each 100 cc. of the saline solution bathing the heart preparation. In this manner, it was found that stoppage in diastole was caused promptly by nembutal, amytal and luminal; whereas the rhythm persisted for relatively long periods after veronal. In a series of experiments, the average time required for stoppage after nembutal was 7.5 minutes; amytal, 9 minutes; luminal, 11 minutes, and more than 68 minutes for veronal. As a further check of nembutal and veronal, a comparison was made on the heart of the barndoor skate.