increased by 15 to 17 beats per minute; pulse pressure decreased in both the ventral and dorsal aortas without change in the pressure gradient across the gills, presumably reflecting the passive response of the gill circulation to an increase in heart rate. Acetylcholine produced cardiac arrest and a precipitous decline of blood pressure in both aortas; resumption of the heart beat was associated with a rise in the ventral aortic pressures to above control levels and an increase in dorsal aortic pressures toward control values; the "overshoot" of ventral aortic pressures was attributed to the re-expansion of the blood volume of the gill and of its vascular bed. With infusion of blood or Ringer's solution, dorsal and ventral aortic pressures increased with a widening of the pressure gradient across the gill. Norepinephrine increased dorsal aortic pressure more than ventral aortic pressure, thereby narrowing the pressure gradient across the gills; this response was presumably due to "back pressure" on the gill circulation from systemic vasoconstriction. These observations provide no evidence for independent vasomotor regulation of the gill circulation. Instead, they suggest that the circulation through the dogfish gills is regulated passively by the heart rate and by the systemic circulation.

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1963 #22

URIC ACID TRANSPORT BY THE AGLOMERULAR KIDNEY OF *Lophius americanus*

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Recently reported data indicate that uric acid may be secreted as well as reabsorbed by the nephron of the mammalian kidney. The possibility of bidirectional movement of uric acid across the tubule cells in the glomerular kidney hampers interpretation of specific effects of substances upon uric acid excretion mechanisms. The aglomerular kidney of the goosefish, *Lophius americanus*, has served as a classic model for tubule transport mechanisms since the absence of filtration-reabsorption decreases the variables to be considered. Uric acid concentrations of goosefish urine (U) and ultrafiltrates (UF) of goosefish plasma were determined in 13 fish. U/UF exceeded 1.1 in 11 of the 13 fish and averaged 1.75. The value 1.1 was used instead of 1.0 since 9% of uric acid was restricted in UF of uric acid standards of concentrations equal to goosefish plasma uric acid concentrations. After the intravascular administration of sodium salicylate or probenecid the urine uric acid concentrations decreased to or below plasma UF uric acid concentrations. These findings suggest that uric acid can be secreted by the renal tubule of the goosefish, and that both sodium salicylate and probenecid can inhibit uric acid secretion.

1963 #23

THE HYPOUREMIC DOGFISH

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Marine elasmobranchs utilize two major substances for the maintenance of extracellular fluid isotonicity, urea, and sodium. The interrelationship between these two substances during osmotic stress is of obvious interest. Several techniques were employed in an attempt to produce a hypouremic state in the dogfish, Squalus acanthias. A modification of the continuous peritoneal dialysis technique (coelomic douche) using urea-free solutions were unsuccessful in removing substantial amounts of urea, indicating a low permeability of the coelomic membrane for this substance. A modified single-coil extracorporal hemodialysis unit similar to the Kolff human twin-coil unit was technically successful, but the ducts of Cuvier did not tolerate long-term blood infusions. The use of exchange transfusion proved quite successful and simple. Pooled blood from several fish of the same species was anticoagulated and dialyzed against sea water until the urea concentration was less than 100 mg%. 200-400 ml exchange transfusions were used requiring 2-6 hours for completion. Judging from plasma urea concentrations, an average of approximately 20-25% of total body urea was removed. Plasma urea concentrations were reduced to as low as 160 mM/L. This loss of urea was accompanied by rises in plasma sodium to values as high as 380 mEg/L. These changes were not accompanied by changes in body weight. Animals surviving as long as 48 hours did not have increase in plasma urea concentration from the post-dialysis values. The data are consistent with the following conclusions: (1) the source of elevated urea in this animal is chiefly related to low urea loss from the body rather than augmented urea production, (2) acute osmotic stresses appear to be met by changes in sodium metabolism rather than urea metabolism.

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UREA TRANSPORT IN ELASMOBRANCH ERYTHROCYTES

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Previous workers have shown that erythrocytes of the dogfish, Squalus acanthius, are permeable to urea. If this permeability was due to simple diffusion these erythrocytes, like mammalian erythrocytes, should rapidly hemolyze in isosmotic solutions containing urea as the only solute. In this study it was found that there is no hemolysis of dogfish erythrocytes in salt free solutions of 1 M urea or 1 M hydroxyurea. Hemolysis is rapid, however, in 1 M methylurea or 1 M thiourea. When dogfish erythrocytes were exposed to various concentrations of urea it was found that slow hemolysis was evident in 0.7 M urea and hemolysis was rapid in 0.3 M urea. The addition of 0.3 M urea to 1 M methylurea or to 1 M thiourea prevented hemolysis of dogfish erythrocytes by these solutions. Flux measurements showed that equilibration was approximately 95% complete within 5 minutes. These findings with dogfish erythrocytes of: a) no hemolysis in isosmotic urea solutions, b) apparent substrate competition, and c) rapid equilibration are similar to the behavior of primate erythrocytes in glucose solutions and suggest a carrier mediated transport of urea by facilitated diffusion.