ON THE MECHANISM OF WATER AND SALT EXCRETION IN THE DOG-FISH, *SQUALUS ACANTHIAS*

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The urine flow in the dog-fish, *Squalus acanthias,* as determined from 117 observations on twenty-four fish, was found to be 12.9 cc. per kilogram per day, with a probable error of 4.3 cc. These data include some experiments in which the fish had received injections of xylose, sucrose or creatinine. While it is found that the rate of urine flow usually falls off during the time a fish is under observation, there is no evidence of any immediate change due to catheterization or to the injection of the substances mentioned. The intramuscular injection into two fish of about four times the amount of xylose regularly used in our experiments produced a less than two-fold diuresis during the following three hour collection period. The urine flow in the second period after injection was not increased, although at this time the urines contained 2.3 and 3.4 per cent. of xylose, respectively. During long experiments the rate of the urine flow tends to fall, especially as the animal approaches a state of collapse.

In a series of sixteen fish it was found that with an average urine flow of 12 cc. per kilogram per day there was a urine: plasma ratio of xylose or sucrose of about 6, and a glomerular clearance of about 70, indicating a reabsorption in the tubules of roughly 80% of the volume of the glomerular filtrate. The highest urine: plasma ratio for sugar in this series was 12, the lowest 3.5; and the extremes of glomerular clearance were 25 and 105 cc. per kilo per day. There is a tendency for the glomerular clearance to fall during a long experiment, but this fall is not so marked as in the fall in the rate of urine excretion.

In previous work on the elasmobranch kidney (Clarke and Smith, 1932) it has been observed that spontaneous diuresis, or the diuresis appearing after phlorizin administration, is usually accompanied by an increase in the urea concentration in the urine. This increased urea excretion might be caused by (1) such a large increase in the glomerular filtration that the reabsorbing limit of the tubules is surpassed, or (2) a reduction in the reabsorbing activity of the tubules due to (a) increased urine flow or (b) a specific action of phlorizin. The following experiments were designed to examine this point.

An attempt was made to produce diuresis by the intramuscular or intravenous injection of sodium sulphate, but even with doses approaching the lethal no great diuresis resulted, although the sulphate was rapidly excreted in the urine. Its presence up to 300 mM per liter in the urine did not interfere with the water reabsorbing activity of the tubules as shown by the constancy of both urine flow and sucrose clearance, although there appeared to be a slight diminution in the reabsorption of urea. This sulphate concentration is, however, only about three times that usually found in dog-fish urine.

The intramuscular injection of 0.3 to 1.0 mg. per kilogram of adrenalin caused a doubling of the urine volume, but since there was very little change in the glomerular clearance, as measured by the excretion of sucrose, the diuresis must have been caused by a diminution in the tubular reabsorption of water. The urea concentration of the urine rose to values never found in untreated fish, and in one case approached the plasma concentration ($U/P = .86$). In the experiment the urea: sucrose clearance ratio, which is a measure of the portion of filtered urea which escapes reabsorption, rose from 0.01 to 0.42, the latter figure indicating that even at the height of the adrenalin action the tubules were reabsorbing about 60% of the urea from the glomerular filtrate.

It is impossible as yet to say whether diuresis itself is accompanied by a diminished reabsorption of urea.

REFERENCES

1. Clarke, R. W., and H. W. Smith, 1932, *J. Cell. and Comp. Physiol.*, 1, 131.