The swelling of mitochondria from the liver and kidney of a primitive rodent (Aplodontia rufus).

A.L. Greenbaum and S.E. Dicker.

Departments of Biochemistry and Pharmacology, University College, London.

Received July 10, 1963

Greenbaum and Dicker (1963) have shown that the three naturally occuring hormones, oxytocin, lysine^{8}- and arginine^{8} - vasopressins produce swelling of the liver and the kidney mitochondria from rats and dogs, and that the mitochondria from the medulla of the kidney are markedly more sensitive to the action of the peptides than those from the cortex. The present investigation was done using mitochondria from the liver and the kidneys of a primitive rodent, Aplodontia rufus. This animal lives in the restricted humid area of the American Pacific North-West. The kidneys lack the anatomical formations which are necessary for the production of hypertonic urine; the cortex contains a majority of nephrons which do not reach the medulla and have no thin segments of the loop of Henle (Pfeiffer, Nungesser, Iverson and Wallerius, 1960). After withdrawal of both food and water the maximum urine concentration observed is of the order of 400-500 m.osmol./l.(with plasma concentration of 400 m.osmol./l.,) (Nungesser, Pfeiffer, Iverson and Wallerius, 1960; Dicker and Eggleton, J. Physiol. in press) as compared with 2000 m.osmol./l. in the rat. As these animals are relatively insensitive to the

administration of antidiuretic hormones, with the exception of vasotocin (Dicker and Eggleton, unpublished results), it was clearly of interest to see whether the mitochondria of their kidney reacted in a way similar to that described for rats and dogs (Greenbaum and Dicker, 1963).

Table 1. The effect of thyroxine and lysine^{8}-vasopressin and lysine^{8}-vasotocin on the swelling of liver and kidney mitochondria from rat and Aplodontia rufus.

		$O.D._{520} \times 10^3/10$ min.	
		LIVER	
	Final molarity	Rat	Aplodontia ruf.
Thyroxine	2×10^{-5}	339	206
Lysine-vasopressin	10^{-6}	216	158
	10^{-7}	99	61
	10^{-8}	30	20
	10^{-9}	0	9
Lysine-vasotocin	10^{-9}	345	40
	10^{-10}	240	31
	10^{-11}	126	15
	10^{-12}	59	0
	10^{-13}	6	-
		KIDNEY	
	Final molarity	Rat	Aplodontia ruf.
Thyroxine	2×10^{-5}	176	97
Lysine-vasopressin	10^{-6}	56	0
	10^{-7}	14	-
	10^{-8}	0	-
Lysine-vasotocin	10^{-9}	0	0
	10^{-10}	-	-

Mitochondria from the liver and kidney of the Aplodontia were prepared from 1:10 suspensions of the tissues in 0.25M sucrose - 0.001M EDTA by centrifugation at 10^5 and 1.5 x 10^5 g./min respectively. They were washed by resuspending in the sucrose-EDTA solution and recentrifuging. The mitochondrial pellet was suspended in 2 ml of 0.25M sucrose and kept on ice in this concentrated form until used. As control, mitochondria of rat's liver and kidney were prepared in a similar way. The effects of thyroxin and of two synthetic analogues of the posterior pituitary hormones, lysine^8-vasopressin and lysine^8 vasotocin (= lysine^8-oxytocin) on mitochondrial swelling was measured as described by Lehninger(1959). Thyroxin was included in these experiments to establish a level of comparison. The results are shown in Table 1.

From the above data it is clear that although the liver mitochondria from the Aplodontia are only slightly less sensitive to the three hormones investigated than rat liver mitochondria, its kidney mitochondria are, in distinct contrast to those of the rat, completely unaffected by vasopressin.

Dicker, S.E. and Eggleton, G.M. (1963) J. Physiol. (in the press)

Dicker, S.E. and Eggleton, G.M. (1963) Unpublished results.

Greenbaum, A.L. and Dicker, S.E. (1963). Biochem.biophys.acta (in the press)

Lehninger, A.L. (1959). J. Biol. Chem. 234, 2187.

Nungesser, W.C., Pfeiffer, E.W., Iverson, D.A. and Wallerius, J.F. (1960) Fed. Proc. 19, 362.

Pfeiffer, E.W., Nungesser, W.C., Iverson, D.A. and Wallerius, J.F. (1960) Anat. Rec. 137, 227.