PHYSIOLOGY

Antidiuretic Activity in the Pituitary Gland of the Koala Bear

ARGININE or lysine vasopressin is found in the pituitaries of most placental mammals and arginine vasopressin has been tentatively identified in a monotreme[1] and in four species of marsupials[1,2]. We have investigated antidiuretic activity in the pituitary of a young koala bear (*Phascolarctos cinereus*), which is of interest because this animal is rarely, if ever, known to drink, its water intake being derived solely from eucalyptus leaves.

The koala studied was about 6 months old and thus quite immature, and had died by falling out of its mother's pouch during the night. The pituitary gland was extracted according to standard methods[3] and assayed against 'Pitressin' (Parke, Davis and Co.) in the hydrated rat[4] with an initial and maintained water load equivalent to 6 per cent of its body weight. We have found this slightly lower level of hydration to produce a satisfactory flow of urine and to improve the sensitivity to injected vasopressin. Sections of hypothalamus and medulla were similarly extracted and assayed for antidiuretic activity.

The antidiuretic activity of the whole pituitary was equivalent to 235 mU or 7·95 mU/mg dry tissue which, considering the age of the koala, seems comparable with that reported for other marsupials. It is tentatively ascribed to vasopressin because the log dose–response curves of the standard and extract were parallel, the standard and extract produced similar effects on urine volume and conductivity both in onset and duration and the activity was destroyed by incubation with 0·01 molar sodium thioglycollate for 30 min (ref. 4). There was no detectable antidiuretic activity in the extracts of hypothalamus and medulla, the lower limit of sensitivity in the assay animal being 1·25 μU.

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Siphuncular Tube of *Nautilus*

SINCE Robert Hooke[1] suggested that the siphuncle (which he took to be the gut) of *Nautilus* produced gas to force liquid from the shell chambers and so buoy up the animal, there have been many speculations on its function. These speculations required that the siphuncular tube was water-tight[2], or air-tight[3–5], or permeable to gas[6–8], or permeable to liquid[9,10] or permeable to both gas and liquid[11]. The only experimental information, however, on the transmission properties of the siphuncular tube is that it is permeable to water[10]. The experiments described here show that the wall of the siphuncular tube is permeable to sea water (with a linear relationship between flow rate and pressure), impermeable to air and able to withstand pressures equivalent to well above 450 m of water.

A fresh shell of *Nautilus macromphalus* was sawn open along the dorsoventral plane. Stainless steel tubes were bonded with 'Araldite' to the siphuncular tube openings so that sea water could enter into the first chamber adjacent to the living chamber, and could leave from the fifth chamber. The inflow tube was connected to the pressure apparatus (Fig. 1) and the outflow tube to a bleed valve. Initially, sea water was forced in under a head of 41 m of water, and immediately small beads of liquid appeared on the surface of the siphuncular tube. In each segment, the beads coalesced into a single drop of liquid at intervals of about 5 min. When the pressure was increased, the flow rate of liquid was found to be directly proportional to the pressure (Fig. 2). At a 205 m head, the five chambers were almost half full of transmitted liquid after an hour.

In a further experiment, sea water under 205 m head was forced into the siphuncular tube segments in the earliest twenty shell chambers. Liquid appeared on the siphuncular tube segments in all chambers except the earliest one. With this exception, all the siphuncular tube segments seem to be functional, even the earliest seven segments which supposedly formed in the egg. Thus at 200 m depth a *Nautilus* shell would fill in about 2 h if the siphuncle did not prevent it.

The salinity of the effluent at various pressure heads up to 200 m was analysed and found to be unaltered from that of the inflowing sea water, so that the siphuncular tube seems to act as a permeable, not a semi-permeable, membrane. A reduction in salinity would have explained

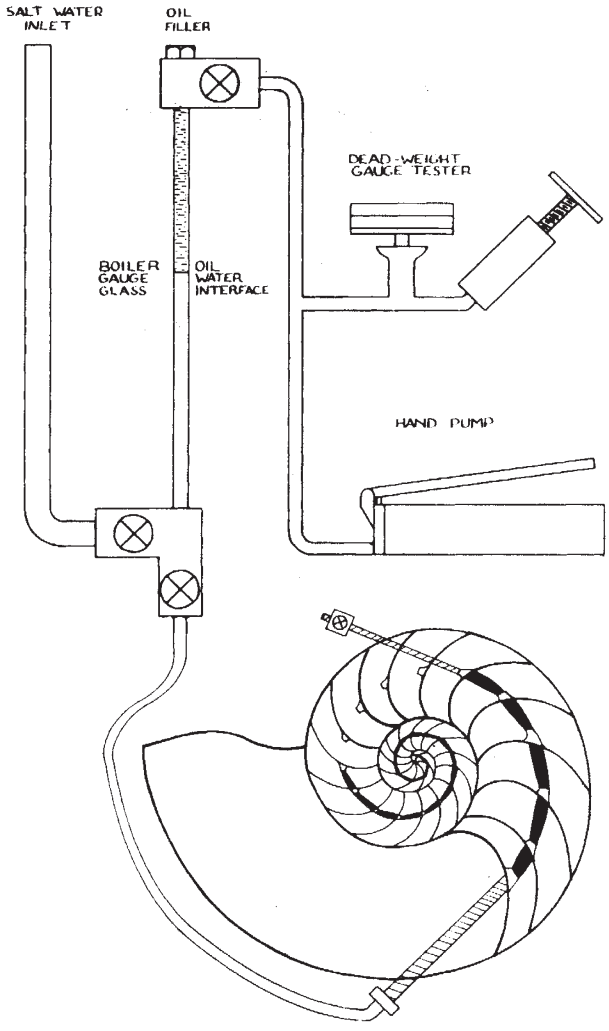

Fig. 1. Apparatus for forcing sea water into *Nautilus* siphuncular tube. Permeable parts of siphuncular tube in black.