

Distribution of Oxytocin, Vasopressin and Intermedin in Hypophysis of the Beaver.* (23336)

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The hypophysis of the beaver (*Castor canadensis*) has been found to lack an anatomically discrete pars intermedia.[‡] In this respect, the gland resembles that of the armadillo, whale, porpoise, manatee and fowl. In these latter species, the pressor, antidiuretic and the oxytocic activities are confined to neural lobe extracts while melanophore-expanding activity is confined to anterior lobe extracts(1-4). Furthermore, assays of the neural lobes of certain whales and armadillo showed a marked disproportion in the pressor-oxytocic ratio compared with that of the U.S.P. standard pituitary powder. The present study was undertaken to determine distribution of hormones in the beaver hypophysis, and to determine pressor-oxytocic and pressor-antidiuretic ratios in this species.

Materials and methods. Live beavers secured by trapping through cooperation of the South Dakota Department of Game, Fish, and Parks, were anesthetized by ether or sodium pentobarbital and decapitated. The pituitary gland was removed, weighed (Table I) and placed in acetone after separation into anterior and neural lobes and stalk. Portions of cortex and hypothalamus were also fixed in acetone. For assay purposes, the tissues were dried, ground finely and extracted with 0.25% acetic acid, 1 cc/mg of dried powder. Weights of the separated lobes are shown in Table I. Three lots of extracts were prepared; in 2 of these, 2 or 3 glands were pooled. Oxytocic activity was measured by U.S.P. method, which utilizes the vasodepressor effect in the anesthetized fowl. Antidiuretic activity was determined by Ham and Landis' modification of Burns' method which uses un-

anesthetized, hydrated rats(5). Pressor activity was assayed by pressor response of anesthetized cats. Melanophore-expanding activity was determined using hypophysectomized frogs. The U.S.P. Posterior Pituitary Reference Standard, which contains 0.4 oxytocic units/mg, was the standard used for oxytocic, pressor and antidiuretic activity.

Results. Oxytocic activity: The neural lobe of the beaver contained approximately 2 units of oxytocic activity/mg of dried powder, and the stalk approximately 0.4 unit/mg. No oxytocic activity could be detected in extracts of hypothalamus, cortex, or anterior lobe when administered in amounts equivalent to 10-fold the amount of neural lobe extract necessary to produce a definite effect.

Pressor activity: The neural lobe contained approximately 2 units/mg of dried powder and the stalk approximately 0.4 unit. Anterior lobe, hypothalamus and cortex failed to evoke a pressor response in amounts 10-fold greater than the effective dose of neural lobe extract.

Antidiuretic effect: An appreciable antidiuretic effect was observed when rats were given 0.6 μ g of neural lobe extract/100 g body weight. A comparable effect was obtained with a dose of 1.25 milliunits of standard/100 g. A significantly greater effect was noted with a dose of 5 μ g of beaver neural lobe/100 g, the effect being similar to that produced by the standard preparation in a dose of 10 milliunits/100 g. Thus, antidiuretic assays indicate activity of approximately 2 units/mg dried powder for beaver neural lobe. No antidiuretic effect could be elicited by extracts of anterior lobe, cortex or hypothalamus when given in amounts of 50 μ g/100 g rat.

Melanophore hormone: Appreciable darkening of hypophysectomized frogs occurred when 0.001 mg of anterior pituitary was injected in 0.5 cc saline in the ventral lymph

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TABLE I. Wet Weight in Milligrams of Separated Portions of Beaver Hypophyses.

Date of collection	Body wt, kg	Sex	Wt of separated portions (mg)	
			Ant. lobe	Neural lobe + stalk
6/55	41.8	♂	97	25
2/56	37.4	♀	67	43
"	35.2	♂	83	30
"	37.4	♀	87	35
3/56	41.8	♂	80	49
6/56	41.8	♂	90	40

sac. A slight response could be detected with 0.5 mg of neural lobe and an equivocal response with 0.125 mg. An equivocal response was also obtained with 0.5 mg of hypothalamus. No melanophore expansion was noted with 0.5 mg of cortex.

Discussion. The results indicate that the neural lobe of the beaver possesses oxytocic, pressor and antidiuretic activity but contains only traces of melanophore-expanding activity. The pressor:oxytocic ratio is similar to that of the standard powder. Hagen[§] has found a similar ratio in freshly collected beef and sheep glands but a pressor-oxytocic ratio of 0.6 in the hog. Using different assay procedures, Stoepel(6) and Van Dyke *et al.*(7) have also found a pressor-oxytocic activity of less than 1 in this species. Earlier studies have indicated a pressor-oxytocic ratio of 1 in the manatee, porpoise, and chicken and of from 3 to 10 in the armadillo and whale. However, different U.S.P. standards were used in these 2 series of comparative assays and it cannot be assumed that the pressor-oxytocic ratio of the standard has remained constant since official assays have been confined to determination of oxytocic activity. The fact that the pressor-antidiuretic ratio was similar to that of the standard is in accord with the generally accepted viewpoint

that the 2 activities are vested in the same moiety(8). Failure to demonstrate pressor, oxytocic and antidiuretic activity in extracts of hypothalamus was not considered significant since the assay procedures used are not very sensitive and no effort was made to dissect out the hypothalamic nuclei where these activities have been reported to be concentrated(9).

The presence of melanophore-expanding activity almost exclusively in anterior lobe extracts is in keeping with previous reports that this hormone is elaborated in the anterior lobe of these species in which a discrete intermediate lobe is lacking.

Conclusions. 1) The neural lobe of the beaver pituitary contains approximately 2 units of oxytocic, pressor and antidiuretic activity/mg dry weight. The stalk contains about 0.4 unit of pressor and oxytocic activity/mg. 2) The pressor-oxytocic and pressor-antidiuretic ratios of neural lobe extracts were similar to those of the U.S.P. standard pituitary powder. 3) The anterior lobe contains appreciable melanophore-expanding activity but no oxytocic, pressor or antidiuretic activity.

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