

Research Reports: 1958

Kidney Function in the Beaver

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If the kidney operates as a countercurrent-multiplier system, as suggested by Hargitay and Kuhn (1951), the maximum concentrations of salt and urea that the kidney can establish in the urine should be related to the length of Henle's loops. The present work is part of a study in which the concentration ability of mammalian kidneys is compared with the length of the loops and the number of short and long looped nephrons. According to Sperber (1944) the beaver kidney seems devoid of long loops. It consists of cortical nephrons and short looped nephrons only. The cortical nephrons are mostly without thin segments. The short looped nephrons all turn in the thick segment. Thus, the kidney has no inner zone of the medulla. The kidney has two or more short papillae, and the medulla is not divided into zones.

The concentration ability was studied in six beavers maintained at the laboratory on aspen leaves and bark. The beavers drank copiously when given free access to drinking water and the urine was isotonic or slightly hypertonic to the blood. When water was restricted to once a day the concentration of the urine was 400-600 mosm/l. When deprived of water, the beavers lost weight and the plasma concentration increased. However, the urine concentration did not rise above 600-700 mosm/l. The administration of pitressin did not increase the urine osmolality any further.

The maximum total electrolyte concentrations measured corresponded to 250 mN KCl. The maximum urea concentrations in the urine during water deprivation and pitressin administration were 220-250 mM/l. When a 1% urea (167 mM) urea solution was given as drinking water the plasma urea concentration increased and urine urea concentrations reached values of 350-375 mM.

These figures indicate an extremely low ability of the beaver kidney to concentrate the urine and are consistent with the hypothesis that concentration ability is related to the length of Henle's loop.

This work was supported by a Grant-in-Aid from the American Heart Association.

Extrarenal Salt Secretion in Marine Birds

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Investigations of the extrarenal salt excretion in marine birds were continued and extended to further species. Field work was conducted on Ship Island and Great Duck Island, Maine, and Bonaventure Island, Quebec, Canada.

¹ The work was done during the tenure of an Established Investigatorship of the American Heart Association.

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Problems of particular interest were chosen to obtain further information about the function of the salt gland in various marine birds. Attention was also given to the renal excretion of electrolytes.

The possible variation in the composition of the nasal secretion was studied in birds made acidotic or alkalotic. The shifts in the ionic composition of the secretion were assayed. Studies of bicarbonate secretion by the nasal gland were made in collaboration with Dr. T. H. Maren. The investigations of the ultra-structure of the gland, which were started in 1957 in collaboration with Dr. Doyle, were continued with special emphasis on establishing the presence and extent of intracellular canals (or infoldings) in the secretory cells.

Supported by National Institute of Health Grant H-2228 and Office of Naval Research Contract Nonr 1181(08).

Fetal and Adult Thyroid Glands of the Dogfish, *Squalus acanthias*

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Study of the structure and activity of fetal and adult thyroids was continued with varying doses of I^{131} ; special attention was again given to the permeability of the "uterus" to maternally-injected I^{131} , and to the uptake of I^{131} by the free-swimming late fetus (pup). Digestive tract, internal yolk, skin, uterine fluid, etc., were also checked for radioactivity. Some fetal and adult hypophyses were frozen for bioassay (1-day-old cockerel and red eft techniques); others were fixed in modified Susa for staining with PAS and aldehyde-fuchsin methods.

The "uterus" is permeable to maternally-injected I^{131} , but radioactivity of uterine fluid is below that of maternal blood. Thyroids of intrauterine pups show little radioactivity even after large doses and long periods of time following maternal injection.

The fetal thyroid is shield-shaped, with a long, slender, cellular stalk attached posteriorly which may represent the location of the original thyroglossal duct. It weighs a fraction of a milligram. Primitive type follicles are minute, scattered among epithelial cords and plates, and are characterized by cuboidal to columnar cells with occasional traces of vacuolated colloid which stains orange or green with Mallory's trichrome.

Such glands, however, show radioactivity proportionately equal to or higher than that of the maternal thyroid (weighing several hundred milligrams) during a 24-hour period or longer when the fetuses are injected directly and kept in partially covered containers within running sea water aquaria (Gilbert's method).

Follicles of pregnant female thyroids are large, with abundant colloid and flattened epithelium; they show neither hyperfunction nor decreased activity, and resemble thyroids of male and nonpregnant females. Peak of uptake is similar in both fetal and adult glands, 16-24 hours.

Supported by NSF Grant 2255.