tained for galvanic skin response "conditioning" are also applicable to alpha conditioning.

If our interpretation of these data is correct, we would predict that if one measured speed of adaptation to tone stimulus alone, one should find that brain-damaged and chronically anxious patients should show adaptation to tone stimulation more rapidly than is true of control subjects. Experiments are presently under way to test this hypothesis.

Analysis of alpha enhancement is depicted in the lower portion of Fig. 1. A rise in the curve is indicative of increasing alertness; a drop, of increasing drowsiness. This interpretation is based on the finding that alpha enhancement or appearance of alpha activity in response to stimulation occurs only in drowsy subjects (6). During the 20 trials of tone stimulation, we see a consistent increase in alertness, while during "conditioning" there is consistent decrease of alertness, or a lapse into a drowsy state, despite instructions on the part of the experimenter aimed at keeping the subject alert and awake. The lack of parallelism between the curves demonstrating alpha enhancement to tone and to light (paired with tone) is attributed to the facts that (i) where there is alerting to tone, further alerting to light is not probable, since the period of analysis for light stimulation immediately follows that of tone stimulation, and (ii) since light is a more potent stimulus for producing alpha desynchronization, it is thus possible for a person to go from a drowsy record to an alert one with minimum or no evidence of alpha activity.

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New Arrangement of Interrenal and Chromaffin **Tissues of Teleost Fishes**

Abstract. An unusual morphologic arrangement of interrenal and chromaffin tissues has been observed in two families of teleost fishes. In most teleosts in which these cell types occur together in association with the postcardinal veins and their branches, the chromaffin cells are located between the lumen of the vein and the interrenal cells. This typical relationship is reversed in some of the Labridae and Scaridae.

The interrenal gland of teleost fishes, located within the anterior or head kidney, appears to be homologous to the adrenal cortex of mammals (1, 2). Chromaffin cells like those of the adrenal medulla, which react with chromic acid, are also found in the anterior kidney. These cell types were delineated first by Giacomini in 1902 (3); since then the interrenal and chromaffin tissues of about 80 species of teleosts have been described (1, 4, 5).

In order to extend these observations, over 125 species from 55 teleost families were collected from a variety of habitats (6). The anterior kidneys of these animals were fixed either in Bouin's or in Orth's (7) fluid. The latter fixative contains potassium dichromate, and was used to determine the distribution of chromaffin cells.

The interrenal morphology is extremely variable in these fishes. Furthermore, the surrounding tissues may be lymphoid or myeloid or both, and may or may not contain renal elements (2). The relationship of the interrenal to these tissues is also variable. Usually the interrenal is associated with the postcardinal veins or their branches or both, which ramify through the anterior kidney tissue. Chromaffin cells are always located within the walls of these veins. Often the interrenal and chromaffin tissues are separate, although more frequently there is some type of association between them.

When interrenal and chromaffin cells occur together around the veins within the anterior kidney, one of several possible arrangements may be found. The chromaffin tissue may be interspersed among the interrenal cells, as in the Cyprinidae and Cyprinodontidae (5). In the Gasterosteidae (5), clumps of interrenal alternate with clumps of chromaffin cells, the entire complex forming a cuff around the lumen of the postcardinal vein.

More often only the chromaffin cells are seen within the walls of these veins, either adjacent to the endothelium or embedded within the connective tissue of the vein wall. The interrenal is found external to both the vein wall and its associated chromaffin tissue. Such an arrangement is illustrated in Fig. 1 (A, B), which shows the interrenal and chromaffin tissue of a butterfly fish, Chaetodon miliaris. Even in the truly interspersed glands mentioned above. the chromaffin cells tend to be located closest to the vein lumen.

During the course of this investigation, an unusual arrangement of the interrenal and chromaffin tissues was seen. This arrangement has not been described previously, and has been observed only in fish from two closely related families: the Labridae (wrasses) and the Scaridae (parrot fishes). In some of these animals, the interrenal cells were found immediately adjacent to the endothelium of the veins, as a single layer of columnar cells. The



Fig. 1. Interrenal and chromaffin tissues associated with a branch of the postcardinal vein within the anterior kidney. Tissues were stained with hematoxylin and eosin; magnification is \times 365. (A) Chaetodon miliaris, Bouin's fixation. (B) Chaetodon miliaris, Orth's fixation. (C) Cheilinus rhodochrous, Bouin's fixation. (D) Cheilinus rhodochrous, Orth's fixation. Abbreviations: i, interrenal cells; c, chromaffin cells (the positively reacting chromaffin cells appear dark after Orth's fixation); l, vein lumen.

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chromaffin cells lie between the interrenal and the connective tissue of the vein wall (Fig. 1, C, D). This peculiar arrangement of cells was observed in all of the species of Scaridae examined, which included Scarus dubius, S. formosus, S. perspicillatus, and Scarops rubroviolaceus. In regions of the anterior kidney where the interrenal is markedly thickened, however, the interrenal and chromaffin cells were often interspersed.

Among the Labridae studied, the relationship between interrenal and chromaffin cells illustrated in Fig. 1 (C, D) was seen in the following species: Cheilinus rhodochrous (Fig. 1, C, D), Cheilio inermis, Hemipteronotus baldwini. Novaculichthys taeniourus, N. woodi, Thalassoma duperreyi, and T. umbrostigma. In most of these fishes, other arrangements were also seen, especially in those regions where the interrenal cells are stratified. In five other species of Labridae (Bodianus bilunulatus, Coris flavovittata, C. ballieui, Cymolutes leclusei, Thalassoma ballieui), this unusual relationship of interrenal and chromaffin cells was not observed.

Modifications of interrenal location and morphology may be related to the maintenance of an adequate blood supply to this gland, particularly as it increases in size. The function of the sinusoids visible in the interrenal of Chaetodon (Fig. 1A) may be performed by the larger blood vessel in Cheilinus (Fig. 1C), as long as only a single layer of interrenal cells lies adjacent to the vein lumen. It is noteworthy that the chromaffin cells maintain a relatively constant position in the vein wall despite marked variations in the distribution of interrenal tissue. The significance of these morphologic variations is not apparent, and attempts to correlate interrenal structure with habitat or taxonomic position of the species have thus far been unsuccessful (8).

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Potassium Deficiency in Marmots during Hibernation

Abstract. Semiquantitation of potassium deficiency in the renal papillae indicates that woodchucks (Marmota monax) are deficient in potassium annually during the time they subsist on stored fats. The deficiency begins prior to hibernation, progresses during hibernation, and, in males, continues during the immediate postemergence period.

A deficiency of potassium appears to be a regular annual event in woodchucks (*Marmota monax*). The deficiency begins prior to hibernation and reaches a maximum immediately after hibernation. During this part of the year the animals subsist on stored fats rather than on ingested food.

Potassium deficiency in these animals is shown by the presence in the cells of the tips of the renal papillae, especially of the collecting tubules, of PAS positive intracytoplasmic granules, or droplets, identical to those which result from potassium deficiency in laboratory rodents (1-3). These droplets alone are presumptive evidence of a potassium deficit (3). However, the fact that the degree of granulation in woodchucks correlates with serum potassium levels establishes the identity of the droplets as being those produced by a potassium deficit. This relationship permits the use of papillary granulation as an index of potassium deficiency and roughly of its relative degree and duration.

The kidneys of about 2000 woodchucks from the Letterkenny Army Ordnance Depot near Chambersburg, Pa., were examined from 1956 through 1960. Sections through the tips of the renal papillae, cut at 3 μ and stained by Lillie's allochrome procedure (4), were available for about 1000 of these (Table 1). The degree of granule formation was graded for each kidney on a scale of 0 to 4, in which 0 indicated no granules and 4 corresponded to the marked degree of granulation observed in rats made severely deficient in potassium experimentally (1).

Animals were collected in all months but January and the first half of February, although samples were necessarily small in the months immediately preceding and during hibernation (Table 1). Both males and females begin hibernation in October in the study area. The midpoint of emergence from hibernation is 22 February for adult males and 5 March for adult females. Two torpid animals were taken from underground burrows in December (Table 1). More animals from December and January would be desirable, but woodchucks are difficult to locate in their burrows during hibernation. Serum potassium levels were determined for a

Table 1. Mean grade of PAS positive granulation in epithelial cells of the collecting ducts of the renal papillae of woodchucks. Grading based on a scale of 0 to 4, where 0 = no granules and 4 = the granulation seen in severe experimental potassium deficiency in rats. Data are combined for 1956 through 1960. *P* differences are as follows: between males and females in February, <0.05; between males and females in March, <0.001; between males for February/March and March/April, <0.001; between males for April/May, <0.05. Differences between all other paired successive means; no significance.

Month	Males			Females			Sexes combined		
	No.	Mean	S.E.	No.	Mean	S.E.	No.	Mean	S.E.
February	30	3.47	0.14	4	2.50	0.41			
March	139	2.23	.12	108	1.58	.12			
April	121	1.33	.12	152	1.20	.10	273	1.26	0.07
May	25	0.84	.21	54	0.68	.11	79	0.73	.10
June	32	0.48	.16	45	0.54	.14	77	0.52	.11
July	32	0.61	.27	78	0.40	.07	110	0.46	.09
August	7	0.57	.28	21	0.48	.15	28	0.50	.13
September	45	0.74	.15	51	0.81	.18	96	0.78	.11
October	10	0.95	.34	5	0.80	.34	15	0.90	.25
November	3	1.00	.58	5	1.00	.71	. 7	1.00	.44
December	1	2.00		1	3.00		2	2.50	