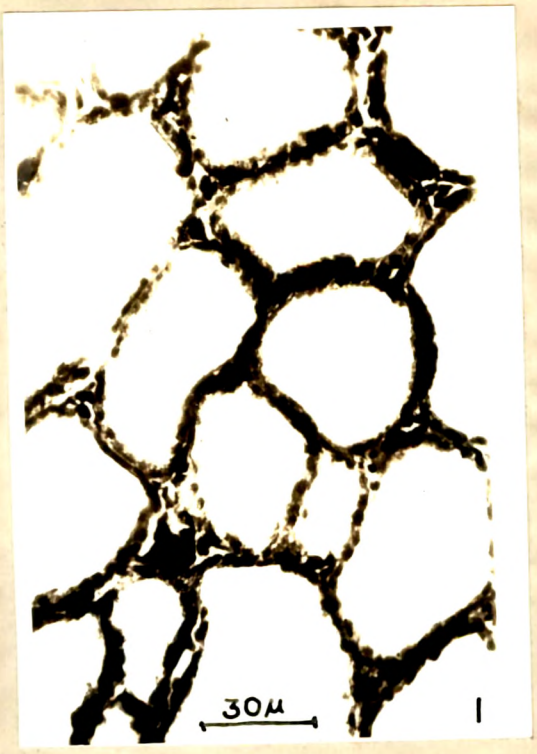
# CHAPTER 10

## CHANGES IN THE THYROID ACTIVITY IN THE HOUSE LIZARD, HEMIDACTYLUS FLAVIVIRIDIS; DURING THE DIFFERENT PHASES OF REGENERATION(TAIL)

A number of investigations have been carried out on the thyroid in relation with regeneration in amphibians (Allen, 1918; Hoskins and Hoskins, 1919; Richardson, 1933, 1940; Ghidoni, 1948; Astwood, 1949, 1954; Washburn, 1950; Kambara, 1953; Wheeler, 1953; Peadon, 1953 and Schmidt, 1958a, b). It is shown that thyroidectomy, treatment with thiourea or administration of additional thyroxine interfere with normal regeneration in amphibians (Pawlowsky, 1933; Peadon, 1953; Schotte and Washburn, 1954 and Hay, 1956). If the thyroid is removed before amputation of the limb, the de-differentiation does not take place and the regeneration stops and if it is removed later, the differentiation and growth are affected (Richardson, 1940, 1945; Schotte and Washburn, 1954 and Hay, 1956). In the present investigation, some preliminary observations were made on the histological differences in the thyroid gland of the normal adult house lizard, Hemidactylus flaviviridis and of those showing different stages of tail regeneration.

## MATERIALS AND METHODS

The thyroid gland was removed and fixed immediately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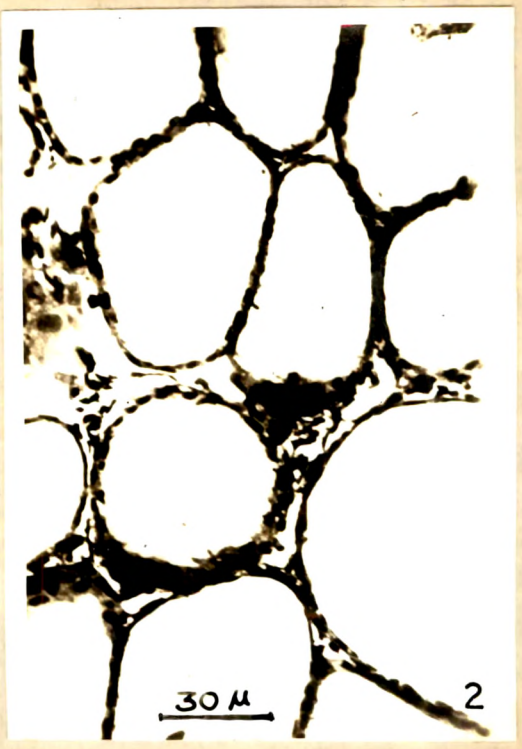
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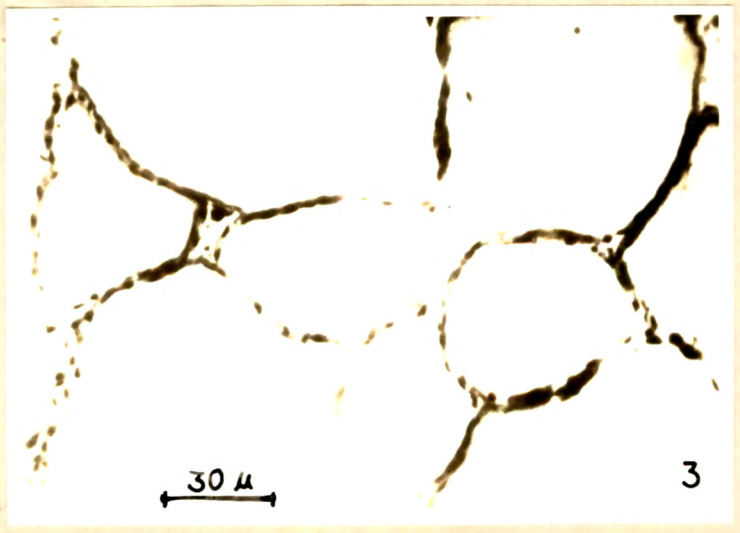
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## EXPLANATIONS FOR FIGURES

Fig. 1. T.S. of thyroid of the lizard with the normal tail.

Fig. 2. T.S. of thyroid of the lizard with the regenerating tail (preblastemal stage). Note the decrease in the height of the follicular cells and increase in the diameter of the follicles.

Fig. 3. T.S. of the thyroid of the lizard with fully regenerated tail. Note a further decrease in the height of the follicular cells and the increase in the diameter of the follicles compared to these in Fig.2.

TABLE I

Data on thyroid at different phases of tail regeneration

| Phases of regeneration | No. of tests | Diameter of the follicle (d) μ | Number of follicular cells (n) in follicle | Height of follicular cells μ | Ratio d/n |
|---|---|---|---|---|---|
| Normal | 5 | 79.43 (70.3 - 115.9)* | 37 (32 - 43)* | 7.6 | 2.14 |
| Wound Healing | 5 | 128.44 (95.0 - 190.8) | 39 (29 - 53) | 7.6 | 3.29 |
| Preblastemal | 5 | 115.42 (101.86 - 143.9) | 30 (25 - 34) | 8.14 | 3.85 |
| Blastemal | 5 | 122.2 (107.16 - 144.4) | 34 (31 - 38) | 7.6 | 3.59 |
| Late Blastemal | 5 | 142.12 (97.28 - 180.88) | 33 (25 - 39) | 7.6 | 4.3 |
| Differentiation | 5 | 187.2 (159.6 - 260.68) | 38 (31 - 46) | 7.6 | 4.92 |
| Growth | 5 | 174.1 (147.4 - 230.3) | 34 (29 - 41) | 3.8 | 5.12 |
| Fully regenerated | 5 | 259.92 (253.1 - 276.64) | 49 (47 - 51) | 3.8 | 5.29 |

*Data in the parenthesis shows the range of readings.

in 10% formol saline at room temperature for 12 hours. The tissue was then embedded in wax, sectioned at 8 μ and stained in Haematoxylin-Eosin for histological observations. The measurements of the height of the epithelial cells of the follicle and the ratio between the inner diameter and the number of cells (d/n) in the follicle were calculated according to Lever (1948,1950). Five follicles from each gland were randomly selected for measurements. The observations were made on the animals during their non-breeding phase and the entire set of observations were confined to a period of the first 50 days during the tail regeneration.

## OBSERVATIONS AND DISCUSSION

The observations on the thyroid of the normal lizards and those with different phases of regenerating tail revealed that the thyroid of an adult lizard with normal tail is relatively the most active (Fig.1). After amputation the thyroid activity gradually decreased as the regeneration of the tail progressed. During the preblastemic phase though there was an appreciable increase in the height of follicular cells, the d/n ratio at the same time appeared to have increased over that of the thyroid of the normal lizard. On one hand if the height of the follicular cells is taken as the criterion for thyroid activity, it would be concluded that the preblastemic

phase where the follicular cell height is more (8.14 μ) than that of the normal lizard (7.6 μ), the thyroid becomes more active (Fig. 2). On the other hand if d/n ratio is to be regarded as the index for thyroid activity it would mean a decreased thyroid activity during the preblastemic phase, since the d/n ratio at this phase was more than that of the normal ~~tail~~. Thus the results obtained using these two criteria are contradictory as far as the thyroid activity during preblastemic phase of the tail regeneration in the lizard is concerned. After the preblastemic phase the height of the follicular cells remains constant which is 7.6 μ (same as that of the normal lizard thyroid cells), till differentiation phase ends. Later during the growth phase and the phase when tail has reached its normal length, the height of follicular cells decreased considerably to about 3.8 μ (Fig. 3). However, during the entire phase of regeneration and growth the d/n ratio showed a gradual increase (Table 1). Thus the above observations, suggest that the thyroid activity decreases during regeneration of tail.

From studies on the effect of thyroidectomy on regeneration in amphibians (Schotte and Washburn, 1954) it was proved that, this interferes with the normal regeneration. Similar conclusions were drawn after studying the effect of administration of thiourea and

thyroxine in amphibians by Peadon (1953) and Hay (1956) respectively. Schotte and Washburn (1954) found in Triturus that if the thyroid is removed before the formation of blastema, the dedifferentiation is delayed and abnormalities occur in the formation of skeleton. Their studies suggested that the influence of thyroid hormone is profound at two different phases, the dedifferentiation and growth. These findings were supported by the work of Richardson (1940, 1949). Further, Hay (1956) reported that the administration of thyroxine has little effect on dedifferentiation but hastens the differentiation and promotes growth on the other hand. Schmidt (1958a,b) showed that thyroidectomy facilitated dedifferentiation and normal regeneration. Rose (1964) while reviewing the work on amphibian regeneration has questioned Schmidt's results and has suggested that it may be the fungicide Aqua aid, which was used by Schmidt to prevent infections which facilitated regeneration. The present study on the relation of thyroid with tail regeneration in lizard showed that during the regenerative phases the thyroid activity gradually decreased. Perhaps these results are in support of the results obtained by Schmidt (1958a,b) in the newt, Diemictylus viridescens. In the present work attention was focussed only on the histological changes that take place in the thyroid gland during the normal regeneration of the tail. Experimental

studies employing thyroidectomy and administration of thyroxine could provide further information on the role of the thyroid during regeneration.