function studies (clearances). There were no serious alterations of the concentrations of serum sodium and potassium. These data suggest that the renal toxicity and altered electrolyte metabolism associated with Viomycin therapy may not be as serious as the earlier observations indicated. Therefore, we believe that further use of Viomycin with careful observations for signs of renal toxicity is indicated, particularly in patients unresponsive to the other more effective therapeutic approaches.

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Regeneration of Lens and Retina in Thyroidectomized and Hypophysectomized Adult Newt (*Triturus v. viridescens*).* (20239)

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The senior author(1-4) has been making an experimental study of factors affecting the release and inhibition of lens regeneration from the dorsal iris in adult eyes of the newt, *Triturus v. viridescens*. It has recently been reported by Hall and Schotté(5) that hypophysectomy, and by Richardson(6,7) that thyroidectomy and hypophysectomy markedly affect regeneration of the limb of the newt. In view of this it became essential to know what effect, if any, the removal of these endocrine glands might have on the regeneration of the lens from the dorsal iris as well as the neural retina pigment cells(8) in the newt. Already Nikitenko(9) has claimed that hypophysectomy in adult newts (species?) had no direct effect upon lens regeneration, and Lenhard(10) reported that the lens could regenerate normally in thyroidectomized adult *Triturus cristatus*, although the results were not consistent.

In the present experiments one group of adult newts was hypophysectomized, another was thyroidectomized, and in another both the hypophysis and the thyroids were excised. Four to 8 days later the lens was removed from the right eyes and both the lens and the neural retina were removed from the left eyes. Many animals did not survive the duration of the experiments. Therefore the results here are based on a study of a total of 173 eyes (81 in the first group, 48 in the second and 44 in the third) in animals sacrificed at frequent intervals from 2-43 days after the eye operations. In many specimens in each group the right eyes were later excised in alcohol and cut along the equator to separate the anterior half for gross examination of the relations of the regenerating lens to the iris. These were later prepared in serial sections as were all other eyes. Also serial sections of all heads and jaws were studied to detect whether or not all the thyroid and pituitary tissue had been removed. Similar gross and histological preparations, fixed at frequent intervals from 2-60 days after operation, were examined as normal controls in 178 eyes from which only the lens was removed in order to determine in eyes with intact retina the average, as well as the individual variations, in the rate of lens regeneration and

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growth within similar age groups. For comparison another series of 84 control eyes was analyzed from which both the lens and the neural retina were excised. These were preserved at frequent intervals from 2-57 days after operation. Sato's(11) staging of lens regeneration in adult *Triturus pyrrhogaster* was applied in these studies where it was possible. The room temperature at which the animals were kept was about 70-75°F.

Results. Two of the 24 animals from which only the thyroids were removed, showed accessory thyroid follicles embedded among jaw muscles. Accessory follicles, usually from 1 to 3, were frequently found in animals from which the pituitary was removed. In each of 3 cases in the latter group there was found a small fragment of the adenohypophysis as well as a small remnant of the neurohypophysis. Also in 4 others a fragment of the neurohypophysis had not been removed. However, in those instances where accessory thyroid follicles or a small fragment of the pituitary was left behind, general after effects of the gland operation and the course of lens and retina regeneration appeared to be no different than in the many from which the tissues of the glands in question had been completely removed.

The animals from which the glands were removed were usually thin and not very active. A thick layer of cornified epidermis and mucus covered the body. Some maintained their normal body color but in others the skin became very dark over dorsal and lateral surfaces with spreading of dark layers on the ventral surface as well. Molting became generally very irregular and failed to occur in many of them. In some there were localized dark spots over the head, body and limbs. A characteristic V-shaped spot appeared on the dorsum of the head in a number of hypophysectomized animals.

Following lens removal in adult eyes with the retina intact, there are distinct variations in the rate of lens regeneration within similar age groups, although regeneration in general is steadily progressing. For example, the thickening of the dorsal iris, the proliferation and depigmentation of cells along the pupillary margin are 3 early stages of lens regeneration which overlap within similar age groups from 6-10 days after operation. Various stages in the formation of the lens vesicle and its primary lens fibers also overlap within similar age groups during the second and particularly the third week. Again within age groups during the third week there is an overlapping of various stages covering the rapid differentiation and acquisition of secondary lens fibers. However during the fourth week most lens regenerates have a completely developed lens capsule and usually become detached from the dorsal iris about the twenty-fifth day. As the secondary lens fibers accumulate and rapidly increase the size of the lens, the cell nuclei of the central primary lens fibers are gradually lost by the end of the second month. However when both the lens and the neural retina are removed, the rate of regeneration and the growth of the lens regenerate are much retarded during the first month. During most of the second month when further detailed staging of lens regeneration is not sharply defined the lens size is still distinctly affected, but by the end of the second month it approaches that of the lens regenerates in eyes with intact retinae.

The delay of the early stages of lens regeneration is associated with the progress of neural retina regeneration from the retinal pigment cells, which, after recovery from the operation require about 2 weeks or longer to establish a layer of depigmented cells. When these cells begin rapid proliferation during the third week the dorsal iris gives rise to the lens vesicle. Its growth and differentiation then proceed along with that of the regenerating neural retina. Differentiation in the latter may be well advanced during the fourth week, and complete soon thereafter while the secondary lens fibers are rapidly accumulating in the growing lens regenerate.

Measurements of lenses in animals from which the glands were removed, showed as in the normal controls, that lens regeneration in the left eyes with regenerating retinae was retarded when compared with that in the right eyes with intact retinae. In fact the rate of lens regeneration in both the right and left eyes followed closely that of comparable eyes in the normal controls. Also in the left

eyes of animals from which the glands had been removed the neural retina was slowly regenerating from the pigment cells almost as rapidly as in the normal control left eyes. Advanced differentiation of the retina layers appeared in some at the end of a month and in others they were still more retarded at this time. Eyes preserved later showed complete retina regeneration.

Although there was no marked effect of gland removal upon the rate of lens regeneration there was a definite effect upon the size of the lens regenerates. Where they could be measured they were definitely smaller than the normal controls, indicating that proliferation in the lens regenerates was at a slower rate. Possibly associated with this is the fact that various stages of cataract formation were very frequently found. This was observed in various groups from 18-50% of the stages in which the primary fibers at least are fully differentiated (Sato's stages 9 and above). Malformed lenses and lentoids were also observed in them. Such abnormal lenses seldom appeared in normal control eyes after plain lens removal. In the left eyes removal of the retina may have played some role, for in the normal control groups from which both the lens and neural retina were removed cataracts were often found (23.4%).

Summary. 1. Lensectomy only and lensectomy combined with retina removal was performed in adult newts 4-8 days after the excision of the thyroids, the hypophysis or both. The results were compared with those in control experiments. Normally lens regenerates reach full shape and structure about the eighth week when cell nuclei of the primary fibers disappear. Rate of regeneration as well as growth of lens were distinctly diminished after retina removal. Early stages of retina regeneration proceeded for about 2 weeks before a lens vesicle was formed. Retina differentiation might be completed during the fifth week. 2. Measurements of lenses showed that regenerates developing in the presence of a regenerating retina were much behind those in eyes with the retina intact. Development rate in both kinds of eyes was very similar when eyes of normal and of gland-deprived animals were compared. In the latter, retina regeneration was not significantly retarded. The size of the lens regenerates at various dates after the eye operation was considerably less in gland-deprived animals. Gland removal seemed to increase the incidence of malformed regenerates and of cataracts. The incidence of cataract was also increased in normal controls after removal of the retina.

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