

Pigmentary Reaction in *Rana Clamitans* Larvae Following Treatments With X-Rays.\*

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Incidental to experiments on the effects of x-rays on the sex-glands of *Rana clamitans* tadpoles, our attention was drawn to certain conspicuous changes in the dorsal skin, especially the formation of whirls by the epidermal melanophores preceding their disintegration. The animals, after being narcotized in a 1:10,000 solution of water-soluble anesthesin, were placed on water-soaked cellulocotton and exposed to unfiltered x-rays. A Victor Snook unit, with a universal air-cooled broad focus Coolidge tube was used to produce x-rays of different qualities.

In the normal skin we find 2 types of brown melanophores: first, the asterisk-shaped pigment cells of the stratum corium (Figs. 2 and 6c),† which are distributed evenly over the back and flanks of the larvae. To them is due the general slate color of the dorsal skin (Fig. 1). Secondly, we find the filiform melanophores of the epidermis (Figs. 4 and 6e). They exhibit a remarkable tendency to form aggregations thus giving rise to the characteristic black spots on the back of the clamitans tadpole. It is well known that the so-called experimental albinism obtained upon hypophysectomy is largely due to the extreme contraction of the epidermal melanophores.

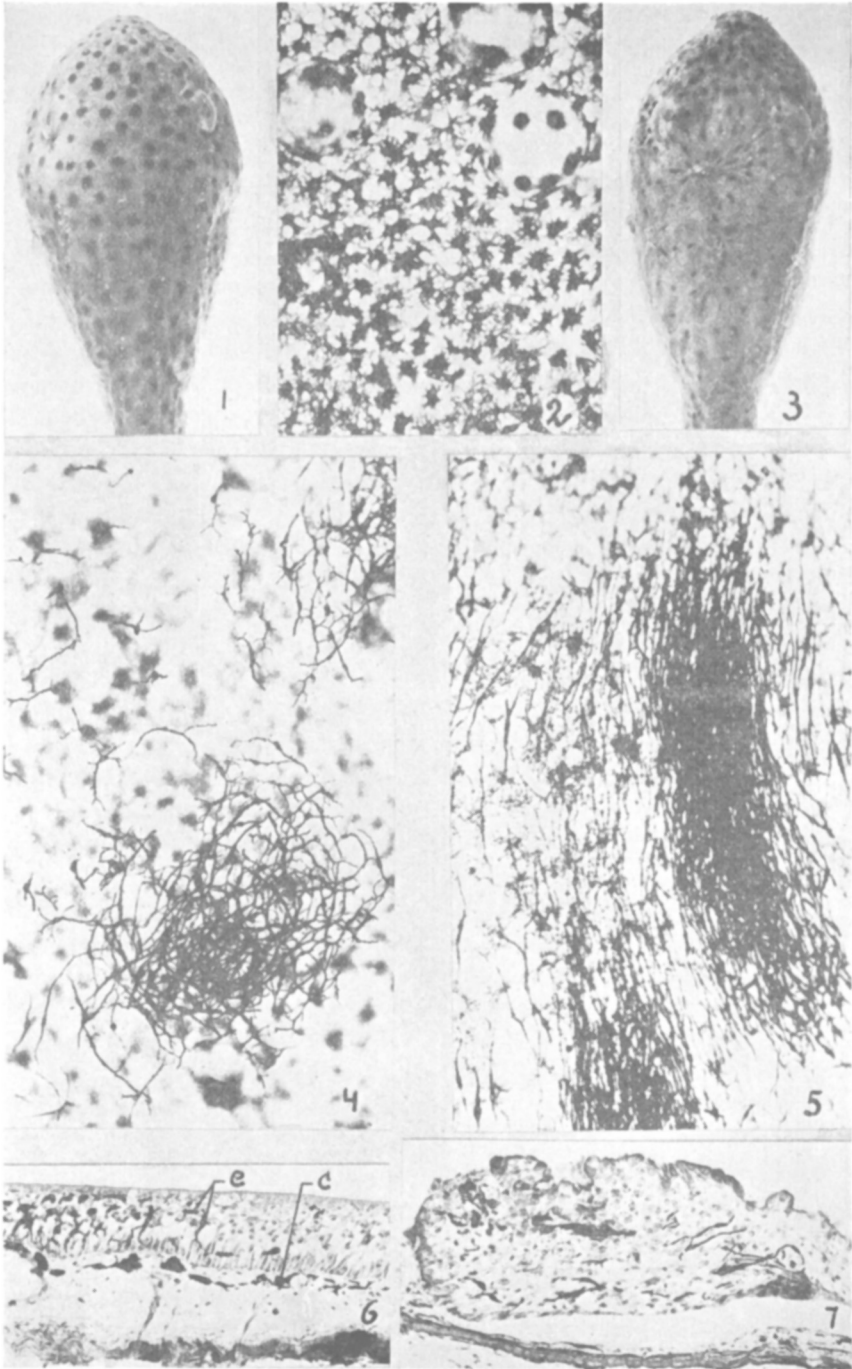
We describe here only 2 stages of the pigmentary reaction following x-ray treatment. In the first case 10 tadpoles, of 43-45 mm. body length, and 8-10 mm. hind leg length, were given 8 treatments of 92 kilovolts 5 milliamperes, at 10 inches from the cathode. The animals were exposed for 10 minutes every other day and killed 6 days after the last treatment.

Towards the end of the treatment the previously round pigment dots become streaky or comma-shaped. Later they begin to converge towards one or several centers which most often are located

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† Figs. 1 and 3 are only slightly enlarged photographs of living specimens. All the other figures are enlarged 85 times. Figs. 2, 4, and 5 are photomicrographs of whole mounts of skin, while 6 and 7 are taken from cross-sections. Figs. 1, 2, 4, and 6 show the condition of a normal animal, while 3, 5, and 7 illustrate the experimental reaction.



in the scapular and pelvic regions (Fig. 3, 22 days after the beginning of treatment). Here one observes a hyperplastic rise of the epidermis and eventually a perforation appears in the center, plugged with a blood clot. Examination of sections (Fig. 7), and whole mounts (Fig. 5) shows that the epidermal melanophores, normally irregularly arranged (Fig. 4), have become oriented in one direction. Evidently, they are making use of their power of ameboid movement and seem to proceed towards the most impaired places. However, on approaching the centers of injury they succumb soon themselves. They contract and subsequently break up into a number of black droplets. The successive stages of this process may be seen in the section reproduced in Fig. 7. The extreme left corresponds to the center of the whirl of Fig. 3. The deeper melanophores of the stratum corium exhibit no marked changes.

A second group of 10 tadpoles was exposed on 2 consecutive days for 45 minutes at 125 kilovolts 5 milliamperes at a distance of 10 inches. One or 2 days after the second treatment they present not only a formation of whirls, but also a noticeable decrease in epidermal pigments. After the second day the epidermis becomes highly abnormal and shows a tendency towards a sloughing off, leaving the stratum corium exposed. This gives the animal a slate colored appearance.

The described reaction of the epidermal melanophores serves as a sensitive indicator of the destructive processes caused in the skin by the exposure to x-rays. The histological changes in the epidermis of clamitans larvae correspond closely to those described by Colwell and Thomson<sup>1</sup> for an unidentified species (probably *Rana temporaria*). In our material, however, the presence of epidermal melanophores renders the progress of the pathological reactions macroscopically visible. Active wandering of melanophores in the epidermis of Californian tadpoles has been observed by Smith<sup>2</sup> in skin transplants. Any mechanical injury to the dorsal skin of our species initiates similar movements of the nearby pigment cells. It is evident, therefore, that the pigmentary dislocations are not specific to external stimuli but rather to internal disturbances due to various causes.

<sup>1</sup> Colwell, Hector A., and Thomson, M. Sydney, *Am. J. Roentgen. and Rad. Ther.*, 1927, **17**, 1.

<sup>2</sup> Smith, Philip E., *Am. Anat. Mem.*, 1920, **11**.