

# THE FATE OF THORIUM DIOXIDE INJECTED INTO THE COELOM OF THE SEDENTARY POLYCHAETE, *SABELLASTARTE LONGA* (KINBERG)

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The fate of foreign particulate matter injected into the body fluids has now been reported for a number of invertebrate animals, using thorium dioxide in the form of "Thorotrast" as the foreign material (Brown 1967a, 1967b, 1967c; Brown and Brown 1965; Brown and Winterbottom 1969). The experiments reported here were designed partly to extend this series and partly in order to discover whether the small, segmental nephridia of *Sabellastarte* were functional or not. Like other Sabellidae, the chief excretory organs are a large pair of "thoracic" nephridia extending through a number of segments and opening by means of a common nephropore on the prostomium. Thomas (1940) states that "this reduction in the number of nephridia so that the only excretory opening is at the anterior end of the animal is characteristic of Serpulids and Sabellids and has been brought about in relation to their tubicolous habits". Nevertheless, we have found that *Sabellastarte longa* has a pair of very small, almost vestigial, nephridia in each of the segments from segment nine to the posterior end of the worm; these are not easy to find on opening the worm but are apparent in section. Goodrich (1946) also reports two forms of mixonephridia in some species of Sabellidae.

Individuals of *S. longa* were collected from Strandfontein, on the False Bay coast of the Cape Peninsula, and maintained in sea-water tanks in the laboratory at between 15° and 16° C. The water was aerated and filtered continuously and was replaced every 48 hours. Small quantities of Thorotrast were injected into segments near the posterior end of each worm and the living worms were then X-rayed at regular intervals, using a Siemens Heliosphere with a shutter-to-film distance of one meter and an exposure of three seconds. Sections were cut through some of the worms, stained with iron haematoxylin and eosin and viewed by the method of Baxter (1960). Faeces and excretory matter which collected in front of the tubes of the living worms were examined for thorium dioxide content from time to time.

Radiographs show that there is little or no tendency for the foreign material to spread to segments other than those injected. A study of the sections confirms this and also demonstrates an absence of thorium in the blood vessels at all stages. Furthermore, all the thorium particles seen in the coelom were free particles, there being no evidence of phagocytosis by coelomocytes or by other cells. It seems, therefore, that, as in the case of *Golfingia* (Brown and Winterbottom 1969) the protective cellular responses of *Sabellastarte* are not greatly stimulated by thorium dioxide. Even after two months no appreciable change could be observed either in radiographs or in sections, the relevant segments remaining opaque to X-rays, while sections continued to show large quantities of free thorium in the coelom.

Nevertheless it is apparent that thorium dioxide was excreted slowly from the animals throughout the experiment. Sections through the segmental nephridia of those segments injected with Thorotrast display lumina containing thorium dioxide throughout their length;

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furthermore, it is apparent from these sections that the nephridial lumina open to the coelomic cavity proximally and that their distal ends open to the outside of the body. Examination of the waste materials deposited in front of each worm, consistently showed the presence of thorium dioxide. Faeces are passed from the anus forwards, up the tube, along the ventral groove and would clearly collect along the way any particulate matter excreted by the nephridia.

The functional nature of the segmental nephridia is, therefore, proved beyond reasonable doubt. It is true that the increase in coelomic pressure at the time of injection might have forced some thorium dioxide through the nephridial canals, but the continued presence of thorium in the waste material indicates a continuation of the process which is confirmed by examination of the sections. The completeness of the intersegmental septa is also established; this has been assumed by previous authors without convincing evidence being offered. It therefore seems that each pair of nephridia is concerned with the coelomic fluid of only that segment into which it opens, though the possibility of substances being transferred from one segment to another via the blood-stream is real and has not been tested in the present work.

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