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## ***Ichthyophonus*-like Infection in Newts (*Notophthalmus viridescens* Rafinesque)**

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Newts were observed swimming in shallow water in Sleepy Creek Lake (Berkeley County, West Virginia, USA) in June 1973. Several were captured by hand and examined. Many had prominent swellings on the body surface and some also had ulcerations. These signs occurred among more than 50% of the animals observed in Sleepy Creek Lake during June and July 1973, and by late summer the prevalence approached 100%. Recent reexamination of this population (May 1983) indicated at least 10% of observed individuals had gross signs of this disease. Swellings ranged from individual small nodules to large areas that resulted in restriction of movement of the animal (Fig. 1). In advanced cases, the affected areas were ulcerated and smears showed that some had been invaded by fungi and bacteria. One specimen, in a terminal stage of the disease when collected, was emaciated and very lethargic.

Several newts were collected for further examination in the laboratory to determine the cause of the disease. Histologic examination of parasagittal and cross sections of six individuals showed an infection with cysts outwardly similar to the resting stage of the fungus *Ichthyophonus hoferi* (Fig. 2). The organisms were limited to the skeletal muscle and, although empty capsules were present, no budding forms were found. Most cysts measured between 100 and 150  $\mu\text{m}$  in diameter; the largest was 260  $\mu\text{m}$ .

The host reaction to intact cysts was

limited, although ruptured cysts were walled off by a dense fibrocytic granuloma. Macrophage type cells, debris laden and sometimes fused into multinucleated giant cells, were noted in areas of necrotic muscle degeneration, apparently a result of pressure from the numerous cysts.

Culture of the infective agent was attempted without success on Sabouraud dextrose agar + 1% fetal bovine serum, cornmeal agar, brain-heart agar as described by Sindermann and Scattergood (1954, Maine Dep. Sea Shore Fish., Res. Bull. 19: 1-40), and Eagle's minimal essential medium + 10% fetal bovine serum.

The fungal infection was most likely a mortality factor in this population. Newts were observed in the lake in terminal stages of the disease and deaths occurred in laboratory specimens, even though some

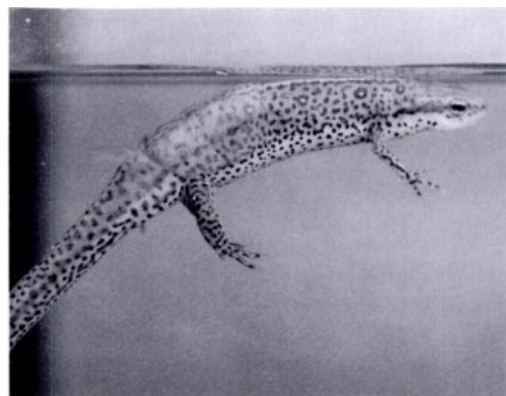


FIGURE 1. Newt (approximate length, 9.5 cm) with large swollen area extending dorsally from mid-body into the tail.

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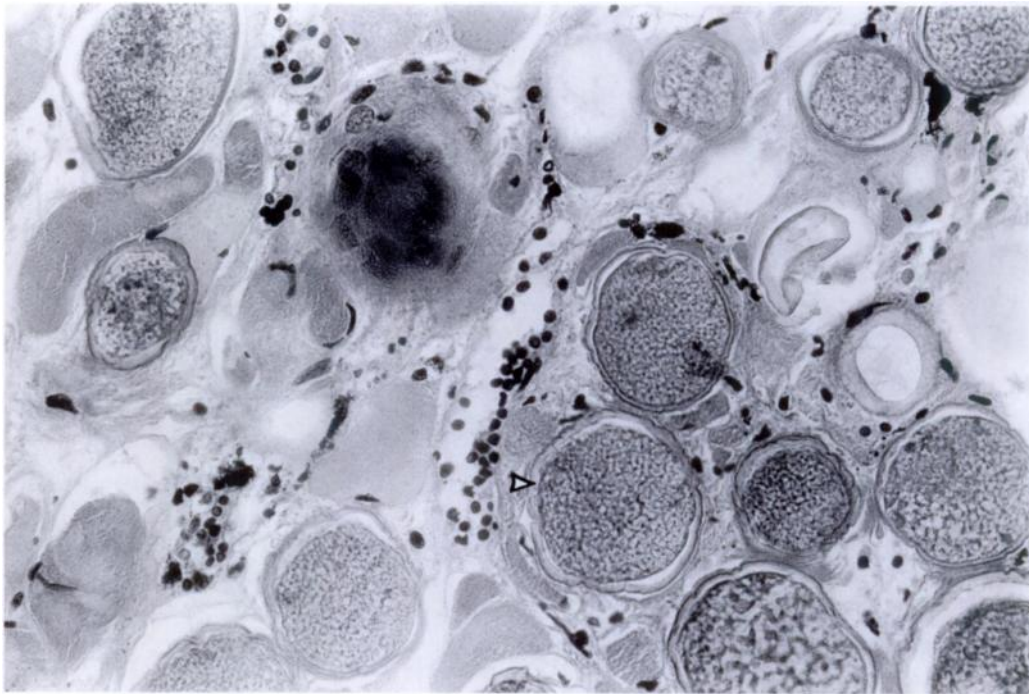


FIGURE 2. *Ichthyophonus*-like cyst (arrow) in musculature of a newt, showing little inflammatory response. Some pressure atrophy of muscle bundles is evident. (H&E,  $\times 64$ )

infected animals fed actively. Secondary bacterial and fungal infections through the ulcerated surface lesions were the most probable immediate cause of death.

The gross appearance and staining qualities of this organism in the salamander were similar to those of the resting stage of *Ichthyophonus hoferi* of marine and freshwater fishes (Amlacher, 1965, Z. Fisch. Hilfswiss. 13: 85-112). However, infection in the salamander appeared to be limited to skeletal muscle and elicited

little inflammatory response, whereas in fishes the infection usually involves visceral organs, and inflammation and granuloma formation are commonly extensive (Wolke, 1975, *In The Pathology of Fishes*, Ribelin and Migaki (eds.), Univ. Wisconsin Press, Madison, pp. 33-116). The taxonomic relationship of the organism from amphibians and that of fishes is uncertain.

Photographs were prepared by H. Monte Stuckey.