Freeze-Etching Observations on *Toxoplasma gondii*-Cysts From Brain of *Mastomys natalensis*

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Summary

The ultrastructure of *Toxoplasma* cysts from brain of *Mastomys natalensis* is described using the freeze-etch technique. Membrane-bound particles can be shown in the pellicle. The outer membrane has an irregular distribution of intramembranous particles (IMP) but shows an apical aggregation which may have a function in host cell penetration. The inner membrane system of the pellicle differs from the outer through longitudinal strips of IMP. The rhoptries are distinguishable from other organelles by their cross-striped arrangement of IMP. Compared to them, the micronemes have an almost smooth membrane. The fine structure observed in freeze-etched cysts essentially confirms the findings already described from the thin-section and scanning electron microscopy, but with a clearer coordination.

1. Introduction

The fine structure of *Toxoplasma* cysts has been examined by numerous authors. After pioneering electron-microscopic studies of the cyst stage by Garnham et al. (1962) and Wanko et al. (1962), the ultrastructure of *Toxoplasma* cysts was further examined by van der Zypen (1966), Mehlhorn et al. (1974), Scholtyséck et al. (1974) and Matuschka (1977). These studies have led to detailed information about the fine structure of the cyst stage of *Toxoplasma gondii* through utilization of conventional thin-section technique for the electron microscope. The electron microscope studies of different cyst building *Coccidia* have demonstrated a relatively uniform appearance of the bradyzoites (= cystozoites). All bradyzoites have several specific organelles and cytoplasmic peculiarities which give them a characteristic look (Mehlhorn et al. 1974). We applied the freeze-etch method to *Toxoplasma* cysts in order to supplement the scanning and transmission electron-microscopic thin-section technique and to obtain further information about the fine structure. Artifact structures by this method are relatively scarce in comparison to those of the thin-section technique, because the ultrastructure can be made...
visible in the still-latent living condition. Moreover, cytolytic effects are prevented. This method is particularly suited for the study of membranes, as preferred membrane surfaces are exposed during freeze-fracturing. In this first brief report, the ultrastructure of the *Toxoplasma* cysts (especially the cyst wall conditions, the membrane structure of the bradyzoites and the cyto-

Fig. 1. *Toxoplasma gondii* cyst from the brain of *Mastomys natalensis*. Scanning e.m. ×2,900

plasmic conditions of the individual parasites) and how they present themselves in the freeze-etch technique shall be correlated with earlier observations. Former examinations are limited to thin-section and scanning electron microscopy.

2. Material and Methods

For selection of the experimental animals and their maintenance, see Werner and Egger (1974). The *Toxoplasma* cysts were obtained from the brain of *Mastomys natalensis*, Smith