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Thallium as a Vital Stain for Yeast Mitochondria

BLACK, hexagonal crystals of thallium oxide, Tl_2O_3 (identified by their shape and colour), appear in some cells of some strains of *Saccharomyces cerevisiae* when the culture is grown in nutrient medium containing 125 p.p.m. of thallium sulphate. The black, hexagonal plates of Tl_2O_3 lie in a space between the cell wall and the plasma membrane. Usually only one large crystal is present, but as many as six small ones may appear; all are outside the protoplast. When a crystal is viewed from the edge, a bulge in the cell wall appears right over the crystal. The large crystals bend to conform to the curvature of the cell (Fig. 1).

The cristate mitochondria are not visible in the living yeast cell and are difficult to fix and stain, but Mr Michael Todd, working with Dr Hewson Swift, has established (by an original staining method, personal communication) that a single layer of regularly arranged, cristate mitochondria (almost in contact with each other) lies in contact with the inner surface of the plasma membrane of the yeast cell.

In some of the cells grown in thallium, as many as forty cristate mitochondria are stained black by thallium (Fig. 2). The layer of irregularly elliptical, black-stained, cristate mitochondria lies against the inner layer of the plasma membrane. In some mitochondria only a small black dot of stain appears.

A layer of lipolated mitochondria covers the outer surface of the nuclear membrane and the spindle-reservoir of the yeast cell[1]. The lipolated mitochondria darkened by refraction can easily be distinguished from the jet-black, thallium-stained, cristate mitochondria (Fig. 2). The lipolated mitochondria do not take up thallium.

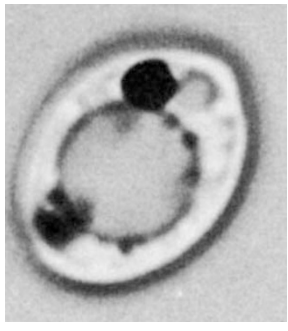

Fig. 1 A yeast cell containing two flat, black, hexagonal crystals of thallium oxide fitted between the cell wall and the plasma membrane. Only one crystal is in focus. Lipolated mitochondria darkened by refraction and others that are bright and refractile lie on the surface of the nuclear vacuole.

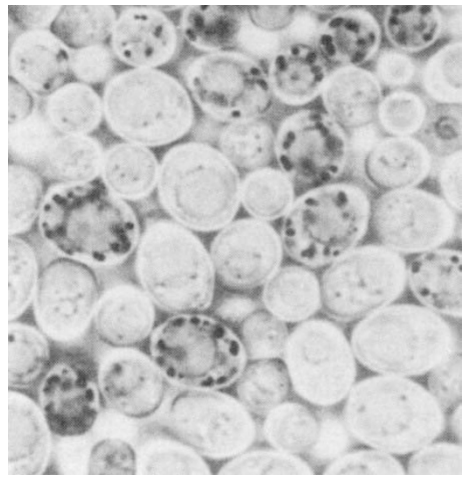

Fig. 2 A culture in which some cells contain a single layer of thallium-stained, cristate mitochondria lying against the inner wall of the plasma membrane.

When cells grown in thallium are spread on nutrient agar, the unaffected cells bud rapidly and produce colonies.

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CARL C. LINDEGREN
GERTRUDE LINDEGREN

Department of Microbiology,
Southern Illinois University,
Carbondale, Illinois 62901

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Unique High Affinity Uptake Systems for Glycine, Glutamic and Aspartic Acids in Central Nervous Tissue of the Rat

NEUROPHYSIOLOGICAL experiments suggest that several amino-acids, especially glycine and glutamic, aspartic and gamma-aminobutyric (GABA) acids, are neurotransmitters in the central nervous system[1-3]. But careful subcellular[4,5] and regional studies[6-8] have not provided supporting neurochemical evidence, because amino-acids, with the possible exception of GABA, also have general metabolic functions in nervous tissue.

Biochemical studies of transmitters in the central nervous system have been facilitated by the discovery of specific uptake systems into neurones with selective high affinities for various putative transmitters[9-14]. There is evidence that such re-uptake mechanisms peripherally inactivate synaptically released catecholamines[9] and it has been postulated that they account for the synaptic inactivation of other neurotransmitters. If amino-acids are neurotransmitters, they might be accumulated into neurones by similar selective uptake. Transport systems have been described for amino-acids in brain tissue, which, however, have relatively low affinity[15]. For this reason and because these transport systems exist for all amino-acids in numerous tissues outside the central nervous system, it is not likely that they have a specific function in inactivating postulated "neurotransmitter pools" of certain amino-acids. Uptake systems for hypothetical "transmitter pools" of amino-acids might be anticipated to have more affinity for their substrates than do general amino-

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