not specific for Mg^{2+} or ATP, and are likely to be composites of several enzyme systems.

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An Electron-Microscopic Technique for Measuring Ribosomal Profiles from Cardiac Muscle

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Current methods of studying ribosomal profiles from cardiac tissue involve the use of sucrose density gradients and measurements of the absorbance. Such methods produce results that are difficult to quantify. An electron-microscopic technique has therefore been developed that attempts to describe ribosomal profiles in numerical terms.

Ribosomes and polyribosomes are separated from cardiac tissue by the method of Earl & Morgan (1968). One drop of a suspension of ribosomes is layered on to a carbon-coated Formvar-backed copper grid. The grids are positively stained with a 1% uranyl acetate solution in the manner described by Burghouts *et al.* (1907). They are then ready for electron microscopy.

Randomly selected fields are photographed with a magnification of 63000 and the subsequent print is enlarged twice. A differential count is performed on each photograph, the results being expressed as a percentage of the total number of ribosomes and polyribosomes per photograph.

Three studies were performed to determine the degree of variation in distribution of the ribosomal populations prepared in this way. In the first, ten micrographs were taken at regular intervals across an individual square of the grid. In the second, 30 micrographs were taken diametrically across an entire grid. In the third, five grids were spread with the same ribosomal preparation and four micrographs taken from each.

Differential counts were performed on each micrograph and the mean percentage of monoribosomes in each study was 42.1 (S.D. ± 4.8), 45.6 (S.D. ± 7.3) and 42.5 (S.D. ± 5.1) respectively. These results show that there is a random distribution of ribosomes between grids, within grids and within squares, and that the results are reproducible.

To examine the sensitivity of the method, it has been used to study the effect of actinomycin D on cardiac and hepatic ribosome profiles. Treatment with this drug produces an increase in the percentage of monoribosomes whereas the percentage of

polyribosomes containing six or more ribosomes decreases. This effect is more noticeable in the liver.

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Giant Mitochondria in Iron- or Copper-Deficient *Candida utilis*

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Dallman & Goodman (1970) demonstrated that rats fed on an iron- or copper-deficient diet developed enlarged mitochondria in their livers and hearts. These effects were more marked with copper deficiency. It was decided to investigate the possible generality of these phenomena, and we have therefore made an electron-microscopic study of *Candida utilis* cells grown in continuous culture under conditions of glycerol, iron or copper limitation (Light & Garland, 1971; Light, 1972; Downie & Garland, 1972). Sections of glycerol-limited cells were of typical appearance for aerobically grown yeast, showing up to 10–15 oval mitochondrial profiles per cell. The larger dimension of these mitochondria was about 0.4–0.5 μm . Sections of copper-limited cells exhibited in many instances as few as one mitochondrial profile per cell, the mitochondria being elongated to a length of 3.0 μm or more. Similar but less marked effects were observed with iron-limited cells. These observations provide strong evidence that the morphological changes described by Dallman & Goodman (1970) are due to abnormal composition of the mitochondria rather than to any more generalized whole-animal effect. It is of significance that deficiency of riboflavin (in mice) also causes mitochondrial enlargement (Tandler *et al.*, 1969). The mechanisms and controls that effect mitochondrial division are unknown; nevertheless it seems possible that one signal for mitochondrial division could be the presence of an inner mitochondrial membrane containing appropriate concentrations of cytochrome oxidase, other iron proteins and flavoproteins. Deficiency of any one appears to inhibit mitochondrial division.

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