lower values of sedimentation. Yeast mitoribosomes were found to be more susceptible to dissociation into subunits than were cytoribosomes.

The RNA components of mitoribosomes were isolated and separated by centrifugation in the sucrose density gradient. The sedimentation diagram showed two major peaks at 21S and 16S and a minor one at 12.5S, in contrast with RNA from cytoribosome (24S and 16S). Whereas RNA from cytoribosomes is totally stable when kept at or under 0°C, RNA from mitoribosomes was found to be unstable even at -20°C.

Biogenesis of Phospholipids in Liver Mitochondria

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Recent work with [³²P]phosphate and CDP-[Me-¹⁴C]choline as precursors has indicated that the limited incorporation of radioactivity into the nitrogen-containing phospholipids and phosphatidyl-inositol of rat liver mitochondria can be largely accounted for by the microsomal contamination present (McMurray & Dawson, 1969). On the other hand, phosphatidic acid can be synthesized intramitochondrially. Although recent reports have indicated that mitochondria have an energy-dependent system for incorporating [Me-¹⁴C]choline into their phospholipids (Kaiser & Bygrave, 1968; Bygrave & Kaiser, 1968; Kaiser, 1969), we have now found that the labelling of mitochondrial phospholipids from this precursor was minimal compared with that in microsomes provided that an incubation medium was used that adequately supported phosphatidylcholine synthesis. In the presence of a suitable medium and a cell supernatant fraction, a plot of choline incorporation into the lipids against the concentration of microsomes added to a constant amount of mitochondria extrapolated to the origin if allowance was made for microsomal contamination of the mitochondria by NADPH-cytochrome c reductase assays. Although recent evidence has suggested that some of this marker enzyme may be associated with the outer membranes of mitochondria (Brunner & Bygrave, 1969), the present results suggest that mitochondria possess a very low if not negligible capacity for forming phosphatidylcholine.

A rapid exchange of phospholipids when isolated microsomes and mitochondria are incubated together has been recently demonstrated independently in a number of laboratories (Wirtz & Zilversmit, 1968; McMurray & Dawson, 1969; Akiyama & Sakagami, 1969). It seems likely therefore that the appreciable

turnover of mitochondrial phospholipids observed in the liver *in vivo* can be explained most satisfactorily by assuming a transfer of newly synthesized phospholipid molecules from the endoplasmic reticulum. In an attempt to obtain direct evidence for such a transfer in intact cells we have performed experiments with isolated liver cells that were pulse-labelled with various phospholipid precursors. To obtain satisfactory phospholipid synthesis in such cells it was found necessary to add a certain proportion of a supernatant fraction obtained by homogenizing liver in sucrose. After pulse labelling with [³²P]phosphate, [Me-¹⁴C]choline, [2-¹⁴C]ethanolamine or [U-¹⁴C]-inositol, incubation of the cells in the absence of precursor caused the specific radioactivity of the individual labelled phospholipids to fall in the microsomes and rise or remain static in the mitochondria. These observations are therefore consistent with the postulate that mitochondrial phospholipids are largely formed in the endoplasmic reticulum.

Akiyama, M. & Sakagami, T. (1969). *Biochim. biophys. Acta*, **187**, 105.

Brunner, G. & Bygrave, F. L. (1969). *Eur. J. Biochem.* **8**, 530.

Bygrave, F. L. & Kaiser, W. (1968). *Eur. J. Biochem.* **4**, 578.

Kaiser, W. (1969). *Eur. J. Biochem.* **8**, 120.

Kaiser, W. & Bygrave, F. L. (1968). *Eur. J. Biochem.* **4**, 582.

McMurray, W. C. & Dawson, R. M. C. (1969). *Biochem. J.* **112**, 91.

Wirtz, K. W. A. & Zilversmit, D. B. (1968). *J. biol. Chem.* **243**, 3596.

Lipid-Protein Interactions in the Structure of Mitochondrial Membranes

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There are new lines of thought suggesting a complex interdigitation of proteins and phospholipids in the structure of the mitochondrial (and other) membranes (Green & Tzagoloff, 1966; Benson, 1966), in contrast with the unit membrane model (Robertson, 1959). Preliminary work in our laboratory has indicated the existence of hydrophobic interactions in the binding of phospholipid micelles to lipid-depleted mitochondria (Lenaz, Sechi, Masotti & Parenti-Castelli, 1969). Experiments reported here clearly demonstrate the hydrophobic character of the interaction.

The binding of phospholipids to lipid-depleted mitochondria is inhibited by increasing concentrations of lyotropic agents (Von Hippel & Schleich,