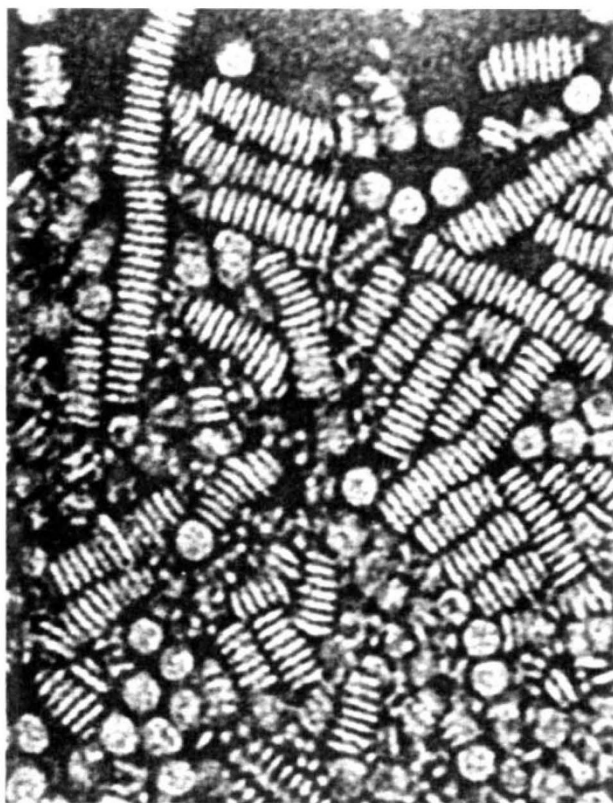


*t*RNA; the N-terminal amino-acid of rabbit globin is valine, but apart from that there is no obvious reason why the system should work but apparently it does. Laycock and Hunt suggest that to get initiation in a cell-free system programmed with a mammalian *m*RNA, it is necessary to add the N-acetylated form of the protein's N-terminal amino-acid. The results of a test they propose, using sheep globin *m*RNA and two initiators N-acetyl-valine and N-acetyl-methionine (methionine and valine are the N-terminal amino-acids of the two sheep globins), will be awaited with interest.

#### ELECTRON MICROSCOPY

### Lipid Helices

THIS electron micrograph, taken by A. M. Glauert and J. A. Lucy of the Strangeways Laboratory, Cambridge, is a beautiful cautionary tale. It is one of the many molecular assemblies which form spontaneously when molecules of lipids such as lecithin and cholesterol, dispersed in saponin solutions, are negatively stained. The helices and circular structures shown in the micrograph formed during the negative staining of a mixture of the two lipids with ammonium molybdate at pH 5.2.



In an article in the latest issue of the *Journal of Microscopy* (89, 1; 1969), Glauert and Lucy illustrate the great range of molecular assemblies, each apparently made up of globular lipid units arranged in different ways, that can be induced by various heavy metal negative stains at different pHs. Their conclusion is simply that electron microscopists should not be content with the image produced by any one staining technique, no matter how aesthetically pleasing, but should use a wide range of stains at varying pH and

search for the common denominators of the structural assemblies revealed.

#### BACTERIAL GROWTH

### Continued Debate on Autotrophy

from our Microbiology Correspondent

Two years ago (*Nature*, 216, 1267; 1967) Smith, London and Stanier made the interesting observation that certain obligate autotrophic microbes lacked NADH<sub>2</sub> oxidase and  $\alpha$ -ketoglutaric dehydrogenase. It was proposed that the failure of such organisms to grow heterotrophically depended on their inability to couple the catabolism of organic substrates to ATP synthesis, a result of the loss of NADH<sub>2</sub> oxidase. Several subsequent reports have challenged or added support to this contention. Smith himself (Smith and Hoare, *J. Bact.*, 95, 844; 1968) demonstrated the presence of the two key enzymes in *Nitrobacter agilis*, while Trudinger and Kelly (*ibid.*, 95, 1962; 1968) found NADH<sub>2</sub> oxidase in obligately autotrophic thiobacilli.

Two important contributions to this debate have been reported lately. The first is a study of obligate autotrophy in the nitrifying bacterium *Nitrosomonas europaea* (Hooper, *J. Bact.*, 97, 776; 1969). Hooper assayed this autotroph for the presence of TCA cycle enzymes and found that *N. europaea* possessed NADP-linked isocitric dehydrogenase, succinic dehydrogenase and malic dehydrogenase. Another significant similarity to the findings of Smith *et al.* was the absence of the  $\alpha$ -keto acid dehydrogenase, a point thoroughly checked in Hooper's study. Contrary to the general hypothesis, *N. europaea* contained an NADH<sub>2</sub> oxidase but this activity was not coupled to ATP synthesis, and NADH<sub>2</sub> is oxidized probably by the combined action of the oxidase and an NADH<sub>2</sub> peroxidase. The absence of  $\alpha$ -ketoglutaric dehydrogenase from autotrophically growing cultures is not necessarily indicative of a genetic lesion, but it is worth recalling that Smith *et al.* found that this enzyme was not repressed in an autotrophically growing *Hydrogenomonas* culture. Hooper argues that the absence of a coupled NADH<sub>2</sub> oxidase from *Nitrosomonas* may reflect the mutual exclusion of the oxidase and the system coupling ammonia oxidation to ATP formation. One consequence of this exclusion could have been the evolution of an efficient ammonia oxidation process necessitating the loss of a coupled oxidase.

The same issue of the *Journal of Bacteriology* (97, 966; 1969) contains a serious dissent on this hypothesis of obligate autotrophy. R. G. Butler and W. W. Umbreit tested the hypothesis in *Thiobacillus thiooxidans*, an obligate autotroph included by Smith *et al.* in their survey, and found high specific activities of both  $\alpha$ -ketoglutaric dehydrogenase and NADH<sub>2</sub> oxidase. Butler and Umbreit suggest that this disparity in results might be explicable in terms of toxin accumulation in the medium from which Smith *et al.* collected their cells. Borichewski (*J. Bact.*, 93, 597; 1967) working in Umbreit's laboratory, showed earlier that the normal limitation to growth of *T. thiooxidans* was the build-up of pyruvate and other organic substances in the medium. Convincing support for this interpretation is the fact that *T. thiooxidans* can be grown on glucose in flow-through culture conditions that preclude toxin accumulation.