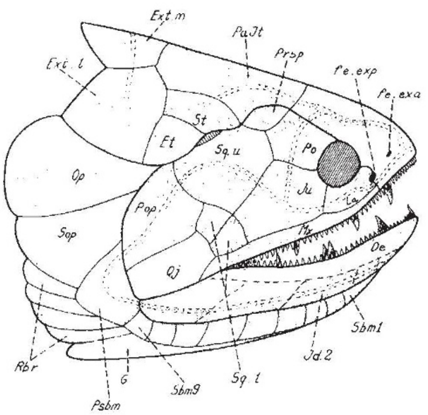
forty years, has concluded (*Medd. Grønland*, **187**, 307 pp.; 1972) that the newts and salamanders (urodeles) have descended from one group of rhipidistians, and the frogs and all other tetrapods, including ourselves, from another.

His study is based on fossils from Greenland and Spitsbergen, where he has collected, notably with the English-Norwegian-Swedish Spitsbergen expedition of 1939 and thirty years later with the French expedition of 1969. Between-times he worked with the Danes in East Greenland. Much of the material described in this article was collected on these expeditions.

Jarvik usefully summarizes his life-work on rhipidistians and the origin of tetrapods. He presents new restorations of the heads of *Holoptychius, Glyptolepis* and *Porolepis* and gives the first full account of his serial sections through the snout region of *Glyptolepis*. There are also valuable restorations of lower jaws, gill skeletons and shoulder girdles. Jarvik's views on the dual origin of the tetrapods result from highly detailed comparisons between the heads of rhipidistians and living Amphibia. Unfortunately few other forms are known in comparable detail and, because the validity of comparative anatomy depends largely on a knowledge of as great a variety of types as possible, one would like to see similarly profound studies of other forms. Such a survey is, however, beyond the scope of an individual.



Jarvik's restoration of the skull of *Glyptolepis groenlandica* (from *Medd. Grønland*, **187**; 1972).

Jarvik also deals with another controversy—that of the origin of the vertebrate skull. Although it is generally accepted that the skull is segmental in organization, the idea that it is composed of modified vertebrae (first conceived by Goethe and the "natural philosophers") has not gained many adherents. Nevertheless Jarvik provides stimulating and forceful arguments in support of this view.

In spite of the controversies, the greatest tribute is due to Professor Jarvik and his colleagues in Stockholm who have, through patient and meticulous work carried out since the 1920s, vastly increased knowledge of extinct forms, and the status of the science of palaeontology.

PHYTOCHROME

Membrane Constituent?

from our Phytochemistry Correspondent

PHYTOCHROME is a photochromic protein present in all green plants in which it mediates a wide range of light-initiated activities ranging from rapid movements of leaflets and chloroplasts to longer term effects on metabolism and morphogenesis. Much evidence has accumulated recently that phytochrome is a membrane protein (or at least associates with membranes) and that it regulates the ionic permeability and thus the electrical potential of certain cell membranes. Roux and Yguerabide (*Proc. US Nat. Acad. Sci.*, **70**, 762; 1973) now show that purified phytochrome can spontaneously enter and alter the conductance of artificial membranes.

Artificial bilayer membranes were constructed from 7-dehydrocholesterol and oxidized cholesterol across an aperture in a 'Teflon' cup and were stable for about 30 min. Phytochrome purified from oat seedlings (molecular weight about 110,000) was injected in the Pr form into the cup and the conductance was measured while the membrane was sequentially irradiated with 660 nm and 720 nm light. The red light caused a ten-fold drop in membrane conductance which, in the case of oxidized cholesterol membranes, was readily and repeatedly reversible by the far-red light. Boiled, aged or otherwise denatured phytochrome had no effects. The simplest explanation of these results is that the membrane-bound Pfr form of phytochrome induces a higher conductance than the bound Pr form.

The fact that phytochrome is a water-soluble protein with a high content of polar amino-acids has caused many plant biochemists to be reluctant to accept it as a membrane constituent, but Roux and Yguerabide point out that the molecule has an even higher content of nonpolar amino-acids. Thus phytochrome may have considerable regions of nonpolarity which are capable of interacting with the hydrophobic environment of the lipid bilayers, and possibly with intracellular membranes.

Other interesting information of the properties of phytochrome has come from the immunological experiments of Pratt (*Plant Physiol.*, **51**, 203; 1973) who has found that purified phytochrome from peas is not immunologically identical to that from oats, rye and barley. Phytochrome from two different cultivars of oats was identical, although that from rye and barley differed slightly from the oat samples. Cundiff and Pratt (*Plant Physiol.*, **51**, 210; 1973) have also investigated the immunological behaviour of large and small phytochrome preparations from oats. When phytochrome is carefully isolated, it has a high molecular weight of around 240,000. Another fraction with a molecular weight of 60,000 is often found and this is produced artefactually by protease hydrolysis during extraction. Cundiff and Pratt have found that large phytochrome has at least two antigens which are not present in the small phytochrome. These two antigens cannot be detected spectrophotometrically and apparently one has a higher molecular weight than the small phytochrome fraction. Thus, proteolysis of large phytochrome yields a moiety of 60,000 molecular weight and other moieties, one larger than 60,000 molecular weight, which are not associated with the chromophore.

RNA TUMOUR VIRUS

Leukosis Agent

from our Cell Biology Correspondent

FOR some time the idea that avian leukosis viruses may in essence be deletion mutants of non-defective avian sarcoma viruses has been going the rounds without any definitive experiments being attempted. A considerable body of circumstantial evidence in support of the idea has been accumulated, but the only way to test whether a virus can cause leukosis in chicks is to inoculate birds and see how they die. There are not that many laboratories equipped for such experiments, but at Houghton Poultry Research Station, Biggs and Milne have recently tested the oncogenicity of two mutants of Schmidt Ruppin Rous sarcoma virus isolated by Graf *et al.* As Graf and his colleagues had shown, these two mutant strains of Rous sarcoma virus have lost the ability to transform chick fibroblasts and they also have all the other *in vitro* properties of avian leukosis viruses. But do they have the ability to cause leukosis in chicks? According to Biggs *et al.* (*J. Gen. Virol.*, **18**, 399; 1973) they do.

Biggs *et al.* inoculated day-old chicks from flocks of strains apparently free of leukosis and sarcoma viruses of subgroups A, B, C, and D with Graf's mutants which belong to subgroups A and D. One of the strains of chicks used is particularly susceptible to injection by sarcoma virus infection and the other is very susceptible to leukosis virus. The inoculated birds were then watched; several contracted Marek's disease and were lost from the experiment; none developed sarcomas, which

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