Iron and the Origin of Life

IN a series of papers[1] published during the last few years, W. D. Francis, assistant Government botanist in the Botanic Museum and Herbarium, Botanic Garden, Brisbane, offers theoretical reasons and experimental evidence for a connexion between iron compounds and the origin of life. In 1925, he suggested that oxidation of ferrous compounds in soils and waters, or of native or meteoric iron, could provide energy for primitive organisms in a manner analogous to that whereby the oxidation of ferrous carbonate has been shown to provide energy for *Spirophyllum*.

In order to test the validity of such theories, Francis carried out series of experiments in which iron wires were suspended in dilute nutrient media, containing, for example, ammonium sulphate, potassium chloride, magnesium sulphate, potassium phosphate and calcium nitrate. The solution and the iron wires were, it is said, rigorously sterilised before the experiments began, and were protected from contamination as long as they lasted. After the lapse of several days, the ferruginous material on the wire was found to contain microscopic "protein" bodies of "irregular and crystalline shapes". If the atmosphere was freed from carbon dioxide, these particles did not appear, but the presence or absence of light had no effect. The protein was identified as "chromatin" after "the application of seventeen different micro-chemical tests".

Francis concluded that the particles observed were closely related to the iron bacteria *Leptothrix* and *Gallionella*. He considers that "the iron bacterium *Leptothrix* is derived from inorganic material through the operation of four fundamental factors : (1) the arrangement of iron atoms in ferrous hydroxide, (2) the processes of aggregation and crystallisation of ferrous hydroxide, (3) the chemical affinities of ferrous hydroxide for the groups of compounds containing the protein elements, (4) the ability of ferrous hydroxide to function in oxidation-reduction processes".

These conclusions can scarcely be regarded as substantiated until similar experiments leading to confirmatory results have been carried out in other laboratories throughout the world. In the meantime, it is permissible to make certain comments. *If* the precautions regarding sterility were really adequate, and *if* the colour tests, as used, prove the presence of protein, the work may be of significance. But besides this, it should not be forgotten that traces of silicon in the iron used might during corrosion give rise to a stainable colourless product insoluble in acids and swelling up in alkali. It is known that carbon dioxide enormously accelerates the corrosion of iron in air. Colloidal silica may thus be misleading investigators just as it did fifty years ago, and the spontaneously generated *Leptothrix* now described from Australia may have the same short-lived fame as the celebrated *Bathybius* of Huxley's day.

[1] Francis, W. D., *Proc. Roy. Soc. Queensland*, **37**, 98 (1926). *Bot. Archiv* (German translation), **15**, 377 (1926). *Proc. Roy. Soc. Queensland*, **44**, 23 (1933). Also three papers privately published, 1933, 1934 and 1935.

Recent Rumanian Work on the Absorption and Movement of Mineral Elements in Plants

DURING the last few years, under the able leadership of Prof. Deleano, much valuable information has been added to our knowledge of the absorption and movement of mineral elements in plants.

A note directing attention to new evidence for the negative migration of mineral elements, particularly in connexion with the work of Bossie on wheat, was published in NATURE last year[1]. Since then, further papers dealing with the work of Prof. Deleano and his colleagues have been received, and it is with these that the present note is concerned.

In 1931, Deleano and Andreesco[2,3], studying the accumulation of mineral and organic substances during the course of development of the leaves of *Salix fragilis*, showed that the total vegetative activity of the leaves can be divided into three periods : (1) At the commencement of vegetative activity mineral and organic substances accumulate in the leaf ; this is called the period of growth. (2) The quantities of mineral and organic substances are then maintained constant for a considerable time, during which the leaves transform them into more elaborated forms ; this is the period of assimilation proper, or, as Deleano calls it, "constant protoplasm", because the total quantity of nitrogen in the leaves remains unchanged. (3) Towards the end of this period the mineral and organic substances begin to be eliminated from the leaves to other parts of the plant or to the soil ; thus giving the third, or period of negative migration. At the onset of this period, it is suggested that the permeability of the cells increases and assimilatory activity declines, resulting in the loss of soluble materials ; protein nitrogen decreases in quantity, being converted into more soluble forms such as amino acids and ammonia nitrogen, in which form it is eliminated ; fifty per cent of the total nitrogen is lost in this way.

The duration of the three periods in the case of *Salix fragilis* is : period of growth, 25 per cent of the growing season ; period of constant protoplasm, 50 per cent ; and period of negative migration, 25 per cent.

Analyses of *Aesculus Hippocastanum* material by Deleano and Bordeiano[4] gave substantially similar results, except that the duration of the three periods was in this case 75, 12, and 13 per cent, respectively, of the total vegetative period.

During the third period it was found that non-combined water content commenced to decrease in quantity some time before elimination of the mineral