Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 935.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Photosynthesis of Carbohydrates *in vitro*

IT has been proved that carbohydrates are photosynthesized when a surface of pure nickel oxide coated with an adsorbed layer of hydrated carbon dioxide is irradiated with white light. The photosynthesis is accomplished by two successive photochemical reactions which are as follows:

$$(1)\quad 4NiO.CO_2H_2O + h\nu_1 = 2Ni_2O_3.CHOH$$

$$(2)\quad 2Ni_2O_3.CHOH + h\nu_2 = 2Ni_2O_3 + CHOH\,;$$

where $h\nu_1$ is a quantum of blue light ($\lambda = 4000$ A.), $h\nu_2$ is a quantum of red light ($\lambda = 6400$ A.), and CHOH represents a molecule of activated formaldehyde which polymerizes on the surface to a carbohydrate. These two processes are followed by a thermal or dark reaction:

$$(3)\quad 2Ni_2O_3 = 4NiO + O_2\,;$$

which takes place in the presence of hydrated carbon dioxide, with the result that the photosynthesis is continuous.

The first product of photosynthesis is a complex carbohydrate which is unstable and undergoes polymerization or condensation into a still more complex carbohydrate which is stable in solution. This second complex substance when thus formed in solution does not appear to be hydrolysed by acid or by diastase. If, however, this substance is deposited on a surface, it at once becomes capable of hydrolysis by diastase to reducing sugars. The stable complex carbohydrate appears, therefore, to be the hitherto unknown parent of a starch, since as the result of its deposition on a surface it becomes endowed with the characteristic property of starch, namely, its ready hydrolysis by diastase.

The stoichiometric relations shown by the two photochemical reactions indicate that the essential criterion of success is a surface of a true crystalline lattice of nickel oxide. Owing to the remarkable power which the hydroxide and carbonate possess of adsorbing hydroxyl ions, thereby becoming highly dispersed, considerable difficulty has been met with in preparing satisfactory surfaces of nickel oxide. Indeed all failures to achieve photosynthesis have been due to the dispersion of the nickel compound by alkali. This difficulty has now been overcome, and two methods of preparation have been standardized.

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Spectrum of Nitrogen and Atmospheric Pressure at High Altitudes

IN a series of experiments on the excitation of nitrogen bands by a controlled electronic bombardment, I have observed, as Dr. Kaplan did[1], the great modifications of the spectrum which accompany any change in the experimental conditions. As the pressure decreases, the intensity of the negative system of bands (emitted by N_2^+ ions) increases in comparison with that of the second positive system. On account of the rarity of collisions, the average energy of the exciting particles (ions or electrons) rises progressively and, at the same time, the probability of excitation of the negative bands becomes higher[2].

Dr. Kaplan proposes a simple method for obtaining the actual value of the atmospheric pressure between the boundaries of the auroral zone, that is, 100 km. and 1,000 km. After measuring the altitude of one aurora and observing its spectrum, it would be sufficient, in laboratory experiments, to seek for the pressure which permits the reproduction of a similar spectrum.

The idea is attractive, but we can oppose to it serious objections. Observation of auroral displays having a height of several hundreds of kilometres shows that the spectral composition is nearly the same at each point. This fact excludes any important influence of the pressure. Such an influence should enhance considerably, at the lower limit of the aurora, the bands of the second positive system of nitrogen, chiefly for low-altitude auroras. It seems that this change has never been observed. Moreover, it would be now difficult to question the electronic origin of the aurora. Admitting this view, I have recently shown that the only factor capable of altering the relative intensities of the radiations emitted is the energy of the electrons. Making use of photometric comparisons, as suggested by Dr. Kaplan, I even succeeded in assigning to the aurora a definite potential of excitation[3]. The development of this work is now going on at the Auroral Observatory of Tromsö.

In conclusion, the influence of the pressure on the composition of the afterglow spectrum is probably too complex a phenomenon to be considered as a source of precise information on the physical state of the upper atmosphere.

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Oct. 25.

[1] NATURE, **139**, 1112 (June 26, 1937).
[2] *C.R. Acad. Sci.*, **204**, 489 (1937).
[3] *C.R. Acad. Sci.*, **204**, 993 (1937).