ducing a dental change from secondary A deficiency as reported by Davies and Moore, may also itself cause a degeneration of quite different kind in the same area.

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Selective Excitation of Spectra by the High-Frequency Discharge

IN a series of preliminary investigations on the excitation of spectra by the high-frequency discharge, several interesting phenomena connected with intensity distribution have been observed, some of which have already been reported[1]. Further work indicates that these consist essentially in a redistribution of intensity among different band-systems of a diatomic molecule (that is, among different electronic energy levels) or among atomic energy states of different multiplicities. Thus the mercury spectrum observed shows that under certain well-defined and reproducible conditions, as for example pressure of gas, frequency of exciting oscillations, etc., only those lines are present which involve triplet initial states. Similarly, again under definite conditions, mainly those band systems of carbon monoxide are excited which involve only the singlet levels.

Keeping the pressure in the discharge tube constant, it is possible in the case of nitrogen, which has been studied so far, so to alter the relative intensities of the first positive and second positive band systems that either one or the other is more prominent at a given frequency of excitation. Thus it is found that with a gas pressure of about 7 mm. there is a critical value ($\sim$ 735 kc./sec.) for the frequency of oscillatory discharge, above which the second positive system and below which the first positive system gains in intensity. This is even more striking visually, the colour of the discharge undergoing a radical change when the frequency is altered.

The phenomena observed are different from those which involve a change of intensity distribution among various bands of a given electronic system. In the simplest case, such an effect will be a consequence of the interaction between the exciting particles and the vibrating nuclei, and has not been established so far in excitation by electrons[2]. In the presence of high-pressure argon[3], and in the afterglow spectrum[4], nitrogen exhibits such a change in distribution of intensity in its first positive band system, but obviously these involve different mechanisms.

The effects observed in the present series of investigations appear to be understandable from a consideration of the different excitation functions characteristic of the initial levels concerned. It has been possible to correlate all the facts with the form of the excitation function wherever this latter is known, thus making it possible to deduce the form of the excitation function in other cases where it may not have been known experimentally. The fact that this is at all possible, however, indicates that in the conditions under which the phenomena occur the following are true to a first approximation:

(1) The pressure in the discharge tube, the frequency of oscillatory discharge and the voltage across the electrodes determine, within a narrow range, the energy available for excitation.

(2) The main process of excitation involves only the emitters in the normal state; excitation through collisions of other kinds appears to be negligible.

Further work is in progress and details will be published elsewhere.

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The Problem of the Autonomy of Life

IN his letter published in NATURE of May 16, Prof. Donnan abandons his previous assertion that a potency for producing order resides in the temperature difference between two surfaces. He substitutes the obvious and indisputable statement that an energy disequilibrium is one of the necessary conditions for the production of the specific structure of a living organism. It is, of course, one of the necessary conditions for the production of anything, and so this does not get us any further. The cause of the discrimination of which there is evidence has still to be sought.

I am directing attention to this confusion between the *cause* of a phenomena, and the *conditions* which must pertain, so that the cause may become effective, because this is a very common confusion. It is at the bottom of many other attempts to explain the organic world. Among these is the attempt in Prof. Donnan's letter to do so by invoking photosynthesis. The problem, be it noted, is not merely why there may be in some cases, as Prof. Donnan puts it, "a decrease in entropy". The problem is far greater. It is to discover what in all living substance causes each particle to reach a specified position. *Why does the random incidence of photons lead to anything but a random arrangement of atoms ?* The presence of enzymes and chlorophyll in living substance is (like the availability of energy) but one of the many conditions which must be met, so that the discriminating agent, whatever it be, may operate. To attribute discriminating powers to chemical substances would be medieval mysticism, so photosynthesis does not solve the problem. It is itself a part of the problem which we must seek to solve. The very presence of chlorophyll just in those places where it makes photosynthesis possible is another part of the problem.

If, as I have attempted to show, the source of the discrimination is not covered by even the widest definition of the word 'material', we certainly need, as Admiral Beadnell says, a new definition of 'non-material'. This definition must be neither so naive as to include things like electromagnetic radiation,