

LETTERS TO THE EDITOR.

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Magnetic Storms and Auroræ.

THE observations of your correspondents Mr. Rowland A. Earp and Mr. R. Langton Cole, published in NATURE of November 23 (pp. 79-80), remind me that an aurora was also visible here (Cape Breton Island, Nova Scotia) on November 15 about 6 p.m., Halifax time.

Although only faintly visible on account of the twilight and the condition of the sky, the aurora was evidently of considerable intensity, throwing up streamers to the zenith.

I looked out again at 7 p.m., but could detect no signs of auroral activity then. Occasional watch was kept upon the northern sky during the rest of the night in hopes of a recurrence, but nothing further was seen.

ALEXANDER GRAHAM BELL.

Beinn Bhreagh, near Baddeck, Nova Scotia,
December 9.

WITH reference to a letter from Dr. Chree in NATURE of November 30 (p. 101) upon the magnetic storm of November 15, it may perhaps be of interest to mention that, according to a notice in the newspaper *Finmarken*, the aurora of that day in Vardö (lat. $70^{\circ} 22'$) was by far the most splendid seen there for many years. It is described as bright red all over, and, when most vivid, forming a belt over the whole sky from south-west to north-east. At last, about 11 p.m., the light gathered in the southern sky, making the impression of a huge fire some forty kilometres away.

Here in Christiania the sky was overcast, except a low horizontal stripe in the north-west, where the vivid greenish light was moving to and fro about 7 p.m.

H. GEDMUYDEN.

University Observatory, Christiania, December 16.

The Origin of Variations in Animals and Plants.

HAVING found much ambiguity in discussions of this subject, I have tried to formulate briefly the probable facts, as they appear to me.

(1) In the beginning, the germ-plasm was not separated from the somato-plasm, and hence it is assumed that "acquired characters" were inherited, and, we must suppose, still are by the protozoa. It seems probable, however, that the obvious effects of the environment were not permanent, but were recovered from in a few generations of cells or individuals, much as they are frequently recovered from in the metazoa during the life of a single individual. When they were too severe, they probably resulted in the death of the affected individuals or strains. In other words, there has been no regular "inheritance of acquired characters" among the protozoa any more than among the metazoa.

On the other hand, it seems reasonable to suppose that there were other more subtle effects, which in various slight ways changed the molecular arrangements or composition of the plasm, and effects so produced would be permanent until further changes of a similar nature took place.

The extraordinary permanence of type of protozoan and prophytan species, both in time and space, compels us to discard the idea that they are easily modified by external or any other conditions; while their marvellous diversity shows that they are capable of extraordinary modification. What causes the molecular changes (presumably nobody denies that they take place) is not apparent to us, partly because the phenomena must be very difficult (or impossible?) to demonstrate, and partly, perhaps, because they have been overlooked, all attention having been given to the obvious but less significant changes. Recent physical science has made us familiar with all sorts of subtle influences, and we do not know how any of them might affect the complex molecule of a living creature. Substances which hitherto behaved in a perfectly well

known manner have given us surprises when we placed them in the presence of something new. So it may well be with the living molecule, and what we call "great changes in environment" may be nothing at all to it, compared with subtle influences which entirely escape our observation.

(2) In the first place, the molecular changes may have been good, bad, or indifferent (as tested by the prosperity of the creatures); but very soon selection would get in its work, and those types of plasm which responded in certain ways to the more usual influences would be perpetuated. Hence it would presently be found that variations were no longer indefinite, but were in certain prevalent directions—as they assuredly are.

(3) The fact that protoplasm shows such very definite tendencies low down in the scale of life (so that the hydrozoa, for example, seem wonderfully prophetic of subsequent evolution) might be used as an argument that life did not originate upon this earth, but came here with a long history already behind it.

(4) In the metazoa the matter is immensely complicated, because we have in each individual not one, but a large number of more or less independent variables. Nevertheless, I cannot doubt that the germinal elements are, as I have supposed in the protozoa, caused to vary (and nobody disputes the variation) by external influences; yet, from the selection and evolution of ages, their reactions have become so definite that we cannot see in them anything but "the nature of the beast."

(5) Since those germs would be selected (through their somata) which reacted in such a way as to produce the most favourable variations, it becomes easy to see why certain kinds of variation may be carried beyond the point of maximum utility. They are like habits, which may be formed in response to certain needs, but which afterwards become tyrannical, because the individual has acquired the property of responding to particular stimuli, and cannot stop when the stimuli become more numerous, or the effects accumulate unpleasantly.

(6) The fact that certain genera (e.g. *Rubus*, *Aster*, *Agriolimnax*) are extremely prolific in species in some regions, and very little so in others, seems to show that some external influences have been at work in the former case and not in the latter. We may also direct attention to the effects of changed conditions in producing variability (e.g. in *Helix nemoralis*), and to the evolution of similar types in different regions.

(7) It may well be that the appearance of characters in the soma does not always or often follow in the generation after the germ is affected (cf. NATURE, February 16, p. 366).

T. D. A. COCKERELL.

Boulder, Colorado, U.S.A., December 1.

An Acoustical Method for the Demonstration of the Magnetism of Liquids.

ONE end of a glass tube, about 5 mm. internal diameter and 1 mm. thick, is heated in a blowpipe flame until the molten end contracts to a round nozzle, leaving a small aperture of less than half a millimetre at the middle. The other end of this tube is connected by a caoutchouc tubing to an air-bag of considerable capacity, which is pressed by a constant weight. The nozzle is wet with a drop of liquid. By opening the cock of the air-bag, the air escapes through the nozzle and produces a clear musical sound, the pitch of which depends upon the dimensions of the nozzle as well as the quantity and the nature of the liquid; it varies also with the pressure of the air inside and the inclination of the tube to the vertical.

If the nozzle, wet with a magnetic liquid, be brought close to the conical pole-piece of a strong Faraday's electro-magnet and the field excited, the pitch of the sound changes more or less according as the magnetic susceptibility of the liquid and the gradient of the field is greater or less. With concentrated solution of ferric chloride or manganese chloride, a change amounting to an interval of a third is easily obtained.

The details have been published in the *Proceedings of the Tokio Physico-mathematical Society*, vol. ii., No. 26.

T. TERADA.

Science College, Imperial University, Tokio, November 5.