

of our solar system which cannot be self-generated, the possibility of having evidence of anti-matter in comet tails and coronal streamers, and the idea of potential matter.

ARTHUR SCHUSTER.

Solar Radiation.

AT the conclusion of his British Association lecture on Phosphorescence,¹ Mr. Jackson makes a suggestion with regard to solar radiation which will doubtless receive due attention from those who are interested in solar physics. It is one of especial interest to me because, by an entirely different train of thought, Mr. Jackson has arrived at a possible explanation of the relation between sun-spots and terrestrial magnetic disturbances which is practically identical with a suggestion I have recently put forward in a paper on "The cause of the darkness of sun-spots," published in the *Astrophysical Journal* (April 1897).

In this paper I attempted to show that absorption by relatively cool material offers no satisfactory explanation of the darkness of sun-spots, and that the spectroscopic evidence is really quite compatible with a relatively high temperature even in the umbra of a spot.

But in abandoning the absorption hypothesis, one is brought face to face with an apparent contradiction of Kirchhoff's law. Thus it is certain from the low mean density of the sun that the interior region under enormous pressures must be vastly hotter than the photosphere. If, therefore, spots are really breaks in the photospheric clouds through which we obtain a glimpse of the interior, why is it that the radiation from them is apparently so much less intense than from the photosphere? The clouds of condensed matter may, of course, possess a much higher radiating power than the gaseous mass below them; but this, according to Kirchhoff's law, should be entirely compensated by the enormous depth of the feebly radiating interior mass.

To meet this difficulty I suggested that the radiation from the interior, at the transcendent temperatures which must exist even a few thousand miles below the sun's visible surface, may possibly not be apparent as visible light, but may occur in wave-frequencies of a higher order than the known spectrum; and "may be effective in producing those magnetic disturbances which are characteristic of large umbræ."

Mr. Jackson however, if I have rightly understood him, supposes that it is not so much a question of temperature as of molecular structure that determines the wave-frequency of the radiation; and he regards the light of the photospheric clouds as a phosphorescent glow induced by undulations of a high order of frequency which are emitted by the simpler uncondensed materials. The condensed clouds containing more complex molecular groups acting as a screen, and converting the invisible radiant energy of high frequency into ordinary light.

With regard to this interesting speculation, one would like to know more particularly what is the nature of the evidence on which the idea is based that very simple molecular systems give rise to undulations of high frequency? There can scarcely be any analogy between the behaviour of matter in highly exhausted tubes and under the enormous pressures and temperatures which must exist within the photosphere.

The case of the phosphorescent limes is an exceedingly interesting one; but is there any ground for the belief that the lime obtained from organic salts, and giving a blue phosphorescence, is really simpler in molecular structure than a lime which glows red? J. EVERSHED.

Kenley, Surrey, October 14.

Hibernating Reptilian Embryos.

WILL you allow me space to correct an error that has crept into the account given in the *Christchurch Press*, and reprinted in the last number of *NATURE* (p. 609), of Prof. Dendy's successful investigation of the development of the egg of the Tuatara lizard, *Sphenodon*.

The fact of an embryo hibernating within the egg was not, as stated, unknown among vertebrates, an exact parallel being offered by no less well-known a reptile than the European pond-tortoise (*Emys orbicularis*). This was first observed in Austria, in the last century, by Marsigli, whose statement has been corroborated by Miram in 1857, eggs laid in his garden at Kieff in May hatching eleven months later, and by Kollinat in 1894, the latter author concluding that hatching does not, as a

¹ *NATURE*, October 6, p. 562.

rule, take place in France before the twenty-second or twenty-third month after oviposition.

I need hardly add how pleased I feel at the result of Prof. Dendy's investigations showing the close resemblance which the development of *Sphenodon* bears to that of the tortoises, since I believe to have been the first systematist to follow Cope (1885) in placing the Rhynchocephalia in close proximity to the Chelonia with the remark: "The affinities of the Rhynchocephalia to the Chelonia are at least as great as to the Lacertilia" (Cat. Chelon., 1889, p. 1).

G. A. BOULENGER.

British Museum (Natural History), October 23.

Organic Variations and their Interpretation.

I SHOULD be glad if Mr. Cunningham would tell us upon what evidence he founds his opinion that, in crabs, "it is certain that the number of ecdyses depend on age, not on size."

This assumption lies at the base of Mr. Cunningham's criticism of Prof. Weldon's arguments; but, even apart from that, the matter is one of such general biological interest that I hope he will respond to an invitation to substantiate a view which to me, at any rate, is altogether novel. I have always understood that exuviation was a phenomenon essentially connected with the process of growth in Crustacea rather than with the mere passage of time, and it is needless for me to remind Mr. Cunningham of the familiar facts and published statements which support this generally accepted view. Will Mr. Cunningham, on the other hand, tell us how many cases of exuviation, unaccompanied by growth, he has observed among Crustacea?

Unless Mr. Cunningham can revolutionise the present state of knowledge on this subject, his criticism, based on the greater relative growth of young crabs in 1893 than in 1895 and 1898 (which in itself is probable enough), falls to the ground; for he admits that "change in the proportions of a crab occurs only at the ecdysis." In assuming that, on the whole, similarity of size in young shore-crabs indicates an equal number of moults, Prof. Weldon appears to me to be quite in accord with our present knowledge of the subject. Certainly—to modify Mr. Cunningham's phrase—the frequency of exuviation in different *Carcini* corresponds much more closely with their relative growth than with the periods of time occupied.

Plymouth, October 22.

WALTER GARSTANG.

Wall Mirages.

MR. R. W. WOOD, who describes a mirage on city pavements, in *NATURE* of October 20 (p. 596), may like to refer to the second volume of *NATURE* (p. 337, August 25, 1870), where he will find an account of mirages seen by looking closely along a wall, which was exposed to a hot afternoon sun. The mirage must be very common, and needs only looking for. Mr. Wood's interesting letter may lead others to photograph this curious phenomenon in our own country. A wall will be easier to deal with than a pavement.

C. T. WHITMELL.

Leeds, October 22.

A White Sea.

I HAVE received several letters respecting this phenomenon (see p. 496), and have distributed the samples of water to two gentlemen who were desirous of examining it. Will you permit me to say that subsequently I received another application from a bacteriologist on the continent, and that the letter was unfortunately lost before complete perusal. Hence my failure to acknowledge its receipt.

JAMES W. BARRETT.

22 Cavendish Square.

SURFUSION IN METALS AND ALLOYS.¹

THE author points out that metals and alloys may be maintained in a fluid state at temperatures which are many degrees below their true freezing points, and states that this fact has been but little studied. As regards salts, the question of surfusion has recently received much attention. Ostwald (*Zeit. für Physikal. Chem.*, 1897, vol. xxii. p. 3) has shown, as the result of an investigation

¹ "Surfusion in Metals and Alloys." By Prof. W. C. Roberts-Austen, C.B., F.R.S. (Abstract of a paper read at the Royal Society, May 26.