

cradle of the human race. Observing that the anthropoid apes of equatorial Africa—gorilla and chimpanzee—are dolichocephalous, while those of Malaysia—orang-utan and gibbon—are brachycephalous, certain polygenists have suggested that the former may be the progenitors of the dolichocephalous Negroes, the latter of the brachycephalous Negritos. But we have seen that the Papûans of the extreme east (New Hebrides, Fiji, &c.) are also dolichocephalous, and even of a more pronounced type than the natives of Sudan. On the other hand, the Obongos, Akkas, and other pigmy tribes of Central Africa appear to be brachycephalous,<sup>1</sup> so that the theory fails at both extremes, Fiji and the Gaboon. Assuming however that mankind may have been evolved in the Eastern Archipelago or in some now submerged adjacent lands, and bearing in mind the relative value attached to the idea of race, as implied in our definition of species, the present conditions might still admit of explanation. In the Andamanese Islanders, whom Prof. Flower justly regards as of an "infantile type," and in the Javanese Kalong, whose features von Rosenberg describes as the most decidedly ape-like he had ever seen, we would have still *in situ* the earliest extant representatives of primeval man. Migrating westwards across a now lost "Lemuria," this primitive Negrito race may have reached equatorial Africa, where it is still represented by Du Chaillu's Obongo, Lenz's Abongo or Akoa, Schweinfurth's Akka, and where it may under more favourable conditions have become differentiated into the Negro of Sudan. Migrating eastwards across a continent of which the South Sea Islands are a remnant, the same Negritos may have similarly become slowly differentiated into the present Papûan or Melanesian peoples of those islands. Migrating northwards, before the severance of the Archipelago from the mainland, they reached Malacca and the Deccan, where they may still be represented by the Maravans and other low castes of that region. Moving thence over the Asiatic continent, they became under more temperate climes differentiated, first probably into the yellow Mongol, and then through it into the fair Caucasian type. But however this be, the subsequent migrations of the Mongols and Caucasians to the Archipelago, as above set forth, was probably, after all, but a return under new forms to their old homes. Here their mutual interminglings have again evolved fresh types and sub-types, producing a chaos of races whose true affinities I have endeavoured in these papers to elucidate, while fully sensible that in all such inquiries the last word still must be, *felix qui potuit rerum cognoscere causas*.

A. H. KEANE

### THE PHOTOPHONE

THE following calculation, made with the view of examining whether the remarkable phenomena recently discovered by Prof. Bell could be explained on recognised principles may interest the readers of NATURE. I refer to the *un-electrical* sounds produced by the simple impact of intermittent radiation upon thin plates of various substances.

It has been thought by some that in order that a body exposed to variable radiation may experience a sensible fluctuation of temperature its rate of cooling must be rapid. This however is a mistake. The variable radiation may be divided into two parts—a constant part, and a periodic part—and each of these act independently. Under the influence of the constant part the temperature of the body will rise until the loss of heat by radiation and conduction balances the steady inflow; but this is not appreciable by the ear, and may for the present purpose be left out of

<sup>1</sup> The Akkas certainly; but Lenz seems to think that the Abongos are dolichocephalous, so that this point remains still to be settled. Dr. Barnard Davis however in his *Thesaurus Craniorum* recognises brachycephaly in equatorial Africa, four out of eighteen skulls in his collection from this region being distinctly brachycephalous.

account. The question is as to what is the effect of the periodic part of the whole radiation, that is, of a periodic communication and *abstraction* of heat which leaves the mean temperature unaltered. It is not difficult to see that if the radiating power of the body were sufficiently high, the resulting fluctuation of temperature would diminish to any extent, and that what is wanted in order to obtain a considerable fluctuation of temperature is a *slow* rate of cooling in consequence of radiation or convection.

If  $\theta$  denote the temperature at time  $t$ , reckoned from the mean temperature as zero,  $q$  be the rate of cooling,  $E \cos \phi t$  the measure of the heating effect of the incident radiation, the equation regulating the fluctuation of temperature is—

$$\frac{d\theta}{dt} + q\theta = E \cos \phi t.$$

Thus—

$$\theta = \frac{E \cos (\phi t + \epsilon)}{\sqrt{\{p^2 + q^2\}}},$$

showing that if  $p$  and  $E$  be given,  $\theta$  varies most when  $q = 0$ .

Let us suppose now that intermittent sunlight falls upon a plate of solid matter. If the plate be transparent, or absorb only a small fraction of the radiation, little sonorous effect will be produced, not merely because the radiation transmitted is lost, but because the heating due to the remainder is nearly uniform throughout the substance. In order that the plate may bend, as great a difference of temperature as possible must be established between its sides, and for this purpose the radiation should be absorbed within a distance of the order of half the thickness of the plate. If the absorption be still more rapid, it would appear that the thickness of the plate may be diminished with advantage, unless heat conduction in the plate itself interferes. The numerical calculation relates to a plate of iron of thickness  $d$ . It is supposed that  $q$  is negligible in comparison with  $p$ , *i.e.* that no sensible gain or loss of heat occurs in the period of the intermittence, due to the fluctuations of temperature themselves.

If the posterior surface remains unextended the extension of the anterior surface corresponding to a curvature  $\rho^{-1}$  is  $\frac{d}{\rho}$ , and the average extension is  $\frac{d}{2\rho}$ . Let us inquire what degree of curvature will be produced by the absorption of sunlight during a time  $t$ , on the supposition that the absorption is distributed throughout the substance of the plate, so as to give the right proportional extension to every stratum.

If  $Ht$  denote the heat received in time  $t$  per unit area,  $c$  the specific heat of the material per unit volume,  $e$  the linear extension of the material per degree centigrade, then

$$\frac{1}{\rho} = \frac{2eHt}{c \cdot d^2}.$$

In the case of sunshine, which is said to be capable of melting 100 feet of ice per annum, we have approximately in C. G. S measure

$$Ht = .008 t.$$

$$\text{Thus } \frac{1}{\rho} = .016 \frac{e t}{c d^2}.$$

For iron  $e = .000012$ ,  $c = .86$ .

Thus if  $t = \frac{1}{5}$  (of a second),  $d = .02$  cents.

$$\frac{1}{\rho} = 1.12 \times 10^{-6}.$$

This estimate will apply roughly to a period of intermittence equal to  $\frac{1}{25}$ th of a second, *i.e.* to about the middle of the musical scale. If the plate be a disk of radius  $r$ , held at the circumference, the displacement at

the centre will be  $\frac{r^2}{2\rho}$ , or  $\cdot 56 r^2 \times 10^{-6}$ . In the case of a diameter of 6 centimetres this becomes  $5\cdot0 \times 10^{-6}$ .

Five-millionths of a centimetre is certainly a small amplitude, but it is probable that the sound would be audible. In an experiment (made, it is true, at a higher pitch) I found sound audible whose amplitude was less than a ten-millionth of a centimetre. We may conclude, I think, that there is at present no reason for discarding the obvious explanation that the sounds in question are due to the bending of the plates under unequal heating.

January 13

RAYLEIGH

### NOTES

WE regret to learn of the death of the Rev. Humphrey Lloyd, D.D., Provost of Trinity College, Dublin, on the 17th inst., at the age of eighty-one years. Dr. Lloyd's contributions to scientific literature have been many and important, and to these and to his career generally we hope to refer at length in our next number.

PROF. HUXLEY has been appointed to the Inspectorship of Fisheries vacant by the death of Mr. Frank Buckland.

THE Queen has been pleased to confer a pension of 200*l.* upon Mr. Alfred Russel Wallace.

THE election of Dr. B. A. Gould of Cordoba in the place of the late Prof. C. A. F. Peters, director of the Observatory at Kiel, as Correspondent of the Academy of Sciences at Paris, completes the authorised number in the section of Astronomy.

YORK has already begun to make preparations for the 51st meeting of the British Association in that city on August 31 next. A meeting is to be held on the 26th inst. to appoint a reception committee and take other steps in connection with the approaching visit of the Association. The local secretaries are the Rev. Thomas Adams and Dr. Tempest Anderson.

THE well-known collection of fossils formed by the late Mr. E. Wood of Richmond, Yorkshire, has been purchased by Mr. William Reed, F.G.S., of York, and by him presented to the Museum of the Yorkshire Philosophical Society, York. The collection consists of about 10,000 specimens, and is specially rich in fossils from the Carboniferous rocks.

THE great *soirée* of the Paris Observatory will take place on February 5. One of the features of the display will be a series of vacuum tubes exhibiting the spectral peculiarities of the several gases inclosed.

DR. FRITSCH, Professor of Zoology at the University of Prague, has sent us a specimen of a cast, taken by the galvanoplastic process, of a skeleton of one of the extraordinary Labyrinthodont reptiles, described by him in his work, "*Fauna der Gaskohle der Permformation Böhmens*." As the matrix in which these skeletons are found contains much pyrites, it soon crumbles away on exposure to the air. By this process of Dr. Fritsch's the specimens however may be examined, even when magnified twenty-fold, and all little minutiae of the skeleton can be seen. Complete sets of these galvanoplastic casts, representing all the more important reptile remains found, can be had on application to Prof. Fritsch.

In Siberia, a country so rich in gigantic fossils, the body of a colossal rhinoceros has been discovered in the Werchojanski district. It was found on the bank of a small tributary to the Jana River, and was laid bare by the action of the water. Similar to the mammoth washed ashore by the Lena River in 1799, it is remarkably well preserved, the skin being unbroken and covered with long hair. Unfortunately only the skull of

this rare fossil has reached St. Petersburg, and a foot is said to be at Irkutsk, while the remainder was allowed to be washed away by the river soon after it had been discovered. The investigation of the skull gave the interesting result that this rhinoceros (*R. Merckii*) is a connecting form between the species now existing and the so-called *Rhinoceros tichorhinus*, remains of which are not unfrequently found in the gravel strata of Eastern Prussia. It is supposed that *R. Merckii* is the now extinct inhabitant of the eastern part of Siberia.

HERR JULIUS GILLIS, a wealthy merchant of St. Petersburg, offers a prize of 1000 florins for a popular work on "Kant's Views on the Ideality of Time and Space." Herr Gillis will not only pay the cost of publishing of the work which obtains the prize, but will also let the author have the profits its sale may realise. Details regarding this matter can be obtained from Last's Literary Institute at Vienna.

MR. WARREN DE LA RUE will, on Friday next, the 21st inst., deliver his discourse at the Royal Institution on "The Phenomena of the Electric Discharge with 14,400 Chloride of Silver Cells." Prof. Schäfer will give the first of a course of twelve lectures on the Blood, on Tuesday next (January 25); Mr. Francis Hueffer, the first of a course of four lectures on the Troubadours, on Thursday next (January 27); and Mr. Sidney Colvin the first of a course of four lectures on the Amazons, on Saturday next (January 29). The next Friday evening discourse will be given by Dr. Arthur Schuster, on the Teachings of Modern Spectroscopy, on January 28.

MR. E. T. SACHS sends us some interesting notes from Batavia:—"Within the past month I have been so lucky as to make what I hope is a very interesting if not remarkable discovery. On the Island of Biliton, 200 miles from here, I found a freshwater fish which produces its young *living from its mouth*. I am quite prepared for the cry of incredulity that will be raised; but I conducted my observations with living fish and closed doors, and what I assert is undeniable: the eggs are hatched in the lower portion of the head of the fish, and are projected out at the mouth and from nowhere else. I have secured several specimens, which I shall send to Dr. Günther, who will of course at once set the matter at rest. I also got on Biliton a butterfly, which is either a new *Thecla* or else it is the male of the pretty *Myrina nivea* peculiar to the island. I fancy it must be the latter. I was only three weeks on the island on other business, and was never two miles from the shore, so I have reason to be satisfied with my trip. I mean to go again next May or thereabouts, and go into the interior, and also try to get some living fish to breed from in Batavia. . . . There is a Dr. Schluyter here who is working hard at invertebrates. He is just busy on the tri-pang family, and will no doubt produce a fine monograph. He gets some fine crustaceans from the Straits of Sunda. I have shown him my fish, and he knows nothing of it."

ON the subject of crickets Mr. Sachs writes:—"These are sold in the markets in Batavia, inclosed in small bamboos. There is not much superstition about it, as little ticklers (pieces of stick with a bunch of plants analogous to our broom tied on the end) are sold with it wherewith to stir up the unfortunate insect when it doesn't chirp. Only children buy them."

A SHARP shock of earthquake was felt at Peshawur at 4 a.m. on December 10. The atmosphere was clear at the time; small drafts and eddies of cold wind followed the shock. The previous evening there had been a few drops of rain, the first for three months. The temperature was rather warmer than it had been, owing to the sky being more overcast. A smart shock was felt at the Bridge of Allan, near Stirling, on the morning of the 12th, about seven o'clock. There was a severe shock at Thurgau on the night of the 13th, accompanied by underground noises.

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