consulted in this connection. The treatment of the families is necessarily brief, but a good working basis for amplification is provided, and the last four sections, dealing with the anomalous order of Deuteromycetes, will be particularly useful to economic botanists.

The author claims to have provided an introduction to new lines of research. This is modestly expressed, for it will be found that, besides furnishing such an introduction, he has performed the additional service of discussing in a broad spirit their significance and interpretation; further, he has touched on most aspects of fungology, although not on the association of fungi in lichens, and has outlined the taxonomy of the group with a view to practical utility. In fact, Mr. Massee has supplied a serviceable and much required text-book on the present state of fungology which is embellished with numerous artistic and practical illustrations.

Douglas English Nature Books. No. 1, One Hundred Photographs from Life of the Shrew-mouse, the Dormouse, the House-mouse, the Field-mouse, the Meadow-mouse, and the Harvest-mouse. By Douglas English. Pp. 93. No. 2, *One Hundred Photographs of Bird Life.* By R. B. Lodge. Pp. 95. Illustrated (London: S. H. Bousfield and Co., Ltd., 1907.) Price 1s. each.

SINCE no less than six out of the ninety odd pages which go to form each of these volumes are devoted to reproductions of photographs of mammals and birds in their native haunts, the lover of animal life has a rich entertainment at a very small cost. As we learn from the introduction to the first, this series of books is intended for the pocket of the field-naturalist, and it is hoped that while the illustrations (which are almost beyond praise) will aid in the recognition of species, the letterpress will be of service alike in confirming previous observations and in suggesting new lines of inquiry. The series is intended to be comprehensive in scope. In the first part, which is devoted to some of the smaller British mammals, it is satisfactory to find a reversion to the use of popular names like water-rat, field-mouse, and shrew-mouse, in place of the spurious terms water-vole, field-vole, and shrew. In the second number Mr. R. B. Lodge gives one hundred photographs of bird-life, with appropriate notes. Since, however, the illustrations include species like the glossy ibis, little egret, and spoon-bill, it is rather difficult to see what they have to do with the ordinary field-naturalist. R. L.

Gold Mining Machinery: its Selection, Arrangement, and Installation. By W. H. Tinney. Pp. xii+308. (London: Crosby Lockwood and Son, 1906.)

THIS book professes to be "a practical handbook for the use of mine-managers and engineers" to assist them in the "selection, arrangement and installation" of gold-mining machinery. Such a work properly executed would doubtless perform a useful function; but Mr. Tinney's production fails in its purpose for it is out of date and superficial. For example, winding machinery, which should surely be one of the most important sections of a work such as this purports to be, is dealt with in seven pages of letterpress, and, as may well be imagined, the modern high-class winding engine finds no place in it. Deep winding, the greatest problem at present engaging the attention of the mechanical engineers of the Witwatersrand goldfields, is passed over in silence. Again, the electrical transmission of power, a subject of vast and ever-growing importance to the miner, is dismissed in four pages of letterpress.

It may well be asked, of what are the 300 pages of this book made up? The work appears to consist of a jumble of extracts from the note-book of the author (whose experience of the gold mines of the world would seem to have been somewhat limited), together with specifications of machinery makers, illustrated by a selection of photographs from their catalogues. To this *olla podrida* has been added a number of workshop receipts and various elementary tables, such as "the sizes of drawing paper," and formulæ for calculating the areas of a circle, a triangle, a square, &c., and the volume of a cube, a sphere, a cylinder, &c. One of the tables gives the "names, common and chemical," of a list of substances, beginning with "aqua fortis" and ending with oil of vitriol, and including such rare materials as chalk, iron pyrites, rust, slaked lime, salt, and soda.

Memories of the Months. Fourth Series. By the Right Hon. Sir Herbert Maxwell, Bart., F.R.S. Pp. x+319. (London: Edward Arnold, 1907.) Price 7s. 6d.

SIR HERBERT MAXWELL'S new volume will be welcomed by the many readers of his previous series of "memories." The ability to combine literary grace with scientific accuracy, and the power to interest and at the same time to impart useful information, is unfortunately rare, and we are grateful to Sir Herbert Maxwell for placing his gifts at the disposal of a large audience by means of these pages. Readers will be able to share with the author of the memories his "delight in the open field, the woodland, and the riverside," and if they prove willing disciples they may in time experience the joy of original observation for themselves—at least they will learn to study and appreciate the boundless beauties of nature.

LETTERS TO THE EDITOR.

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On the Relationship of Lemurs and Apes.

ACCORDING to the report published in NATURE (April 11, p. 574), Mr. H. F. Standing recently presented a memoir to the Zoological Society in which he described certain extinct lemuroids from Madagascar as being, "in many respects, intermediate between existing lemurs and monkeys," and, as the result of this interpretation of the anatomy of these animals, he expressed the view "that it was not possible to separate the Primates, as hitherto, into the two suborders Lemuroidea and Anthroipoidea."

At the suggestion of Dr. A. Smith Woodward, Mr. Standing kindly sent me casts of the cranial cavities of three of the Prosimiæ found by him, and in January last I sent him a report in which their outstanding features and the inferences to be drawn from them were set forth. My conclusions not only lent no support to the above-quoted summary of Mr. Standing's opinions, but are in direct conflict with them. But I would not have deemed it necessary to repeat these statements, already made in my report (which I presume will be published along with Mr. Standing's memoir), had it not been for the fact that, since my report was written, further investigations (chiefly histological studies in the structure of the neopallium of Tarsius, Loris, Nycticebus, Perodicticus, Lemur, Propithecus, Hapale, Cebus, and Cercopithecus) have revealed important facts that enable me to speak more emphatically on the old problem once more raised

for discussion by Mr. Standing, and also incline me to suggest a modification of my previously expressed views.

The evidence afforded by the cranial casts is very precise and unmistakable. One of them does not differ in any essential feature, excepting size, from the form exhibited by the brain in the living species of the genus *Lemur*; a second is an almost exact replica of the cranial cast of *Indris*; and the third, so far from affording any evidence of affinity to monkeys, presents highly specialised features, which enable us to place the animal (and also *Nesopithecus*, *Megaladapis*, and possibly *Chiromys*) within the fringe of the *Indrisinæ*. As these lemuroids are the most diversely modified members of the most highly specialised family of the *Prosimiæ*—which means that they are furthest removed from (and presumably have retained least resemblance to) the very early and remote ancestor from which both lemurs and apes could have sprung—it follows that these, the most aberrant and outlying branches of the *prosimian* phylum, are the least likely to supply us with any evidence bearing on the relationship of lemurs to apes; and the facts elucidated by the actual examination of these specimens quite bear out this *a priori* supposition.

I am the more anxious to make my position absolutely clear in regard to this matter for the reason that, some four years ago (*Linn. Soc. Journal—Zool.*, vol. xxix., p. 83), in protesting against Hubrecht's suggested exclusion of all *Prosimiæ* (except *Tarsius*) from the *Primates*, I may have unduly minimised the differences in structure that indicate the wide separation of the *Lemuroidea* and the *Anthropoidea*.

The organisation of every part of the body proclaims the kinship of lemurs and monkeys, distant though it be; this has been so often summarised (see Earle, "On the Affinities of *Tarsius*," the *American Naturalist*, 1897, pp. 569 and 680) that it does not need repetition. I might direct attention to the fact that the lemurs are the only mammals that exhibit the true Sylvian fissure such as we find in the *Anthropoidea* or *Simiæ*; that the true central (Rolando's) sulcus is present in *Perodicticus* and in no non-Primate mammal, although there are distinct evidences in many *prosimian* families of the tendency toward the development of this caudal-limiting sulcus of the motor area; that the motor area presents histological features like those of the lowlier monkeys, and has a similar topographical distribution; that the calcarine sulcus and the distribution of the visual cortex (area striata) conform essentially to the Primate type, although in certain respects the structure of this cortex and its relation to sulci more nearly resembles the condition found in certain primitive *Carnivora*; and that the organisation of the other parts of the cerebral hemisphere and of the brain-stem and cerebellum resembles that of the corresponding parts of the brain in monkeys much more nearly than that of the *Carnivora* and *Edentata*, in which there are some analogies to the *Prosimiæ*.

But if the facts of cerebral anatomy establish the claim of the *Prosimiæ* to be included in the *Primates*, they afford equally emphatic evidence of the sharp line of demarcation between the diversely specialised suborders *Lemuroidea* (*Lemures*) and *Anthropoidea* (*Simiæ*) and the degraded rank of the former. In attempting to formulate the contrasts between these two suborders, *Tarsius* comes to occupy such an enigmatical position that it must be put into a category by itself, the suborder *Tarsii* (Gadow), the other *Lemuroidea* then forming the suborder *Lemures* (Hubrecht).

The *Lemures* are macrosomatic, and (excluding *Megaladapis*) have a sessile olfactory bulb, whereas the *Simiæ* are microsomatic, and have an elongated olfactory peduncle. *Tarsius* has a sessile olfactory bulb like the *Lemures*, and in form exactly like that of the *Galaginæ* and *Lorisinæ*, but it is much smaller than that of any lemur, and at the same time is bigger than that of a monkey.

The cerebral hemisphere in the *Simiæ* is prolonged backward to cover the cerebellum, carrying with it a diverticulum of the lateral ventricle to form a posterior cornu, the walls of which are composed to a large extent of very highly specialised striate cortex differing markedly in structure from the homologous area of other mammalian

orders. In *Lemures* the occipital prolongation is not so extensive; there is no posterior cornu, and the cortex of the area striata approximates in structure to that of the *Carnivora* more nearly than to that of the apes. In *Tarsius* the extent of the occipital pole and its form most nearly resemble the condition found in the brain of the *Galaginæ*, but there is an extensive posterior cornu as in the apes, and the structure of the area striata presents a marked contrast to that of the lemurs, and resembles that found in *Hapale* and *Cebus*.

In the lemurs the frontal, temporal, and parietal association areas are much smaller than in monkeys.

The lateral hemispheres of the cerebellum exhibit a much greater expansion in the *Simiæ* than in the *Lemures*, although there is a very close resemblance between the patterns exposed in mesial section in the two suborders.

In many respects the structure of the brain in *Tarsius* departs widely from that of all the other *Primates*, both *Lemures* and *Simiæ*. Most of these features, such as the form and proportions of the corpus callosum and the architecture of the cerebellum, are indicative of a very primitive generalised condition, such as we find in the insectivore *Gymnura*.

All these considerations, and the mass of facts elucidated by Burmeister, Turner, Hubrecht, Mivart, Leche, Eugen Fischer, and the writer among many others, can, I think, find a rational explanation only by admitting that the *Primates* consist of three divergent phyla, which have all departed in varying degrees and in different ways from their original common ancestor, which must have been a creature in many respects like *Tarsius*, but more macrosomatic, and possessed of a smaller and less highly specialised visual cortex.

G. ELLIOT SMITH.

The School of Medicine, Cairo, April 22.

Radium and Geology.

Two points of special interest have come to light in recent investigations which I have made in connection with this subject.

(1) Typical rocks from the Simplon Tunnel contain quantities of radium considerably in excess of the average of igneous rocks. The Simplon rocks are altered sediments, for the most part, from Archæan to Jura-Lias age. There appears to be sufficient radium to account for the excessive temperatures met with in boring the tunnel, and the practical suggestion is allowable that engineers will do well to estimate the distribution of this substance before embarking on similar projects in the future.

The investigation suggests that radium, accumulating in great thicknesses of sedimentary deposits, may enter as a factor in mountain building by raising the temperature at the base of the accumulated mass. This would lead to a lessened resistance to compressive stress and pressure from beneath. In short, it will be for future investigation to explore how far radium (and uranium) in the surface materials has proved a source of *instability* in geological history, its transport by denudation being, in fact, not a transport of matter only, but a convection of energy.

(2) A sample of red clay from a depth of 2740 fathoms in the North Atlantic contained sixteen times as much radium as the average of igneous rocks as determined by the Hon. R. J. Strutt, and a specimen of globigerina ooze from a depth of 1990 fathoms in the South Atlantic about six times this average. These materials I owe to the kindness of Sir John Murray.

Here the question will arise, Whence all this radium? Sir John Murray's cosmic dust, of course, at once comes to mind, and, taking all the facts into account, I venture to regard these results as further evidence in favour of the extra-terrestrial origin of some portion of the radium we find upon the earth.

The above results are obtained by measurement of the emanation, with every precaution against error.

The point as to what constituent of the oceanic deposits is responsible for the radium is under investigation.

J. JOLY.

Geological Laboratory, Trinity College, Dublin,
April 29.