we should have been equally impressed with its insignificance—and yet the two statements are virtually the same. In fact, the unscientific reader is not likely to realize the prodigious number of pounds in the earth's mass.

It may be remembered that Croll computes, in "Climate and Time," the value of the eccentricity of the earth's orbit from Leverrier's formulæ, and endeavours thus to assign actual dates to various glacial periods. Now, Sir Robert Ball very justly will not admit that our knowledge of the solar system is accurate enough to justify the application of these formulæ to the enormously long intervals of time involved. I think, however, that it would have been of interest to the general reader to be told in round numbers the kind of intervals which we have reason to believe may have elapsed between one glacial period and the next; in fact, to learn whether the intervals are probably millions of millions of years, or hundreds of thousands of years. I conjecture that our knowledge of the planetary movements is sufficient to enable us to say that such an interval may be something comparable with 200,000 years. I should like, further, also to ask Sir Robert Ball whether he does not consider that Leverrier's formulæ may probably be relied on to give at least a rough approximation for about 100,000 years in the past; and, if this is so, whether we might not conclude, with fair probability, that the last glacial period occurred about that number of years ago? I must, however, disclaim any special knowledge on this point, and I should gladly see his opinion, or that of any other physical astronomer, on the matter.

In conclusion, I wish to say that, in making the foregoing criticisms and suggestions, I have no intention of disparaging the book; on the contrary, it is only because it is a good book that it is worth while to consider it carefully. I have found it profoundly interesting from end to end, and I am convinced that it will be widely read, as it deserves to be. G. H. DARWIN.

POPULAR ZOOLOGY.

Animal Sketches. By C. Lloyd Morgan, F.G.S., Principal of University College, Bristol. (London: Edward Arnold.)

THIS is one of those delightful books of natural history for young people which their parents never had the benefit of, and for which they ought to be duly thankful. A competent naturalist here gives them the result of his full and varied knowledge, but gives it so blended with imagination and humour, so intermingled with anecdote and personal adventure or observation, as to make it a real story-book about animals, by reading which we learn much of their lives and habits, their peculiarities of structure and their relations to each other, while we seem to be only reading for amusement. There is nothing systematic in this volume. It is merely a collection of miscellaneous chapters on a variety of animals, beginning with the lion and ending with the oyster, every chapter of which is both pleasant and instructive.

The best way to notice a book of this kind is to give a few examples of the author's style, which in this case will certainly commend the book better than any description of its contents. First, then, as a bit of serious biology, we will give a passage on the nesting-habits of the ostrich.

"The nest is scooped out in the sand, and two or three hen-birds may combine to lay their eggs in it, to the number of about twenty. It is said, and that by several observers, that, besides the eggs laid in the nest, each hen lays several in the neighbourhood, and that these are broken when the young are hatched, and the contents are given them as food. But I am inclined to regard these statements with some suspicion. The hens take turns in sitting during the day, never leaving them long in the scorching heat of the South African sun. But at sun-down the cock-bird takes charge of the eggs, and sits throughout the night. He is not going to be bound by any conventional rules as to the proper division of labour between the sexes.

"A very careful observer, Mrs. Barber, has drawn attention to the fact that the indistinct grey colours of the hen ostrich are wonderfully adapted for purposes of concealment. These birds while upon their nests do not erect their necks, but place them at full length in front of them upon the ground; and the grey-brown body might, Mrs. Barber says, be easily mistaken for some other object, such as, for instance, an ant-hill, so common on the plains of South Africa. That so large a bird should be inconspicuous may seem surprising; but another observer, Mr. W. Larden, tells us of his experience with the rhea, or South American ostrich, which seems quite to bear this out. 'One day,' he says, 'I came across a rhea in a nest that it had made in the dry weeds and grass. Its wings and feathers were loosely arranged, and looked not unlike a heap of dry grass; at any rate the bird did not attract my attention until I was close on him. The long neck was stretched out close along the ground, the crest feathers were flattened, and an appalling hiss greeted my approach. It was a pardonable mistake if for a moment I thought I had come across a huge snake, and sprang back hastily under this impression.'

"The male ostrich, with his splendid black and white feathers, would not be thus inconspicuous *by day*. But he sits at night, and his strength and pugnacity would induce most other creatures to let him alone. Mrs. Barber describes the careful manner in which the female bird approaches the nest in the morning, when her turn for incubation has come. In wide circles, and apparently in the most unconcerned manner, she will feed round the nest, never once looking towards it, but gradually approaching nearer and nearer to it by diminishing each circle as she walks round, until at length her perambulations have brought her to within a yard or so of the nest, when the birds will rapidly change places, the male walking swiftly away, and not remaining in the vicinity of the nest during the day. The wonderful rapidity with which the change is effected is perfectly astonishing, and it is impossible to see the exact manner in which it is done, so swiftly do they change places."

As an example of Mr. Lloyd Morgan's lighter manner, what can be more attractive than the opening sentences of his chapter entitled "Long-nose, Long-neck, and Stumpy"?

"'And which of all the animals in the Zoo do you like best?' I said to a bright, fair-haired little girl whom I had assisted in her descent from the elephant.

"'I think I like Long-nose, Long-neck, and Stumpy best, because they are so big and curous, and Long-nose best of all because he has given me a ride. Did *you* know it was his nose?'

"Of course I affected the most extreme surprise and

delight at the novel suggestion that the big, patient animal's trunk was really his nose, and said that I had always thought it was his proboscis.

"'No, it isn't that, it's his nose. Auntie says so. That's Auntie over there, waiting for me. I suppose you's seen Stumpy?'

"I inquired who Stumpy was, and whether I might not know him by another name.

"'I think they sometimes call him Pottums. But we call him Stumpy. Now I must go to Auntie.'"

And then our author tells us much about those three strange and remote types, the elephant, hippopotamus, and giraffe, in his own pleasant manner—their singular structure and habits, their external diversities concealing so much internal resemblance—devoting, however, most attention to the elephant, and correcting some exaggerated statements that have been made respecting that animal.

One of the most interesting chapters is that on snakes. It is full of information, and there is an almost fascinating account of the whole process of capturing and devouring its prey by a python, as observed at the Antwerp Zoological Gardens. Prof. Lloyd Morgan has visited, or lived in, many lands, and often enlivens his pages with personal anecdotes, of which the following is by no means the most remarkable:—

"My first experience of South African death-dealing snakes was somewhat different. One of my pupils brought me, in a large cigar-box, a 'ring-hals-slang,' a deadly and courageous snake not uncommon at the Cape, and turned him out on the verandah for our delectation. He was a spiteful little fellow, with an ominous hood, dark glossy skin, and glistening brown eye. He struck viciously at the cigar-box held up before him, indenting the wood, and moistening it with venom and saliva. I was particularly anxious to dissect out the poison-gland and examine the poison-fang of the snake, so my friend kindly presented it to me, replacing it in the cigar-box, which he tied securely. After examining the fastenings, I placed the box on the window-sill of my bedroom, which looked out into the verandah, and left it there for the night. Next morning I procured a large washing-pan, big enough to drown a small python, placed the cigar-box therein, loaded it with a couple of bricks, and poured in water to the brim. I gave the 'ring-hals' three good hours to get thoroughly drowned, removed the bricks, took out the box, gently cut the string, lifted the lid—and found that I had been drowning with the utmost care an empty cigar-box. It had been securely tied, and how a creature more than thrice the girth of my thumb had managed to escape was, and still is, a mystery to me.

"I leave the reader to imagine the detailed search of every cranny of our bedroom, on which my wife insisted. For several days every boot had to be hammered with a stick before it was put on; I stood on a chair and shook every pair of trousers, and other analogous garments, lest they should be already occupied. But no 'ring-hals' was forthcoming. And I suppose it must have been a week or so afterwards that I was summoned to the kitchen to expel an unwelcome intruder—the black cook being, so far as her skin permitted, pale with terror—which proved to be none other than the missing 'ring-hals.' I despatched him promptly, but not by drowning."

Among the specially good chapters are those on "Cousin Sarah," the chimpanzee; on the sparrow as typical of birds, under the title "Master Impertinence"; on chameleons, frogs, sticklebats, crayfish—but it is useless to particularize when all are good. The book is well illustrated, both with pictures and diagrams; and we may especially note that the structure of the elephant's tooth and that of the bee's compound eye are clearly elucidated by the cuts that accompany the descriptions.

Lastly, there is a pervading tone of sympathy with all that lives, as well as a general love and admiration of Nature, that renders it a most suitable work for the young. The cover and general get-up are attractive, and every school should add this charming volume to its list of prizes, with the certainty that it will be highly appreciated for its own sake by the recipients, and that its influence will be altogether wholesome and good.

A. R. W.

PHYSIOLOGICAL CHEMISTRY FOR MEDICAL STUDENTS.

Outlines of Practical Physiological Chemistry. By F. Charles Larkin, F.R.C.S., and Randle Leigh, M.B., B.Sc. Second Edition. (London: H. K. Lewis, 1891.)

THE authors state in their preface that this edition of the work is "the result of seven years' experience in teaching the subject to medical students," from which we gather that the medical student is being treated in the physiological laboratory in much the same spirit as he has long been dealt with in that of the chemist. The work before us is constructed upon an essentially similar principle to those numerous little treatises, the be-all and the end-all of which is to instruct the medical student in three months how to analyze simple salts. For such treatises, and the unedifying kind of instruction to which they give rise, neither teacher nor student is to be blamed: the fault lies with the authorities who frame the medical curriculum and the syllabus for the subjects of examination. The root of the mischief lies in having to treat the medical student during his preliminary scientific training as a separate genus from the student of general science, a course which is rendered necessary through the attempt to crowd such a large number of subjects into a period of time which is wholly inadequate for the purpose; whilst another evil tending to degrade the standard of the examinations is the existence of competing corporate bodies possessing the power of granting medical qualifications. For these ills the obvious remedies are, on the one hand, extension of the minimum time occupied by the curriculum, whilst, on the other hand, a uniform standard for qualification is required for the whole of the United Kingdom: fortunately, both of these changes are already in progress. Considering the necessarily technical and empirical character of the greater part of medical education proper, it is, in our opinion, of the greatest importance that in the teaching of the pure sciences to medical students there should be as little empiricism and rule-of-thumb as possible; and it is, therefore, just in his study of chemistry that the future physician and surgeon should receive an insight into the scientific use of the understanding.

Now, it is in this respect that the work before us, which contains a large number of facts arranged in a handy form, falls short of what is required. The subject of physiological chemistry is still at best such a very empirical one, that it becomes the more necessary to give an