lived, however, some seven or eight weeks, were active, seemed well and happy (?) and, as far as we know, never ate a mouthful of anything during the entire time. I neglected to mention that the old snake shed her skin once during her captivity, unfortunately, it was during our absence, and we did not witness the operation.

It certainly seems strange that, with so much fasting, they none of them should look thin and poor, but should apparently grow and increase when having consumed nothing.

MRS. W. A. KELLERMAN.

Columbus, O., Jan. 9.

Geographical Variation in Birds.

IN your issue of Jan. 6 there appears a communication entitled "Geographical Variation in Birds," containing several remarkable statements, two of which I would like to correct. In speaking of "desert coloration," this writer says: "If the scorching sun of the desert regions will bleach out one species, why will it not do the same for another? The plea of adaptation of coloration for protection cannot be urged here." Such a conclusion does not follow, and the plea of protective coloration might reasonably be made, because the "bleaching" of which he speaks did not take place during one summer, but is the result of natural selection for an unknown number of generations, and, while in some species this protective coloration has proved beneficial, it does not follow that in other species with different habits natural selection would work along the same lines.

But this is only a slight error compared to the following astonishing paragraph, which I quote in full, the italics being my own: —

"Not only are colors affected, but size as well, by geographical position. This is probably more marked north and south than east and west. *And yet the variation in size alone is not sufficient for a sub-specific division* It is not at all strange that those individuals of a migratory species which push farthest north should possess stronger bones and muscles and so be larger than those which were not able to fly so far. It would seem natural that the constant recurrence of such a difference would tend in time to form a race peculiar enough to be recognized as a sub-species. *But it has not proven true thus far in the history of the world,* and why should there be any change under the same conditions?"

If the above quotation means anything, it is that the author believes increase in size to be more or less general and due to the longer migrations of originally stronger individuals, and yet that this process of selection has not up to this time produced even a tenable sub-species! Considering these two unique ideas in reverse order, let us see whether there are not some species, or at least sub-species, based solely on an increase or decrease in size. Hastily running over the list of North American birds, we find the following interesting facts: *Troglodytes alascensis* is accepted as a different species from *T. hiemalis*, but the variation is only in the size. *Accipiter velox* differs from *A. cooperi* practically in size only. *Totanus melanolensus* and *T. flaripes* are described by Coues as "precisely the same" except for size. And, lastly, *Rallus virginianus* is "a perfect miniature" of *R. elegans*, being about forty per cent smaller.

In addition to these species, we find there are at least sixteen sub-species which differ from the original stock only in size. About half of these vary from east to west, the others north and south. Furthermore, as Dr. Coues so truly says, many American representatives of European species are "larger and better birds" than their foreign relatives, but we will not include them here, because there are generally some slight differences in coloration as well. So much for the existence of sub-specific variation in size; now, as to the idea that this increase is due to migration. If it is so, how will we account for the cases already given in the genera *Accipiter* and *Totanus*, where the differing species have practically a co-extensive range; or for the even more difficult case of *Rallus*, in which the smaller species is a much more northern bird? But the best illustration to show the fallacy in both ideas is *Dryobates villosus*. Here we have a widely distributed bird, a resident, not a migratory species, which has two accepted sub-species based solely on variation in size: the northern form, *D. v. leucomelas*, larger than normal, and the southern form, *D. v. audubonii*, smaller. How can this be accounted for on the proposed "migration" theory? To sum up the whole matter, it is probable that northern birds will average larger as a rule, especially in resident species, as they are thus better fitted to stand the severity of the climate and the other difficulties of boreal existence. Furthermore, it can hardly be denied that variation in size is in a number of cases not only sufficient to denote a sub-species, but, occasionally, where the connecting links have disappeared, to form what is universally considered a distinct species.

HUBERT LYMAN CLARK.

Pittsburgh, Pa., Jan. 13.

Pseudoaurora Not Shadows.

THE explanation of the phenomena reported by me in *Science*, issue of the 16th of December, is altogether too common an observation to leave any doubt of its failure to clear up the mystery. My calling has made me very familiar with all of the "shadows cast upon the fog by projecting arms or objects in the beam from the light," as "seen at any time when there is smoke, light fog, or mist."

The phenomena which I described was entirely new to me, and apparently distinct from *shadows* of any kind, consisting of pencils of light radiating upward from a dark arc, the centre of which was somewhat east of north, the pencils constantly changing in length, and having an apparent movement laterally precisely like those of the ordinary northern lights while I remained standing still. The characteristic coloration of the pencils was unmistakable, but not as distinct as I have sometimes seen it. I have seen the "shadows" so often under similar circumstances of smoke, fog, and mist, that I should scarcely have noticed the matter but for the dark arc with its superimposed luminous arch and the radiations described. But I spent considerable time, in making the different observations mentioned before, and took in the familiar shadows that impress the mind of Professor Hazen so strongly.

P. L. HATCH.

Anacortes, Washington.

Natural Selection at Fault.

WE are generally told by orthodox Darwinians that both the structure and the actions of animals are to a great extent dependent upon natural selection. Any organ, or any habit which is not advantageous to its species will be, it is said, promptly suppressed as a possible danger, or at least, an unremunerative demand.

Yet there are a few cases of habits which seem to have been acquired or maintained in flat contradiction to this doctrine. Every one knows that the *Felidæ*, from the Bengal tiger down to our domestic mouser, when they have seized a prey do not at once kill and devour it, but either torment it or at least sit and watch it for some time before administering the fatal bite or blow. The consequence is that the victim sometimes escapes, as we all have witnessed, when pussy is playing with a mouse. One instance at least is on record where a man, struck down by a tiger, quietly drew a dagger and stabbed the assailant to the heart. This could not have been done with a beast of prey of the canine or ursine family, as they do not allow time for devising and executing such a manœuvre. Hence we see that the peculiar conduct of the cats is disadvantageous to themselves, and we ask why it has not been abandoned. Certainly any cat which should at once devour any mouse or bird which it had caught would, in times of scarcity, have a decided advantage over its fellow-cats.

Similarly injudicious is the conduct of the domestic hen. As soon as she has laid an egg she at once announces the fact to all whom it may concern by her well-known cackling. What benefit is this outcry to herself or to her species? On the contrary, the outcry is heard by animals which are given to stealing eggs and is understood by monkeys, if we may accept the evidence of La Vaillant. There again, therefore, we have a line of conduct quite contrary to what natural selection would determine.

In man, there is not, indeed, a habit, but an organ which has lost its uses, yet is still developed in every child brought into the world. The outer ear was formerly provided with muscles by which it could be turned towards any sound for its better recognition. These muscles have become obsolete by heriditary disuse, so that in all normal subjects the ear is motionless. That it could formerly be directed so as the better to receive a sound will the less be denied as it survives in certain exceptional individuals. But as it is absent in the great bulk of our species, the question arises, Why does the external ear not gradually cease to be developed? No one can now contend that it is useful.

J. W. SLATER.

London, England.

Speed of Flight of Birds.

I HAVE always been more or less of a sceptic in regard to the high rate of speed in the flight of certain birds, but I have only just obtained a bit of satisfactory evidence from my own observations. Our wild ducks are admitted to be among our strongest flyers, but I am satisfied that the buffle-head (*Charitonetta albeola*) does not attain a speed of forty miles per hour. While travelling on the Baltimore and Ohio Railway, up the valley of the Potomac, on Jan. 3, I saw a great many ducks, nearly all of which were buffle-heads. Those who are familiar with the road will recall how closely it follows the windings of the river, so that a bird flying up mid-stream would travel just the same distance as the train on the bank. It so happened that, on rounding a sharp curve, my train flushed a pair of buffle-heads, which started up stream at full speed. On watching them I found that, instead of leaving us behind, we were actually beating them, and I am confident that their rate of speed was not equal to that of the train. We kept alongside of them for nearly a minute before they turned back down-stream. Careful calculation showed that the train was running at about thirty-seven miles per hour, so that the rate of speed for those wild ducks would be about thirty-six. I hope that others may have some evidence on this question of speed in flight which will throw more light on the subject.

HUBERT LYMAN CLARK.

Pittsburgh, Pa.

Bowser's Trigonometry.

As I have learned to admire the mathematical text books of Professor Bowser from the excellent results I have had from their class room use for several years, I was surprised to see the somewhat adverse criticism of his Trigonometry in *Science* of Nov. 25. I disagree with your critic's assertion that the best way to study trigonometry is along the line of its historical development. I believe that such a course of study would be objectionable, because of the long time it would require, and because the student would be compelled to unlearn, if I may so phrase it, many things he would necessarily be called upon to learn if he followed the historical method. It is a recognized pedagogical fact that it is easier to teach correct methods to a student who has never used incorrect methods, than to one who has. To acquire a complete knowledge of trigonometry would undoubtedly require a study of its development, to acquire the knowledge required for its proper and facile use in its many applications, does not require a study of its history.

And accordingly I believe his plan of giving the best results and methods of the best students and workers in trigonometry is to be preferred to a method which requires a student to test and reject what has long before been tested and rejected. I admire Professor Bowser's plan of giving such definitions of the functions as apply to all angles, acute, obtuse or reflex. I think some of the writers on the subject have fallen into a grave error when they give definitions of the functions of acute angles, and afterward modify the definitions to suit obtuse angles.

In Professor Bowser's development of the theoretical part of the subject, he is especially clear. His book is a readable one. He is precise in his statements, and his demonstrations are such as the average student can readily follow—which cannot be said of every book on the subject.

The collection of exercises and examples is an unusually large one, suited to every requirement, while the model solutions are truly model in their methods and arrangement. His chapter on De Moivre's Theorem is more complete than is usually given in text-books, while his final chapter on the application of spherical trigonometry serves at once to show the student its use, and to give him a glimpse of several fascinating branches of mathematics.

Your critic is hardly justified in his claim that Professor Bowser has made several historical mistakes. It is unfortunate that Professor Bowser should imply that Napier was the inventor of what are now called Napierian logarithms; but surely he is right in saying that Briggs introduced the common system in 1615, since it is generally admitted that Briggs lectured on them in that year, though his tables were not published until two years later. And why your critic should object because Professor Bowser, in speaking of addition and subtraction logarithms, refers to Zech's tables, I fail to understand, since Zech's tables are equal if not superior to any others published.

Of course, only a class-room test can determine the merits of a text-book, but this latest book of Professor Bowser is so filled with the many qualities which have made his previous books so successful that I cannot see any reason why it should not meet with a like success. H. L. HODGKINS, Professor of Mathematics.

Columbian University, Washington, D. C., Jan. 5.

Humming-Bird's Food.

IN several recent numbers of *Science* there have been notices of the habit of *Trochilus colubres* feeding on the sap of different trees. I have also noticed the fact, and was interested on becoming acquainted with *T. anna* to find that it also made this a staple article of food during the summer and fall. In this part of California there are few trees yielding a sap save the cottonwood and willow.

During a mountain trip in August, 1890, I found the humming-bird very common in the willows along the creeks, at about 5,000 feet elevation; and was pleased to find that the red-breasted sap-sucker (*Sphyrapicus rufer*) filled the office of *S. varius* to the ruby-throat. The willow thickets were very dense and composed mostly of dwarfish shrubs of *Salix lariolepis*. I forced my way into the interior, and watched the birds; sap-suckers, humming-birds, and warblers (*Dendroica auduboni*), often waiting turns at a favorite drinking-spot; though possibly the latter were more interested in the insects attracted by the honey than by the honey itself. There were often three, and even four or five, humming-birds in sight at a time. They were very tame, and very curious; coming within three or four feet of me, poising themselves on their wings and looking me over. I noticed most of these were young, and that the adult males were quite shy.

Subsequently, while teaching at Dunlap, at about 3,500 feet elevation, I found the birds as late as December feeding in the same manner.

Irrigation seems to have an important influence on the habitat of this bird.

For three years I have lived most of the time in the southern half of Fresno County, in an open plain. For the first two years I saw but very few humming-birds, and never saw them feeding on the native flowers, no matter how showy they were.

Meanwhile, the water had formed a pond by sub-irrigation on the ranch, and the same variety of willow (*Salix lariolepis*), which in the valley forms a tree 40–60 feet high and 3–5 feet in diameter, had come in thickly and grown to about 15 feet in height. This fall I noticed many humming-birds about the place, and traced them to this pond.

I have never seen but one or two sap-suckers here, but I found the birds in great numbers feeding on the sap exuding from the wounds caused by a large borer, the moth of which, about two inches across the wings, colored black and white, was flying about in abundance.

I have not as yet found them feeding upon any tree save this willow. Maples are very scarce in the Sierras of this county, and the sap-suckers prefer willows to any other tree. I have not observed that the squirrels score the bark of trees here as in the