result. The illusion is quite complete; I seem to be looking at an actual pattern. The use of a material point of regard, as the tip of the finger, was not, as Professor LeConte seems to have understood me, to aid in properly fixing the axes of the eyes, but simply to make sure on which side of the actual pattern the horopter lay — the all-important fact in the experiment. I may add, that in my case the coalescence of the images is easier with a more distant than with a nearer point of regard — contrary to Professor LeConte's experience. It seems to me that it would be valuable to secure some additional evidence as to the way in which the phenomenon strikes a person who has had no previous knowledge of its existence, say by using a stereoscope without lenses, fixing the distance of a point in monocular vision and then suddenly introducing a pattern, the observer being simply asked to estimate its distance. In closing, let me say that I lay no stress on my remarks in explanation of my own case. It really is more or less of a mystery, but it surely need not remain so. The abnormal eyes of Dalton did great things for the theory of color vision, and indeed it is from the abnormal more than from the normal cases that fruitful trains of thought are apt to take their rise. I esteem myself fortunate to have interested Professor LeConte, and I hope that this is by no means the last thought that he will give to the matter.

ARTHUR E. BOSTWICK.

Montclair, N.J., June 19.

A Night-Singing Cat-Bird.

PERHAPS it is not a rare occurrence, but I never heard of such a thing before, and I give the incident for what it is worth. A few evenings since I heard a cat-bird sing for nearly an hour just before midnight. The weather was mild, with not enough moonlight to cast a shadow. The bird's song was somewhat intermittent and scarcely so rapturous as his usual sunset or sunrise singing. In the intervals there occasionally came one or two of the mewing utterances characteristic of the bird.

A. STEVENSON.

Arthur, Ontario.

Is it a Paleolith?

A STONE axe has just been found in a field about eight miles northeast of this place, which very nearly proves (if not quite so) that man existed during, or prior to, the glacial period in North America. It was found by A. A. Newlin, on the summit-level in this (Parke) county, Indiana, on the south side of Sugar Creek. It is $6\frac{7}{10}$ inches long, $2\frac{3}{4}$ inches wide on the blade, $4\frac{3}{10}$ inches wide at the groove (or eye of our steel axes), $3\frac{1}{2}$ inches wide at the "back," or "poll," and is $1\frac{6}{10}$ inches thick, and, I am confident, was, when first made, nearly two inches thick.

One side is ground flat, and by glacial action, without any doubt. By that grind the groove was planed almost out on that side, and has been re-cut or filed out by some Indian long ages after the Indian who first fashioned the axe. The striations run from edge to poll, and the axe was moving edge forward, as the striations indicate, for they are deeper cut toward the edge, and weaker, become shallower and less distinct, toward the poll.

The opposite, or convex, side of the axe has been striated just enough to produce a distinct plane, which inclines to (or from) the flat side about eleven degrees.

The poll, the ends (as timber men call that part of the axe nearest to and farthest from the hand when using), the present convex side, and the grooves around the ends show the deepest and oldest weather-pits. Then the glaciated, flat side shows the next oldest weathering. Next, the newly-deepened groove on the flat side, and, also, a little deepening of the groove on the convex side, where the grinding had made the groove somewhat shallow, show the next oldest weathering; and, last, the smooth, whetted edge shows very little weather wear.

This axe was found about one hundred miles north of the southern boundary of the glacial drift on the Wabash River. I have found eleven places in the county where the rock, in place, is strongly and clearly glaciated, and three places have been found by other parties. The erratic bowlders which are striated on one to five sides are countless (to say nothing of those not marked), and I have examined them and studied them a great deal, and think I am not a bad judge of their comparative exposures and decompositions. As a result of my experience and judgment, I am strongly inclined to believe that this axe was made before, or during the glacier. That it was lost, or in some way fell into the sweep of the glacier and was ground flat on one side and striated a little on the other. That, after the glacier had receded, it was found, repaired, sharpened, and used till the steel tomahawk took its place, when it was cast aside. I feel confident that experienced archæologists will so decide.

JNO. T. CAMPBELL.

Rockville, Indiana.

Cloud Formation.

I wish to call the attention of meteorologists to a rather peculiar phenomenon witnessed by me several times last winter.

The slough between King's River and the San Joaquin, overflows in seasons of high water, causing dense growths of tule (*Scirpus lacustris*, or round tule, and *Typha latifolia*, or flat tule), often ten feet high. The buccaroes of the large stock ranches burn the dead matter in winter, to clear the land that the stock may get the young feed.

On Jan. 28, at 3.30 p. m., I noticed one of these fires. The wind was northwest, slight, and quite warm; the weather had been showery for a few days previous, but, saving a few clouds of the cirrus type, the sky was clear. The fire was not extensive, but made a dense smoke which rose in a nearly perpendicular column, nearly 2,000 feet, when it met a counter current of air from over the Coast Range, as evidenced by its drifting abruptly away to the northeast.

All this is a natural result of the topography of the country; but what arrested my attention was a cloud of the cumulo-stratus type, resting on the top of the column at the point of flexure, like a cap. It did not appear to drift away, nor did it grow larger or diminish, save that from its base it gave off a cloud of the nimbus type, that mixed with the smoke and gradually increased and extended, till, at about 10 o'clock p. m., it extended across the northern horizon, like a dense rain cloud. Meanwhile, other clouds began forming at sunset, and it rained before morning.

On Jan. 29, it cleared away, another fire was started, the smoke rose in a column to the same altitude, struck the current, and drifted away, no cloud forming. The same thing happened on the 31st. On Feb. 1, the apparent conditions were the same, save a few clouds came in from the coast, but were soon dissipated. In the afternoon I saw the fire start, and watched it. The smoke rose as before, and struck the upper current of air. Immediately a cloud formed. In less than half a minute it had reached its usual size, as large as the column, which it seemed to cap. It was a dusty day, so the column was often broken. I saw it blown from under the cloud, and a new one form three times in about five minutes.

I now noticed that, whereas the smoke drifted down the wind, with its upper surface a horizontal plane, the liberated clouds ascended into the wind in the manner of a kite. Once outside the influence of the smoke, they were dissipated like the rest of the clouds. General showers prevailed throughout the valley for the next three days.

Reasoning from my limited knowledge of physics, I might think the cloud was caused by a column of heated and vapor-laden air rising with the smoke, and being cooled by coming in contact with the upper current, causing its vapor molecules to agglomerate into cloud particles; but, for various reasons, I think this inadequate. I have since seen the fires several times, with a southerly wind, which generally brings our rain, but no cloud formed.

I have seen a theory advanced that vapor molecules need some solid nucleus to start the process of agglomeration. Can any one tell if this be so, and, if it is so, the rank that carbon takes as a condenser?

I would also like to know why no cloud formed save in a "chronic" state of the weather; and finally, why did the liber-

ated clouds float into the wind in opposition to all known physical laws?

I cannot help but think that had a meteorologist been on the spot, he would have been able to throw light on the subject of cloud formation and precipitation. ALVAH A. EATON.

Riverdale, Cal., May 20.

Birds that Sing in the Night.

I WAS somewhat surprised that the writers under the above caption in the Dec. 2 and 16 Nos. of *Science* omitted some of the most familiar night-singers of the Atlantic seaboard of the latitude of New England. While never having heard some of those mentioned, I have often heard the field-sparrow, *Shizella pusilla*, break forth into rapturous song by night, especially if the moon be shining, at the nesting period.

Another of the most common night-singers is that songster of songsters, the prince of the thrushes, the Wilson's thrush, or "Marten," *Turdus fuscescens*. During late May, June, and early July he prolongs his vespers till nine or ten o'clock, and often breaks forth at intervals throughout the rest of the night.

Another songster is the cuckoo, whether the yellow or blue-billed, I know not. He generally sings in the low ground, and is popularly supposed to foretell rain. "Oft in the stilly night," while the moon was playing hide and seek with the clouds, and a thin mist was creeping slowly over the landscape, have I heard the "rain-bird's" voice come weirdly from the swamps. At first low and indistinct, perhaps owing to the inequalities of the atmosphere, a few steps may suffice to place one so it is heard with startling distinctness. At such times the sweetness of his voice is enhanced, and, as the clear, liquid notes swell on the stillness, we forget to quote Shakespeare: "The nightengale if she should sing by day, would be thought no better a musician than the wren," but rather burst into the rapturous quotation of a later poet:—

"O cuckoo! shall I call the bird
Or but a wandering voice!"

Then we forget the songster's ill-repute as an egg-thief, forget his benefits to the agriculturist, and love to feel the author of this melody is of supramundane origin, and not of earth, earthy. If a few birds' eggs mixed with a diet of tent caterpillars will make such a voice, let him have them, by all means. I heartily believe the bluejay is author of most of the mischief laid to his door, as I have seen him take both eggs and young of the smaller birds.

The horned lark, *Otocoris a rubea*, is the most common night-singer in California, at least the valley. ALVAH A. EATON.

Riverdale, California.

Books for Children.

MR. FRANK WALDO, in *Science* for June 16, asks for lists of books that will enable children of ten to call by name the natural objects they meet in their rambles.

He says that those books which he has seen do not give the "necessary details." Therein lies the difficulty with children of ten years of age. As soon as the necessary details are given so many scientific words have of necessity been used that the results are beyond the comprehension of the clientage to which he proposes to cater. Those whom he wishes to reach, need just what he himself states at the end of his letter he was so fortunate as to have, viz. a personal guide and instructor.

The best book, for children, about flowers, with which I am acquainted, is Gray's, "How Plants Grow." Bright children of 12, if properly instructed, could use it in the woods and fields and find out, without the presence of a teacher at the time, the name of any of the larger and more interesting of the flowers, excluding, of course, the golden rods, daisies and other compositæ.

In the correspondent's state, New Jersey, there are several hundred species of birds, and many of them have nests and eggs so nearly alike, that by them even oölogists cannot tell the species with certainty. Most birds give several different notes, some an extensive range; nearly all sing differently at different times of the year. The bird book asked for — one that will enable a person of ten or any other age to name "free birds" without a teacher — is an impossibility.

The best book on birds, is probably Coues's "Key to North American Birds," but it could not be used by children under 15.

French's "Butterflies of the Eastern United States," is probably rudimentary enough for children of 12–14, provided a little preliminary work were done by an older person who understands the vocabulary used by the author. My own "Trees of the Northern United States" deals only with the leaves, bark, and occasionally the fruit, and contains as few scientific words as possible, and those are all defined with added illustrations whenever at all necessary. This fact, and its containing an accurate picture of the leaf of each species, ought to enable even those of ten to use the book. Binney's "Land and Fresh Water Shells of North America" contains illustrations of all the species, and, as far as these will enable one to name shells, ought to be all right for children. I attempted in my "Mollusks of the Atlantic Coast" to make an easy book to be used by children of 14 or more in naming the shells of the shore.

The beetles are too numerous in species for any book, large or small, expensive or otherwise, to enable children or even grown people to name all or even a majority of them. The moths are also very numerous in species and so far no one book, cheap or high priced, names them all. AUSTIN C. APGAR.

Trenton, N. J.

Teaching of Biology.

THE recent discussion in the pages of *Science* as to the methods of teaching biology now in vogue in this country, has brought out much that is of interest to all who seek to present that subject in a fair and unbiased manner to their students. Ignoring the controversial phase, which too many of the letters have shown, is there not, after all, the question yet remaining—How shall biology be taught?

Circumstances are alike at no two colleges in this country; differences of courses, students, surroundings and many other factors make it necessary that each teacher should solve the problem for himself. But in a large number of institutions the plan of study is such that unless a student elects to specialize in biological lines he will receive but one, or at most two, terms of training in natural history.

In such a case what is the best plan to adopt? A course in botany will give the student a slight acquaintance with some of the flowering plants only if the course be the one usually given in such cases. On the other hand, a course in zoölogy would leave the student with no knowledge of plants and but little of animals. He will receive no farther work in either line during his course. What will be the best for *him* in his life after leaving college?

After much consideration, the writer has sought to find a way between the two horns of the above dilemma by seeking to present fundamental principles, illustrating and demonstrating them by examples taken from either the animal or vegetable kingdom, as might be most advantageous. In this work the form itself has received far less stress than the principle which it illustrated, and the bearing it might have on the question whether the course was more botanical than zoölogical was not for a moment considered.

It was found convenient to begin by assuming that, in a degree, animals and plants are machines for the transformation and utilization of energy; adding to this, during the course, a consideration of the problems which must be successfully met to ensure existence and comparative study of the various ways in which these problems are solved.

The result of this course has been to encourage me to continue along these lines, reserving for psychology, which follows, the task of checking any tendency to regard living things as machines only. Looking over the ground covered, I find that nearly two-thirds of the examples chosen to illustrate the various principles were from the vegetable kingdom. Surely, whatever else it may be, this is not a course in zoölogy masquerading under