few of them," etc. Everybody will understand the meaning of the sentence, which was, that a close examination of what he had assumed to be facts might lead to the rejection of a part thereof.

But it is also perfectly plain that all of this has really no bearing on the point at issue. It is always easy to quibble about words and phrases, while it is not always easy to avoid error in observation or erroneous deductions from correct observations.

If Dr. Shufeldt's observations and conclusions are correct, they are of the highest importance, and they must be subjected to the most searching examination before acceptance. I must still confess that there is much that is mysterious to me in his account of his sensations and observations. I do not understand what he means by saying, "My entire system seems to become thoroughly charged with this animal electricity." His "sense of the most profound relief," etc., in the case of the mulatto girl, is a mystery to me. His inability to use any other than a rubber penholder, and the statement that "even then the constant passage of the electricity is exceedingly exhausting during most of the time," are hard nuts for me to crack. In short, the whole matter hinges upon the question with which my first letter closed, — "Is man one of the extremely small number of animals having specialized electrical organs?" for only in that case is the expression 'animal electricity' properly applicable. In that letter I gave reasons for the belief that all such phenomena, the existence of which was certainly established, were nothing more than cases of accidental electrification by well-known methods and under long-recognized conditions; that under similar conditions no differences among individuals could exist; that such electrifications had been known for a long time, and that no extension of well-established principles was needed for their explanation.

To this statement nothing need be added until Dr. Shufeldt, or some one else, shows that it is insufficient to account for observed facts.

T. C. M.

Terre Haute, March 27.

A sensitive wind-vane.

In the last number of *Science*, under 'A sensitive wind-vane,' the statement 'The notation is the same as,' etc., should be 'The notation is opposite that,' etc. H. ALLEN.

Washington, D.C., March 25.

As suggested by Mr. Allen in his interesting letter in *Science*, No. 216, it is important first to determine what is meant by a sensitive vane, and still more important, in my judgment, to determine what kind of a vane is wanted in meteorological observations. I have experimented a good deal with both the long, heavy vanes, and those which are short and light. Neither variety, as ordinarily constructed, is satisfactory. I have more than once seen two large 'standard' vanes, on the roof of the office of the chief signal officer in Washington, sullenly staring each other in the face, while a very light breeze held a short and very light vane nearly at right angles to both of them. Such performances are confusing, to say the least. But it seems to me not impossible to have one vane which shall satisfy all the requirements. The desired conditions are to be met with in what is known as the *dead beat* galvanometer. In this, the needle under the action of a steady current, whether strong or feeble, moves to its proper position, does not go beyond it, and does not vibrate about it. This is brought about by making use of a force opposing the movement of the needle, which increases with the angular velocity of the needle, and is zero when the needle is at rest. Something of the same kind ought to be accomplished, and I think may be, for the wind-vane. The force opposing the motion of the vane should increase with its velocity, and *should be zero when the vane is at rest.* If the latter condition is strictly satisfied, it will be infinitely sensitive: the slightest breeze will move it, but the opposing force will prevent violent oscillations. Such a vane will be somewhat slow in its movements, and may not respond to extremely rapid fluctuations in the direction of the wind, through only a few degrees; but I do not believe meteorologists will consider this a serious objection. What is wanted is a vane which will be steady in a high and somewhat varying wind, and which can be controlled by the slightest movement of the atmosphere. About two years ago I suggested what appeared to me to be a solution of the problem. It was to use a small and extremely light vane, so as to reduce ordinary friction to the lowest limit, and then to 'deaden' its motion by means of a liquid damper. This might be applied at the extremity of the axis of the vane produced below the roof, or at any points in that axis. A fan attached to the axis, and moving in a closely fitting vessel of oil or other suitable liquid, would afford almost any desired degree of stability.

Some steps were taken towards the construction of such a regulator, but I do not think it has ever been completed. Possibly the same method may have been experimented upon by others. T. C. M.

Terre Haute, March 27.

A question for economists in regard to value.

Will not economists undertake to make some agreement as to what the meaning of the word 'value' is to be in scientific discussions? That a uniform meaning be given to this word is most essential to an intelligent discussion of an economic subject.

As an instance of the necessity of such an understanding, see the last number of *Science* ('Professor Marshall on the unit of value'). In that the professor evidently assumes that the market-price of commodities is their 'value.' Yet we all know that the price of a thing may be greater or less than its 'value' or worth. In order to establish a 'unit of value,' the professor proposes a plan whereby the variations of prices of commodities shall be averaged, and that plan implies that a dollar (money-unit) shall be established whose weight shall be increased or decreased from time to time as the average commodity price increases or decreases. All this is a matter of *money* and *price*, and not *value*. The real thing to be determined is what is *value*, and then a measure may be designed for it.

At present there is among economic writers a great confusion in the use of the word 'value.' Some, as Professor Marshall, use it as meaning price (market-price); some, comparative utility; some, exchange value; some, cost of production in terms of human labor; and some, "the average amount of socially requisite labor measured by time" involved in the production of the article. I hold that this last is the

best definition of value or worth, and that it should be adopted as the scientific meaning of the term.

At any rate, a discussion on this topic is most timely. The basic idea of the modern labor movement is the idea that workingmen do not get an *equivalent* (equal value) for what they produce. If scientific men are to take any hand in practical politics or applied sociology, this is the point where their work is most required at present.

E. LANGERFELD.

New York, March 26.

The destructive caterpillars of the squares of New York.

Since the importation into America of the quarrelsome, active, and noisy English sparrows, which have driven the quiet and brilliant birds of the south from the city gardens and parks, a new prolific horde, with fierce appetites, every year more extended, threatens to destroy our fresh and green shade-trees.

As early as 1882 the *New York evening telegram* sounded a note of alarm on this subject, to which we added another, but without effect. When nature threw off its summer mantle, and this ravaging army quietly took up its winter quarters, every thing seemed to be forgotten, and our modest communication no doubt went into the pigeon-hole of oblivion; nevertheless, we try again.

After three years' study of the devastating habits of caterpillars, we tried to engage the attention of the committees having charge of the city parks; but to no purpose, for in the summer of 1883 the enemy had greatly multiplied. After some years of neglect, it was too late to save from destruction the plants which had become insufficient to feed the successive broods of myriads of caterpillars. The new-comers soon got beyond the city limits; and once getting a foothold in the suburbs, science, the fruit of observation, could no longer keep within bounds the voracity of these unattackable hairy pests.

The damage of one year may be unlike that of the preceding or following; atmospheric changes may destroy multitudes; but the enemy is prolific, and will in a year increase ten, a hundred fold, and even more.

As the press of New York and even intelligent citizens may think that this enemy has disappeared, we raise a new cry of alarm, addressing ourselves to the learned societies of our adopted country, at the same time communicating the results of our studies to intelligent readers interested in the natural sciences. Our statements will be based on facts observed by us in New York, supported by the testimony of learned colleagues with whom we (myself and son) have corresponded for more than two years, during which we have studied the increasing ravages of this coquette with brilliant, silky, and variegated dress which science names the Orgyia caterpillar.

When the European sparrow was first introduced into the parks of New York, a caterpillar was there committing great depredations. Linnaeus called it the geometer: we call it looper, spanner, and canker-worm. The larva has six feet on the first three segments, and four on the last two, and as it progresses seems to measure the ground. The sparrows were very fond of this caterpillar, to a degree that their increasing numbers speedily exterminated it: for this they deserve our gratitude. It was different with the larvae of the Orgyia. Consequently we have thought it might be of interest to the public to say a little of what is known of the habits of the first as compared with the second equally destructive species. The first still exists in many private gardens in New York

Phalaenidae. — The butterflies which come from the larvae of the geometers almost all have the body slender, the thorax narrow, and wings proportionally wide; their flight being consequently more uneven and jerky, more unsteady, than that of the nocturnal species: the flight, in fact, is more like that of the diurnal ones, but is neither so strong nor of long duration, on account of the comparative weakness of the framework of the wings. They especially like serene and still evenings and nights. But there are to this characterization many exceptions. Some of the Phalaenian larvae have 12 legs, and some even 14; among the nocturnal species, again, some have 12 and others 14 legs; the general rule being 16 legs among the nocturnal, and 10 among Phalaenians. It is also a curious fact that the larvae of those with 16 legs loop in progressing, for some reason making no use of the intermediate legs.

Another kind of exception is that some Phalaenians which are nocturnal, a small number it is true, have a diurnal flight; that is to say, that certain species fly in full sunlight, gathering food on flowers in company with diurnal butterflies: so that the division into diurnal and nocturnal species is, in this respect, conventional. It is, however, true that day butterflies have almost always the antennae club-shaped, and come from larvae with 16 legs; while the Phalaenians, whose larvae have 10, 12, or 14 legs, have filiform or pectinated antennae.

There are in Europe some 600 Phalaenians, 700 nocturnal, and 400 diurnal butterflies; though it is probable that in hot climates the diurnal are more numerous than in the temperate. The Phalaenians, especially in cold regions, have usually sombre colors, gray or black, though there are many exceptions. In France there is a large and handsome green species, which is a common symbol on the tombs of children, probably on account of its delicate form and color. They hatch at all seasons of the year: there is even a group (Hyberniadae) which appears in December, January, and February. The Phalaenians may emerge from the pupa even below 50° F., while the others, and especially the diurnal species, require at least this temperature.

In Hibernia we find a singular fact. The females have either no wings, or semi-wings unfit for flight. As the pupa is generally in the earth, the female, on emerging, crawls up the nearest tree, where pairing takes place; the male bearing her to the top of the tree, and sometimes carrying her off in his flight. The females are small; and the males, much larger, deposit them in places proper for the support of the larvae, — buds of flowers, or masses of leaves, according to the species. There are in this group some veritable pests for man. The H. de foliaerio sometimes so destroys the leaves of forest-trees, that, unable to respire, they either die or partially wither. The H. brumata consumes every thing in the orchards, attacking the flowers of all kinds of fruit-trees.

It would be interesting, but impossible here, to speak of the habits of many of these butterflies, and to note their exceptional characters; but a single example must suffice. There is among the Phalae-