bucolic readers, and they doubtless serve their purpose: it is, however, a fair question, whether a scientific man has the right to bury his discoveries, or even the confirmatory results of his researches, by giving them only to publications of this character. The wheat may be served up with chaff as provender, if need be; but a portion of the same wheat, judiciously winnowed for presentation in the journals of our learned societies, or in the established periodicals which are widely accessible to scientific men, would doubtless yield a fairer return to science. It is, in short, exasperating to find important facts regarding the structure and the life of domestic animals and cultivated plants published only in the midst of details which are of little interest to any one, except as they may have a remote influence upon possible appropriations by a legislature. We submit, that it is the duty of experimenters, who are obliged to publish in such ephemeral, not to say trashy pages, to present the scientific features of their useful work also in a more worthy manner.

THE account given in our notes, of an engineering work planned in western New York, may serve to convince those cautious legislators who look chiefly for immediate results from the forces which they set in motion, that even so theoretical an affair as a state topographical survey may have direct and practical ends. A large swamp occupies a district that might be valuable agricultural land, and spreads its unhealthy exhalations over the adjoining country. The farmers thereabouts, impatient at the slowness of the outlet-stream in cutting down the rocky barrier that holds up the swamp, ask for state aid to hasten the deepening of the channel. The state surveyor is called to their aid: he examines the ground, and reports that the undertaking is entirely feasible, and that, while thus to discount nature's work will cost somewhat over one hundred thousand dollars, the operation may nevertheless commend itself even to the most careful counter of the cost, for the value of the drained land will be increased over one million dollars.

LETTERS TO THE EDITOR.

The cranial ribs of Micropterus.

IN No. 65 of *Science*, Mr. Shufeldt has called attention to a pair of rib-like structures articulating with the 'base of the occiput' in Micropterus salmoides. He is apparently inclined to refer them to an occipital vertebra. Sagemehl has lately (in the *Morphologisches jahrbuch*) advanced a theory to the effect, that, in the occipital region of all teleostean skulls, there are a certain number of vertebrae which are to be compared to the anterior spinal vertebrae of the elasmobranchs, and which have fused more or less completely with the true coalesced occipital vertebrae; i. e., those corresponding to the vagus branches. Without either condemning or supporting this theory, I may point out, that, even though spinal vertebrae should have been taken up into the skull, there is no apparent reason why their ribs should persist. The ribs of teleosts are ossifications of the internal portions of the myocommata, and on the disappearance of these, consequent on the abortion of the segment, one would naturally expect the disappearance of the ribs also.

I have, unfortunately, not been able to examine a black bass osteologically, and therefore cannot speak with any degree of certainty as to the nature of the structures described by Mr. Shufeldt. There is, however, a very possible explanation for them; and that is, that they are portions or rudiments of the supraclaviculae. In many fish these are two T-shaped structures, the portion corresponding to the perpendicular limb of the T being, in each, horizontal, and articulating with the lower portion of the occipital region; while one end of the portion corresponding to the transverse limb articulates with the pterotic and epiotic, and the other end with the mesoclavicula. If the perpendicular limb were to ossify separately, or if the transverse limb should become rudimentary, a condition would result, apparently similar to what Mr. Shufeldt describes.

This is, of course, merely a suggestion, thrown out for the purpose of arriving, if possible, at a correct identification of these peculiar structures.

J. PLAYFAIR MCMURRICH.

Ontario agricultural college, Guelph, Can., May 13.

A singular optical phenomenon.

The phenomenon described by 'F. J. S.' in *Science*, No. 57, and which I at first thought must have been a binocular phantom image, I now think has been truly explained by Mr. Oliver in No. 63. If so, it is only one of a class, examples of which may be seen on every side. I never pass a picket-fence, with another similar fence beyond, without observing and admiring the broad waves of interference running rapidly in one direction or the other. I never look through two fly-screens, one behind the other, without remarking the tortuous shifting waves of interference, like waves of *watered silk*. A lady's silk veil loosely folded shows the same effect beautifully. Of course, the phenomenon is well known and understood; but I was misled by the fact that 'F. J. S.' described it as in mid-air, and nearer the fly-screen. I suppose it may be imagined at any distance, but is usually referred to the plane of one of the objects.

JOSEPH LECONTE.

Berkeley, Cal., April 28.

Popular names of California flowers.

A botanist, coming to the Pacific coast, may be surprised at the large number of plants that are generally

known by their true scientific names. This is the case with Eschscholtzia, Romneya, Clematis, Isomeris, Silena, Malva, Ceanothus, Hosackia, Ribes, Phacelia, Gilia, and many others for which the generic name has become a popular name.

This is owing to various causes, one being the difficulty of applying the old familiar garden names; which are used, however, when any resemblance can be traced, as is the case with larkspur, honeysuckle, columbine, etc. Many of the settlers have also become familiar with the true names of these flowers by having received them from parties that have introduced them to cultivation, for which the greatest credit is due to the late James Vick.

Many visitors, as well as settlers, seek to learn the names of the many strange and beautiful flowers, that, by massing, become such a feature in the scenery, and find the 'dry' scientific names as easy to learn, and as sensible, as the old Spanish names, but few of which survive in the popular mind. Thanks to the little botany of Volney Rattan, largely supplemented by visiting and amateur botanists, all are enabled to learn the more common species with comparative ease. C. R. ORCUTT.

The use of the method of rates in mathematical teaching.

In the case of the question, "Does change in the rate of motion take place at an instant, or during an interval?" I am surprised to find that Professor Wood (*Science*, May 16) regards my amendment as only increasing the difficulty. It may be that I have been misunderstood: permit me, therefore, to answer the questions which the professor goes on to ask in illustration of this difficulty. Assuming (of course, correctly) that my answer to the question is, that it takes time to produce a change in the rate of motion, he asks, "How long is this interval?" I answer, "As long as you please usually: of course, the longer the interval, the greater the change." — "If ever so small, is the rate variable during the interval?" — "Certainly." — "If variable, the original question arises, and we wish to know if *change* involves *a part* of the interval." — "Of course, a part of the change takes place in a part of the interval, and the rest of the change takes place in the rest of the interval." — "Does change in the rate take place at 'a point' in the path, or during 'a space' of the path?" — "During 'a space' of the path; that is, while the point is passing over a space of the path." — "If at 'a point,' is it not equivalent to asserting that a change takes place in no time? [Most certainly it would be, but we do not assert this at all.] And if an interval is necessary, must it not be conceived as infinitesimal?" — "By no means: if you want a finite change, and that is what is usually meant by a change, you must take a finite interval of time; but, if you insist on introducing the conception of an infinitesimal change, you must admit also an infinitesimal interval of time." Let us put precisely parallel questions with respect to the *position* of a moving point. Does change of position take place at an instant, or during an interval? During an interval. How long is this interval? That depends upon the amount of change of position you desire to produce. If ever so small, is the position of the point variable during the interval? Certainly, if the point moves. Does change of position take place at a point in the path? Certainly not: a point has position, but no magnitude.

If there is any difficulty in conceiving the velocity of a point to be continuously variable, there is precisely the same difficulty in conceiving the abscissa of a point moving on the axis of x to be continuously variable; in other words, in conceiving the possibility of motion itself. It should be remembered that the definition of the measure of a variable velocity, presupposed in this discussion, is simply that which we find in such treatises as Tait and Steel's Dynamics of a particle: "Velocity is said to be variable when the moving point does not describe equal spaces in equal times. *The velocity at any instant is then measured by the space which would have been described in a unit of time, if the point had moved on uniformly for that interval with the velocity which it had at the instant contemplated.*" WM. WOOLSEY JOHNSON.

Annapolis, May 19.

Pleuracanthus and Didymodus.

In your issue of April 11, my friend Professor Gill communicates his views on the relationships of Pleuracanthus and Chlamydoselachus, and endeavors to correct some of my opinions and statements. On some points I stand corrected, thanks to Professor Gill's superior knowledge of the literature of the subject. However, as Professor Gill has not seen my material, nor the paper which I read before the Philosophical society upon it, I may, in turn, enlighten him on some important aspects of the case.

Professor Gill objects to the identification of the genera Didymodus and Chlamydoselachus on the sole ground of the diversity in the form of the teeth. He probably has other reasons for objecting; but, with his usual magnanimity, he has not used his most effective weapons. He doubts the pertinence of the recent and extinct genera to the same order. He points out that the oldest name of the genus called Diplodus is Pleuracanthus, and that my order Ichthyotomi has been already defined and named by Lütken as the Xenacanthini.

On these positions, I make the following comments: —

1. There is no generic difference to be detected, in my opinion, between the teeth which are typical of Diplodus Agass. and Thrinacodus St. J. and W. and the recent Chlamydoselachus. Differences there are, but apparently not of generic value. The identification of the recent and extinct genera rests, as far as this point goes, on the same basis as that of the recent and extinct Ceratodus.

2. At the time of my proposal of the name Didymodus, I was not convinced that fishes of this type bore the spines referred to the genus Pleuracanthus Agass. None of the authors cited figure any specimens which present both tricuspidate teeth and a nuchal spine. None of my ten specimens possess a spine. However, Kner describes two specimens as exhibiting both tricuspidate teeth and a spine, and Sir P. Egerton's statements (*l.c.*) on this point are positive. So we must regard Pleuracanthus as the name of this genus, with Diplodus as a synonyme.

3. Diplodus being regarded as a synonyme of Pleuracanthus, it follows that Chlamydoselachus Garm. is distinct on account of the *different structure of the dorsal fin*, which is single and elongate in Pleuracanthus, according to Geinitz and Kner. The presence of the nuchal spine in Pleuracanthus is also, probably, a character of distinction, although we do not yet know whether such a spine is concealed in Chlamydoselachus or not.

4. The identity of Didymodus (type, Diplodus compressus Newberry) and Pleuracanthus may now be questioned. None of the specimens are figured and described by the authors above cited, as displaying an occipital condyle, or posterior frontal cornua. My specimens of Didymodus compressus do not exhibit