ŒCOLOGY.

TO THE EDITOR OF SCIENCE: I share Professor Ganong's surprise that, after the word 'ecology' had been fully discussed in your columns by many leading naturalists (of whom Mr. Ganong was one), you should have admitted my belated remarks. I can only suppose that you recognized, what Mr. Ganong seems to have forgotten, that I am not responsible for the intervention of the Atlantic Ocean. Still I confess that I should not for the moment have forgotten the difference between the American and English languages. I can only say that if the spelling 'ecology' be not a vagary, the fact is to be regretted, since such contractions undoubtedly mislead those who wish to follow the excellent example of one of your correspondents and to use the Greek lexicon. I do not recognize the parallel with 'economy,' a word which came to us through the French, and which is a familiar everyday word, whereas 'œcology' is, and no doubt will long remain a purely technical term. I infer that here I have the support of Mr. Lester F. Ward.

As to the meaning of 'œcology,' I am glad to find myself in entire agreement with Mr. Ganong and Dr. Theodore Gill. But when the former belabors me for bringing a false accusation against botanists, in saying that they have restricted the meaning of the term, I must defend myself. I do not profess to speak with the authority of Mr. Ganong, whose studies in this branch of natural history we all admire; I speak merely as a casual skimmer of such publications as SCIENCE. It certainly appeared to me that the two authors whose papers suggested the recent discussion, namely Mr. H. S. Reed and Mr. H. C. Cowles, used the term as meaning 'œcological plant-geography.' The former entitles his paper 'The Ecology of a Glacial Lake'; does Mr. Ganong seriously maintain that this means 'The science of the adaptation of a glacial lake to its surroundings?' The latter (whatever he may have said 'in his elaborate paper' here distinctly asserted that the 'phytogeographic' was one of the two aspects presented by 'all ecological problems,' and his paper dealt solely with this aspect. Your own editorial explanation of the term laid even more stress on geographic distribution. Surprised at this, I consulted one or two botanical friends, who assured me that by 'œcology' they really did understand the study of plant-associations. I therefore turned to Mr. Robert Smith's paper in *Natural Science* and found that he did not use the term 'œcology' in the same sense as the botanists just alluded to, but used instead the phrase 'œcological plant geography,' which I quoted in my previous letter. Mr. Ganong need not have hunted up all the instances of the words 'œcological' and 'œcology' in Mr. Smith's paper. I admit that the latter does occur once (Mr. Ganong says 'four times'). But my whole point was that Mr. Smith used it with its full and correct meaning, and that he did not mention it as an equivalent for the subject of his paper.

I trust Mr. Ganong will now see that, though my ignorance of botanical literature may have led me to give too extended a form to my statement, still the use of the term in a restricted sense does actually obtain among botanists. Indeed I am assured by a botanical colleague that such use is increasing. I hope therefore that some of Mr. Ganong's hearty blows will have glanced off me on to the shoulders of the real offenders.

The whole object of a technical terminology is precision and unambiguity of language. The moment a term ceases to be used in the strict sense of its original proposer, this object is defeated.* The fact that there are signs of such a change in the case of the word 'œcology' justifies a protest before it is too late.

F. A. BATHER.

MASS AND WEIGHT.

TO THE EDITOR OF SCIENCE: I notice in your issue of June 13, a communication from Dr. Goodspeed, on the subject of 'Mass and Weight.' I am glad that attention is called

* Professor W. M. Wheeler uses 'Ethology' "in the place of the less satisfactory 'ecology'" (SCIENCE XV., p. 774, May 16, 1902). Why is 'ecology' less satisfactory, if not for this very reason?

to this subject, as I think that some reform is greatly needed. I agree with him in all that he says except that I do not think the term 'measurement' is the proper one to take the place of the common title 'weights and measures.' Under the latter title is always understood a list of the *units* and their equivalents, and therefore the term 'measurement' does not apply. In view of the fact that the units of weight are *measures* quite as well as the units of length are, it seems to me a much better title would be simply 'measures,' and I would urge the adoption of that title in place of the word 'measurement,' suggested by Dr. Goodspeed.

Carl Hering.

Philadelphia.

SHORTER ARTICLES.

Divergence of Long Plumb-lines at the Tamarack Mine.

In September last two very long plumb-lines were hung in No. 5 shaft of the Tamarack Mine at Calumet, Michigan. They were 4,250 ft. in length, being longer than in any previously recorded instance. They were of No. 24 piano wire and the bobs were of cast iron, weighing fifty pounds each. Great care was taken that there should be no interference from projecting objects nor from dropping water, of which indeed there is not a great deal in the shaft. Measurements between the lines taken at surface and at their lower extremities showed a divergence to the amount of 0.11 ft. A divergence of 0.07 ft. remained after the western wire had been moved about 1.25 ft. further west to ensure its freedom from obstacles. Thinking that the air pipes which run down the western end of the shaft might, through magnetic action on the bob nearest them, be causing this divergence, I advised the use of lead bobs in a plumbing of No. 2 shaft, which took place a little later. Although the length of the lines in No. 2 was about 120 ft. less than when they hung in No. 5, and although the lead bobs were used, there was yet a divergence of 0.10 ft.

The publication about this time in the Houghton *Daily Mining Gazette* of the fact that a divergence had been observed attracted wide attention, and brought forth many attempts to explain its existence. Those immediately cognizant of the conditions had no satisfactory theory to offer. One of the explanations was that the divergence was due to the greater attraction of the material at the end of the shaft for the bob hanging nearest it. It is remarkable how many engineers and other trained persons held to this theory. There seems to exist a general lack of appreciation of the forces of gravitation, except in the single instance of the force between the earth and objects upon it. It is of course true that the attractions on either bob toward the ends of the shaft are different, the stronger being toward the end nearest to which it hangs. Furthermore, these differences of attraction tend to diverge the lines. Their amounts, however, are in this case so insignificant as to put them quite out of consideration in attempting to explain the divergence. Their sum is only a few hundredths of a grain, and the consequent divergence only about 0.001 ft.

Professor Hallock, of Columbia University, suggested the theory of repulsion between like poles at the lower extremities of the wire, but afterwards modified this to include repulsion between like consequent poles distributed along the wires.

Permission having been granted me to carry on further experiments in No. 4 shaft of the Tamarack Mine, there were hung in this shaft bronze wires No. 20 B. & S. gauge, carrying 60-pound lead bobs. These lines were approximately 15 ft. apart and 4,440 ft. in length. By a simple system of triangulation the distance between the mean positions of their lower extremities was determined, while the distance between them at surface was directly measured. It is thought that these distances were compared with an error not greater than 0.003 ft. A small convergence of 0.028 ft. was observed. The steel wires were then hung in the same position at the top, and the positions at the bottom observed, both with lead and with iron bobs. The bronze wires were hung a second time, but somewhat nearer together, and were found practically parallel. The steel lines showed a slight con-