direct from the dry cell and wound around the rod or arm supporting the top of the drum, bent so that the short, bare, free end is directed downward. Now a second copper wire may be led from the opposite pole of the cell to the simple key and connections made from it with other wires via the inductorium to some basilar portion of the instrument. Next, a clean copper wire may be twisted or clamped to some part of the top of the revolving drum and properly adjusted in such a way that, if contact is just barely made with the first wire the circuit will be completed for an instant and the desired stimulus to the muscle will be given at certain definite intervals, always at exactly the same time on a uniform moving drum. In other words, the circuit is through the instrument and its action becomes automatic. In the case of the Harvard kymographion such an arrangement can not be used, for inasmuch as the drum is held by a spring to the sleeve which in turn fits over a tall vertical rod with its base resting on the friction plate there is no external support of the drum for attaching the wires.

Accordingly, in order to produce such automatic action on this particular type of machine, it is evident that some other device must be used. The one which has been worked out by the writer has been very successfully used at the laboratory of the University of Maryland during the past year. It consists of a thin metal disk of about 18 mm. diameter with a central opening large enough to admit the screw of the spin-screw and is held in place by means of the spin-nut against the head of the sleeve of the kymographion. To the outer under edge of this disk are soldered four copper wires of two thirds mm. diameter and about four cm. in length, which radiate out horizontally from the flat under surface of the disk and revolve with the drum. The circuit is then made complete by leading wires of two thirds mm. diameter; one series from the cell, first to the simple key and inductorium, then to the milled head, or some other basilar portion of the instrument; and the other to a tall iron-stand where the insulated wire may be wound around the upper portion of the upright rod, in order to hold it in place with about 6 or 7 cm. of the free end projecting laterally from it and vertical to the rod. Just enough of the insulation is removed from the far end of the wire to make a small eye about 3 mm. in length and 2 mm. in width, and bent so that the loop is directed downward. Into this is placed a wire pendulum made from the same kind of wire (uninsulated) having a similar sized eye at one end and being 5 to 6 mm. in length. When properly adjusted this wire arm projects out over the top of the drum of the kymographion, so that the wire pendulum just barely touches the outer extremities of the radiating arms as they come from the disk and revolve with the drum, thus making the electrical contact for just an instant, and thereby stimulating the muscle automatically.

It is of the utmost importance that the eye in the end of the wire and also the pendulum and ends of the radiating wires from the disk be kept clean and bright by means of emory paper, so that the electrical contact may always be at its highest point of efficiency. I might also mention the fact, that, if the pendulum is allowed to drag itself over the radiating arms by being too long, it will usually have a bouncing movement making several contacts and giving as many stimuli to the muscle.

It is also of advantage, although not absolutely necessary, to use a second simple key between the wire containing the pendulum and the cell, so that the circuit may be broken without stopping the instrument, or moving it away. However, one simple key in the circuit is usually sufficient.

T. L. PATTERSON
LABORATORY OF PHYSIOLOGY,
UNIVERSITY OF MARYLAND

ACCURACY IN STATING THE OCCURRENCE OF SPECIES

TO THE EDITOR OF SCIENCE: The difficulties of exact scientific expression pointed out by Mr. J. D. Kusen[1] relate to the loose use of certain words in attempting to describe the

[1] SCIENCE, Vol. XXXV., June 14, 1912, pp. 930, 931.

comparative abundance or rarity of certain species of birds in a given locality, at a given time. There are two methods of meeting this difficulty, neither of which will probably meet the approval of every one. The former of these, which will be outlined later, has grown into general use and with a reasonable exercise of common sense in judging the relative occurrences of the species, with due regard to season, meets most requirements.

The latter method will dispense with the sometimes indiscriminate and loose use of adjectives and adverbs such as "very rare," "rather common," etc., and the substitution of a system suggested, I believe some decades ago, by the late Joshua Billings. This system under proper use and a full study of any given locality will express, with mathematical accuracy, all gradations of the occurrence of any species, not only of birds but of the entire range of the vegetable and animal kingdoms.

In this system, the absolute zero and maximum occurrence of any species would be represented by exact expressions indicating accurately the abundance or rarity of a given species. The scales of abundance and rarity would cross or intersect at the gradation now vaguely expressed by the word "common," and their use would entirely dispense with any doubt as to its meaning, and also with such expressions as "very common," "not uncommon," "rather rare" and the like. Mr. Billings's system would express the superlative of abundance, like blackbirds in a tree in spring or the hairs on a dog's back, by *abundance 100;* grading down numerically to *abundance 0,* which would cover the case of no blackbirds at all or the degree of hairiness presented by a billiard ball. *Rarity 0* would express the entire absence of a given species, while *rarity 100* would express an approach to abundance which need not necessarily be noted in the terms of the rarity scale at all.

It will be noted at once that abundance 50 = rarity 50, and that any degree of accuracy can be secured by the decimal system thus:

*Myiarchus Crinetus,* abundance 67.3; or *Virco Philadelphicus,* rarity 2.7. An obvious advantage of this system is that it will cultivate close and systematic study coupled with accuracy in the expression of results, but they are both subject to serious interruptions by the habits of migration and breeding which vary the occurrence of all species to such an extent as to necessitate commencing the work over again before it could be satisfactorily completed. This, however, is not without its advantages, particularly if those who undertake to alter or direct the use and development of our language by juggling with its synonymous terms could be set at putting the system in use. But for the great mass of English-speaking scientists in search of the clearest mode of describing the things they see and of setting forth the thoughts they have, good Anglo-Saxon well understood and properly used is a strong and flexible medium.

Marsden Manson

San Francisco, Cal.

## "QUITE A FEW"

To the Editor of Science: I have just read with much interest the illuminating paper by Professor H. L. Bolley, of the North Dakota Agricultural College, in Science of July 11, with the caption "The Complexity of the Microorganic Population of the Soil."

The writer is however somewhat puzzled to know just what is meant by an expression used by Professor Bolley, in its relation to the commonly accepted standard of what is called "good English." The expression referred to is "quite a few," introduced in the following sentence: "So now, there seems to be quite a few who think they can tell a productive soil," etc.

The puzzle is, to apprehend just what Professor Bolley means by "quite a few." We can well understand that the expression "a few" means a very small number of units; and in the formula "quite a few" there would seem to be an emphasis placed on the "few" by the qualifying adverb "quite." So that in an analysis of the formula the conclusion must be that "quite a few" means a less number of units than "a few."