In drawing his conclusions with regard to the showing made by the different phosphates, the writer was governed chiefly by a consideration of the soil conditions and results of the individual series and, as he thinks, very naturally placed acid phosphate first, bone meal second, and rock phosphate third in profitableness.

With all the individual series in view, let us see the kind of formula Dr. Hopkins must use in order to arrive at his conclusion with regard to the relative standing made by bone meal and rock phosphate. The formula and his conclusions may be stated as follows:

Disregard series 4, omit one half the bone-meal data of series 3, include series 1 (conducted on a soil not poor in phosphate), and with the acid of series 2 obtain averages which show that, as used, the bone meal returned more profit than the rock phosphate. Now, make the unwarranted assumption that the profit from bone meal would decrease in direct proportion to the quantity used, and obtain the result that a dollar invested in rock phosphate made a profit of 39 cents more than a dollar invested in bone meal, or, the rock phosphate was superior to the bone meal. Q. E. D.

In Science, March 2, 1917, page 214, Dr. Hopkins says: "The calculated profits mentioned in Professor Mooers's Science article[3] are evidently based upon different valuations than those reported in the bulletin." The writer finds that the calculated profits for both acid phosphate and rock phosphate, as given in the Science article referred to, should be divided by 2. This, of course, does not affect the relative standing of the two materials. One dollar invested in acid phosphate shows an average profit of \$2.14 per acre where the cowpea crops were turned under, and of \$2.71 where removed, but one dollar invested in rock phosphate gave an average return of only \$1.29 under either condition. The writer has assumed that Dr. Hopkins could give a simple explanation for his conflicting estimates, as given in Science, November 3, 1916, p. 652, and in Science, March 2, 1917, p. 214. In the former article he says, "For each dollar invested rock phosphate paid back \$2.29," but in the latter article he says, with regard to the same data, "Easy computations show profits per \$1.00 invested of . . . \$1.29 from phosphate rock."

From correspondence with dealers in rock phosphate, the writer is informed that until about six years ago the usual guarantee of fineness for the rock phosphate sold to farmers for fertilizer purposes was that 90 per cent. would pass through a 60-mesh sieve, but that the present guarantee is for 90 per cent. to pass through a 100-mesh sieve. Dr. Hopkins seems to have this in mind when he says, "Raw rock phosphate is now procurable in very much better mechanical condition than when these experiments were conducted."[4] That he was in error with regard to the rock phosphate used in the experiments referred to may be seen by reference to page 59 of Bulletin 90, where the following statement is made: "90 per cent. was found to pass through a 100-mesh sieve."

In conclusion, the writer will add, that on page 60 of Bulletin 90, the content of total phosphoric acid in the rock phosphate was stated to be 33.9 per cent. The usual guarantee and expectancy for this material, as sold to farmers for fertilizer purposes, is a little under 30 per cent. With perfect fairness the calculations for phosphate rock used in the experiments might have been placed on the latter basis, and an increase of 13 per cent. can be properly allowed—as was referred to on page 59 of the bulletin—to the estimated cost of the applications made. This change would appreciably increase the unfavorable showing made by the phosphate rock.

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[3] Science, January 5, 1917, pp. 18 and 19.

[4] Science, March 2, 1917, p. 214.

A METHOD FOR OBTAINING AMŒBA

In common with many teachers I have found it necessary, at the opening of college in the fall, to provide large numbers of the indispensable amæba. I venture to set down a method which I have found successful during several years. Publication of other methods for obtaining a large and more or less continuous supply of these animals has not been infrequent and many are familiar with use of *Elodea* (*Philotria,* Michx.-Britton), *Ceratophyllum* and other aquatic plants.

The ditch-moss is not readily found in many localities. My personal experience with several aquatic plants yielded indifferent results and failed to give sufficient numbers until, by chance one season, I tried the marsh plant, *Elodes campanulata* (*Triadenum virginicum* (L.) Raf., see Britton and Brown) and was rewarded with large numbers of amœbæ. Although absence from town in some seasons occasioned a too long interval between the times of collection and the use of the material, or made it impossible to provide the proper sequence of cultures, I have seldom been disappointed in finding the animals, though they may not have come just when wanted.

The usual custom was followed in making up the cultures. Crystallizing dishes or battery jars—the shallower dishes gave the better results—were crowded not too densely with the stems of the plants. The stems were usually cut two or three times. Tap water and water from the pond or marsh where the plants were collected were used, separately, but no difference in results was noted. The dishes were covered with plates of window glass, placed in a room of moderate temperature and there allowed to remain in diffuse light for a period of three weeks or more. When pains were taken to collect the plants at intervals and provide a sequence of culures the results were most gratifying.

I have used the plant from four different localities, collecting from the water and from banks where the plants could only have been submerged at high water and mixing, with success in all cases. Since the locality seems not to be a controlling factor, and since the cultures of tap as well as pond water yield the animals, I assume that the *Elodes* is favorable for the original lodgment of amœbæ and their later multiplication.

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CROSSING-OVER IN THE SEX CHROMOSOME OF THE MALE FOWL

Several years ago an experiment was begun with the object of studying the inheritance of several sex-linked characters associated in the same individual, but the experiment had to be laid aside until last year. The second generation chicks are now at hand and prove beyond doubt that crossing-over takes place between the sex chromosomes of the male fowl.

In this preliminary report attention will be confined to the factors themselves, without regard to the somatic appearances of the individuals. Three dominant sex-linked characters, viz., B, I, and S were employed. B and I were introduced on one side; S, on the other. Hence the F_1 males were all BI, S,; B and I being in paternal (or maternal) sex chromosome, S in the maternal (or paternal). These males have been tested by mating them back to females of the composition b Is, b is.

If there were no crossing-over, offspring of this back cross showing the combination of somatic characters found in the F_1 male, would not occur. Actually, however, they do occur, thus demonstrating that crossing-over has occurred, a chromosome having the composition B I S, having been formed. Other cross-over classes have appeared, but the one cited is the one at the present age of the chicks, most easily recognized.

No crossing in the female is to be expected on theoretical grounds. None was observed in the original cross. Partly because of practical reasons and partly because no new combinations were available in F_1, it seemed wise to defer a test of this point until next season, when the new combination B I S should be available in the mature female.

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THE EQUAL PARALLAX CURVE FOR FRONTAL AND LATERAL VISION

In the article by Mr. C. C. Trowbridge on "The importance of lateral vision in its relation to orientation"[1] is given an equal parallax curve showing the distances that a man

[1] Science, N. S., Vol. XLIV., No. 1135, pp. 470–474, September 29, 1916.