

beginning with the seed and germination. Dr. Cavers lays some stress on the second chapter, which is intended to impress a more thorough knowledge of the organic products in plants. Seeing that the real aim of students' courses is rather to teach general methods and provide training than to implant facts, tests for proteins and other complex substances are much less valuable than the more tangible experiments of a physical nature.

Except in this matter, there is no hesitation in recognising that the author presents a remarkably clear and informative series of experiments. There is always satisfaction in experiments requiring simple and natural material, as in the test of a living turnip with beetroot juice, but Dr. Cavers on the whole favours the view that there is a necessity for specially designed apparatus capable of yielding exact measurements, in which connection he directs attention to several instruments designed by Prof. Ganong. An appreciable amount of generally unknown detail is supplied in the life-history of *Pellia* and *Funaria*, and otherwise this section is no mere repetition of available information. Teachers will be well advised to consult the book before drafting their physiological courses, as they are tolerably certain to discover suggestions or new experiments.

LETTERS TO THE EDITOR.

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Heredity.

So long as naturalists persist in using ill-defined terms, the meaning of which they have not clearly thought out, the controversy about the inheritance of so-called "acquired characters" is bound to be sterile and interminable. If it be once granted that organisms are the product of the interaction of two sets of factors—the factors of the inheritance and the factors of the environment—it becomes obvious that not only every organism, but every "character" of an organism, must be the result of both sets of factors. And if by "character" we mean any such resulting structure or property as it appears to our senses, as we see it before us, then it becomes manifest that no character can be due wholly to inheritance or wholly to environment. The very words "acquired character" involve a fatal fallacy—suggesting as they do that one character may be more acquired than another. Since such wholly acquired characters do not exist, it is waste of time to discuss their possible inheritance.

Even Dr. Reid, in his letter in last week's *NATURE*, does not entirely escape from this logical error when he uses the word inheritance for the transmission of acquirements (characters) in unicellular organisms. It is a return to the vague, popular use of the term which would inevitably lead us back into the old tangle of inconsistencies. The biologist may define inheritance as the transmission of hereditary factors—it is not ready-made characters which are inherited, but the factors which help to produce them. The transmission in a protozoon of the characters of its parent is no more inheritance in the strict biological

sense than is the transmission of the eggshell and albumen from the fowl to the chick, or of money from father to son.

Variation may be caused by changes in the environment giving rise to "modification," or by changes in the inheritance (the totality of the hereditary factors) giving rise to "mutation." Changes in the inheritance are due to the rearrangement of, addition to, or subtraction from the factors of inheritance. Ultimately these changes must be referred to the environment, and it is only when something from the environment thus alters or enters into the inheritance that mutation can occur.

It follows that if certain observations seem to show that "acquired characters" are transmitted by true inheritance, either they must be capable of some other interpretation, or our premise that every organism is the resultant of two sets of factors must be wrong. No escape from this alternative seems possible.

The dogmatic tone of this letter will, I hope, be forgiven me, as it has been assumed merely for the sake of brevity.

E. S. GOODRICH.

Merton College, Oxford, March 1.

Mars and a Lunar Atmosphere.

IN *NATURE*, February 22, p. 565, reference is made to an interesting observation by Prof. Luther, of the Düsseldorf Observatory. The note states that he saw the half of the disc of Mars nearest the moon become green just before occultation on December 4, 1911, and he suggests that this may have been due to a lunar atmosphere. The time was 16h. 40m. (Greenwich mean time), and I notice that the moon was full at 14h. 52m. on December 5, so that, at the time of the observation, the unilluminated crescent of the moon towards the planet must have been extremely narrow, so that the illuminated part of the lunar disc must have been quite close to the planet.

Now no refracting telescope is perfectly achromatic, and as one of the residual colours is green, it seems to me possible that this colour may have been due to moonlight imperfectly achromatised. It may also be suggested that the reddish colour of Mars might lead to the focus of the telescope being different for the planet and the moon. Another suggestion is that the colour of the planet might give rise to a complementary tint.

Turning to the date of Prof. Luther's previous observation, October 16, 1902, I find that the moon was full on that very day, and this seemed to link the two observations together, both being associated with a nearly full moon.

But, to my surprise, I found, on consulting the Nautical Almanac table of occultations, that no occultation of Mars, or of any planet, is set down for October 16, 1902, and, on looking up the positions of the moon and of Mars, it is obvious that none could have occurred, as they were distant in R.A. by some nine hours. It is evident then that there is some mistake in the earlier date, unless it is meant to apply to some small stars in Pisces.

I observed with a refractor the disappearance occultation of Mars at the dark limb of a moon rather more than half-full in the early morning of January 29 this year, but saw no trace of any green colour on the disc of the planet.

C. T. WHITMELL.

Hyde Park, Leeds, February 26.

The Teaching of Mathematics.

IN an article entitled "The Teaching of Mathematics" in *NATURE* of November 30, 1911, considerable space is devoted to a memorandum written by me for