of the Medical School of Yale University, have returned from Russia, where they were members of the American Red Cross Mission to assist in the sanitary survey.

PROFESSOR WALLACE C. SABINE, Harvard exchange professor at Paris last year, has returned to America.

PROFESSOR DR. THEODORE KOCHER, chief surgeon of the Inselspital, Berne, Switzerland, and professor at the medical faculty of the University of Berne, died on July 27.

UNIVERSITY AND EDUCATIONAL NEWS

THE teaching hospital of the University of Nebraska college of medicine was dedicated with appropriate ceremonies on October 17, the principal speaker being Chancellor Avery of the university. The new structure, now in full operation with a capacity of 119 beds, was made possible by three legislative appropriations, $150,000 for the building; $65,000 for equipment and $100,000 for a biennial maintenance.

PROFESSOR HENRY C. ANDERSON, of the mechanical engineering department, of the University of Michigan, who has been on leave of absence for the past two years, has been appointed head of the department in place of Professor John R. Allen, who resigned to accept the deanship in the college of engineering at the University of Minnesota.

PROFESSOR C. F. CURTIS RILEY, who has been in charge of the department of biology at the State Normal College, Milwaukee, Wisconsin, for the past four years, has been appointed special lecturer in animal behavior, in the department of forest zoology, at the New York State College of Forestry at Syracuse University.

DR. L. G. ROWNTREE, of the University of Minnesota, has declined the deanship of the Illinois school of medicine. His salary at Minnesota has been increased to six thousand dollars and an additional appropriation has been made for the further development of his department of medicine.

DR. CARL ROSENOW (Ph.D., Chicago '17), and Dr. Jacob Kantor (Ph.D. '14, Ph.D. '17, Chicago) have been appointed instructors in the department of psychology of the University of Chicago.

AT the college of medicine of the University of Nebraska Dr. Maurice I. Smith, for several years connected with the department of pharmacology at the University of Michigan, has been placed in charge of the department of pharmacology. Mr. J. A. Kittleson, of the University of Minnesota, has accepted the position of assistant professor of anatomy and Dr. S. A. Rubnitz has been made instructor in biochemistry.

AT Queen's University, Kingston, Canada, E. Flammer, Ph.D. (Harvard), has been appointed assistant professor of physics; O. F. S. Smith, M.Sc. (Pennsylvania State) has been made lecturer in the same department. In the department of geology, Kirtley F. Mather, Ph.D. (Chicago), has been promoted from associate professor to professor of paleontology.

DR. OLAF BERGEIM of the department of physiological chemistry of Jefferson Medical College, has been promoted to associate in that department.

DR. A. E. SHIPLEY, Master of Christs College, Cambridge University, has succeeded to the office of vice chancellor of the University, in succession to the Rev. T. C. Fitzpatrick, president of Queen's College.

DISCUSSION AND CORRESPONDENCE

ALGONKIAN BACTERIA AND POPULAR SCIENCE

THERE are two points in Dr. R. S. Breed's communication of September 7 entitled "Popular Science" to which I would like to call attention.

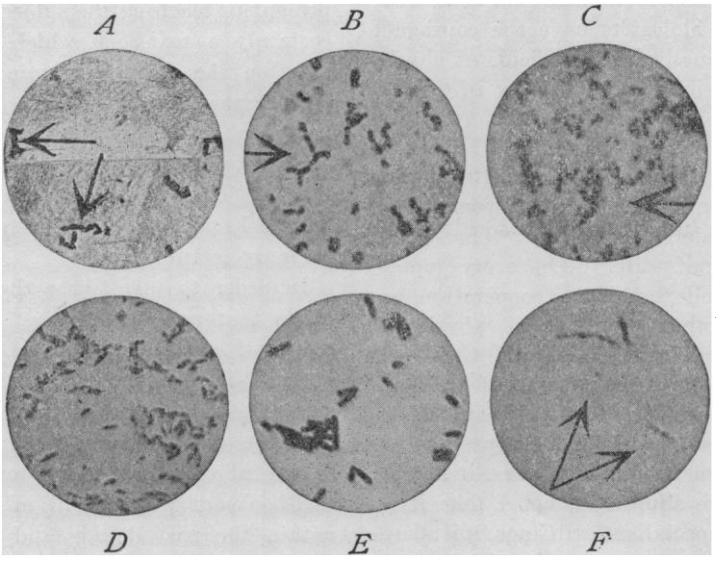
First, my obvious error in the citation from page 292 of *The Scientific Monthly*. How this *non sequitur* slipped through my reading and that of Dr. I. J. Kligler I do not know. It is a wholly illogical statement which is corrected and replaced in the following sentence of my

recently published work "The Origin and Evolution of Life," where it reads (p. 85) as follows:

> The great geologic antiquity even of certain lower forms of bacteria which feed on nitrogen is proved by the discovery, announced by Walcott in 1915, of a species of pre-Paleozoic fossil bacteria attributed to "*Micrococcus*," but probably related rather to the existing *Nitroso coccus*, which derives its nitrogen from ammonium salts.

Perhaps the words "rendered probable" would be more accurate than the word "proved" in the sentence as it stands.

As to the second point, Dr. Breed raises the question whether the fossil markings described by Dr. Walcott in the fossil limestone are actually bacteria. On this point there can be no doubt whatever. Walcott reproduced for comparison an illustration of *Micrococcus* from the Encyclopedia Britannica and referred the Algonkian bacteria to *Micrococcus* sp. undt = species undetermined.



At my request this very interesting determination by Walcott was taken up by Dr. Kligler, and after a careful investigation he made the series of special preparations of bacteria which are reproduced (*B–F*) in the accompanying figure together with parts of Walcott's two figures (*A*). Dr. Kligler came to the conclusion that the Algonkian type was closer to the existing *Nitroso coccus*, which derives its nitrogen from ammonium salts, than to *Micrococcus*. The similarity between the Algonkian bacteria (*A*) and some recent forms of nitrifiers (*B, C*) is shown in the comparison of the parts indicated by arrows in the figure.

A comparison of these fossil and recent preparations appears to bear out my statement, made on the authority of Dr. Kligler, that

> The cell structure of the Algonkian and of the recent *Nitroso coccus* bacteria is very primitive and uniform in appearance, the protoplasm being naked or unprotected.

Here the word "relatively" might have been inserted.

My entire chapter on bacteria was prepared with the kind cooperation of Dr. I. J. Kligler. Walcott's discovery was cited as indicative of the antiquity of bacteria and my statement was intended to be hypothetical and not categorical. Dr. Breed may be correct in the assumption that the fossil bacterial impressions represent forms related to the denitrifying bacteria and not to the nitrogen fixers or nitrifiers, as Dr. Kligler has suggested. The acceptance of his view would strengthen rather

than weaken the general thesis that bacteria represent a very ancient form of life, for the denitrifying bacteria are generally conceded to be higher in the scale of bacterial life than either the nitrogen fixers or the nitrifiers. If organisms related to the higher denitrifiers existed in the Algonkian, is it not reasonable to assume that simpler forms existed earlier in geologic time? In other words, the hypothetical point as to whether the Algonkian bacteria represent forms related to the nitrifiers or the denitrifiers is immaterial to the conclusion regarding the great antiquity of bacteria.

As to the matter of "popular science" in general the popularizer always runs into danger as soon as he leaves his own special field of research. No one is more conscious of such pitfalls than myself; it is difficult enough to avoid pitfalls in one's own field without venturing into others. At the same time I feel very strongly that little or no progress will be made in the principles of biology (as distinguished from discoveries in special fields of research) unless biologists have the courage to venture occasionally into the fields of physics, chemistry, physiology and zoology in order to look at life from a broader and more distant point of view. Such an attempt I have made in the Hale Lectures which Dr. Breed cites and which now appear in a somewhat more carefully considered form in "The Origin and Evolution of Life." On every topic I have sought and found the cooperation and criticism of other workers—in physics of Pupin, in chemistry of Gies and Clarke, in zoology of Wilson, in astronomy of Hale and Russell, in botany of Goodspeed and Howe, and many others. Although every effort has been made to guard against errors, it may be that others have slipped in, but I take it for granted that specialists will not mistake a popular work for a work of reference nor imagine that I presume to speak with the authority of a specialist in any field but my own.

Henry Fairfield Osborn

THE TEACHING OF OPTICS

The recent discussion in the columns of Science as to the best method to be followed in presenting the fundamental laws and concepts of mechanics to the student has been followed with much interest by teachers of physics. To the writer it seems equally important that attention be directed to another branch of physics, and the question raised as to whether there should not be a radical change in our methods of introducing the student to the subject of optics.

It is generally conceded by those qualified to speak with authority that the establishment of the electromagnetic theory of light represents one of the greatest achievements of modern science. Yet in spite of the far-reaching importance of this principle, the average student who has completed his college course in general physics, or even in many cases more advanced special courses, is entirely unfamiliar with the meaning or the significance of the electromagnetic theory. This need occasion no surprise, however, in view of the methods commonly employed at present in teaching the subject of optics. For certainly a text-book which either does not mention the electromagnetic theory of light or relegates it to a footnote or inconspicuous paragraph is hardly calculated to inspire the student with any great respect for that theory. This criticism applies, not to our text-books alone, but with equal force to the ordinary lecture course.

In order to investigate the justice of this claim that one of the most important principles of modern physics is almost entirely ignored in our present system of teaching and is seldom accorded the attention its importance demands, the writer recently made a careful examination of ten representative text-books of physics, all of them published within the past decade and including practically all, so far as known to the writer, which are very extensively used in our American colleges and universities at the present time. As a result of this examination it was found that in three of these text-books no reference whatever is made to the electromagnetic theory; three other authors content themselves with a bare mention of the theory;