

the method of publishing separate bulletins mailed directly to a selected list of those interested may be quite satisfactory, but if the publications of a laboratory cover a large range of subjects it would seem to be preferable to publish each paper in the journal which deals with the department of science most akin to that of the subject dealt with. If this is not done, there is a grave danger that the paper may be missed by the abstract journals and may fall out of sight altogether, while in any case the publication of single bulletins throws a heavy burden on any investigator engaged in compiling a bibliography of a subject.

In this laboratory we have confined the publication of our scientific communications to the recognized technical and scientific journals, and I find that our first fifty communications have been published in no less than seventeen different journals, twenty-eight being published in journals relating to some branch of physics, five in chemical journals, and seventeen in photographic publications.

Since it is an advantage for all the papers issued from one laboratory, which, naturally, have a common interest, to be available in some collected form, we issue periodically bulletins containing abridgments of all our scientific papers, the second volume of these bulletins containing the papers published during 1915 and 1916 being now ready.

It would be of interest to learn the views of others interested in this question as to the relative advantages of the issue of separate bulletins as compared with publication in the current press.

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POPULAR SCIENCE

UNWARRANTED deductions have been drawn in a recent popularization of science by one of our eminent paleontologists, Dr. H. F. Osborn, not however in his own field, but in a special field apparently unfamiliar to him. Lest others may be misled into thinking that the deductions are based on good evidence, may I be permitted space to call attention to them.

Dr. C. D. Walcott has recently reported¹ the discovery in an Algonkian limestone of fossils having appearances and associations which give valid reasons, though not positive proof, for thinking them to be bacteria. The finding of these fossils in a limestone rock in association with fossil algæ as well as other related facts lends support to his previous suggestion² that this limestone was probably partially deposited by bacterial action in a manner similar to that described by G. H. Drew³ as taking place to-day in the tropical waters about the Bahamas. A reference back to the article by Drew shows that the bacterium which he found causing the deposition of CaCO_3 is a denitrifier which he has named *Bacterium calcis*. It is an organism similar to other denitrifiers, possessing the power to reduce nitrates to nitrites with the later disappearance of the nitrite accompanied by the formation of ammonia and a gas which, from the few simple tests made, was in all probability free nitrogen. Like other denitrifiers, this organism was found to possess the power of utilizing organic carbon in the form of sugars and even possessed the power of secreting ectoenzymes capable of liquefying organic nitrogen compounds like gelatin. The precipitation of the calcium carbonate is explained as due to the increase in the concentration of CO_3 ions caused by the advent of $(\text{NH}_4)_2\text{CO}_3$, which is partially ionized into NH_4 and CO_3 ions.

If the validity of the evidence that the fossils found are bacterial in nature is admitted, and it is assumed that the particular fossils in question are of the organisms which were instrumental in having caused the deposit of limestone, then the deduction might be drawn that these fossils are those of denitrifying bacteria. The fact that Dr. Walcott refrained from making this deduction is quite probably due to the fact that he had a feeling that it would be based on too many "ifs."

Turning now to the article by Dr. Osborn⁴

¹ *Proc. Nat. Acad. Sci.*, 1: 256-257, 1915.

² *Smiths. Misc. Coll.*, 64: 76-156, 1914.

³ Papers from Tortugas Lab., 5: 8-45, 1914, Pub. 182, Carn. Inst. Wash.

⁴ *Sci. Monthly*, 3: 289-307, 1916.

we find that he has not been as cautious and that he sees in Dr. Walcott's fossil bacteria certain resemblances in appearance and structure to nitrogen-fixing bacteria from soil (by context the bacteria referred to appear to be *Azotobacter* and related forms). He is not dismayed by the fact that the metabolism of marine, denitrifying, lime-depositing bacteria, and that of the nitrogen-fixing bacteria in soil which utilize both atmospheric nitrogen and organic carbon, are in a sense opposed to each other. Still less is he troubled by the very great difference between the metabolism of nitrogen-fixing bacteria and the autotrophic, nitrifying bacteria like *Nitrosococcus* and *Nitrosomonas* organisms which do not utilize organic food and derive their nitrogen from ammonium salts instead of free nitrogen). In fact, he apparently thinks of the nitrifying and the nitrogen-fixing bacteria as essentially identical, as appears in the following statement (p. 292):

The great antiquity of even higher forms of bacteria feeding on atmospheric 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 *Nitrosococcus* which derives its nitrogen from ammonium salts.

The illogical nature of this statement may be brought out by substituting groups more familiar to paleontologists than are bacteria. Thus we have:

The great antiquity of Carnivores feeding on flesh is proved by the discovery of a species of pre-Paleozoic mammal attributed to Herbivores, but probably related rather to Rodents who derive their food largely from grain and nuts.

Needless to say that Dr. Osborn would be the first to see the weakness in such a statement. In reality this paraphrase does not exaggerate the illogical nature of the original statement, though it may appear to do so to the layman unfamiliar with the fact that great differences in these tiny organisms are very frequently hidden behind superficial resemblances in appearance.

The almost universal uniformity in protoplasmic structure of living species of bacteria

and their universal possession of a definite membrane which gives them definite form will cause bacteriologists to wonder at the statements on the following page of Dr. Osborn's article where he says:

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

Any one who looks at the uniform black of the fossil organisms in the microphotographs given and who realizes that these are pictures of fossils and not of living organisms will be skeptical in regard to the evidence on which this statement is based.

Statements based on evidence of the sort furnished which claim that the presence in the Algonkian of nitrifying, denitrifying or nitrogen-fixing bacteria has been shown appear like a pyramid of speculation supported on an apex of fact. They have, however, already misled a bacteriologist into an acceptance of one of these claims, for I. J. Kligler⁵ says in a recent paper (p. 166):

Finally Walcott's discovery of bacteria closely resembling our nitrogen fixers of the soil is added proof of the primitiveness of these microbes.

It is because of the great interest of the findings by Drew and Walcott, that this word of warning has been uttered to protect science from conclusions which others have drawn from them. If this is not done there is danger that the next time reference is made to their work it will be in some textbook as a positive statement that nitrifying, denitrifying or nitrogen-fixing bacteria, or all three, have been shown to exist as far back as the Algonkian.

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MAN AND THE ANTHROPOID

TO THE EDITOR OF SCIENCE: In the July 27 number of SCIENCE Prof. Mattoon M. Curtis devotes a column and a half to a criticism of the "common error" that man is a lineal descendant of the anthropoid apes. "The evident implication," he tells us, "is that the

⁵ *Jour. Bact.*, 165-176, 1917.