and Lütken, Steindachner; *C. pentadactylus* Peters; *C. mystacinus* Burmeister; *C. podicipinus* Cope, etc. Generic names ending in *gnathus* are as rare among birds as those ending in *ryhnchus* and *ramphus* are common (and needless to say no ornithologist, or other zoologist, has used the latter as neuters), but we have at least *Hemignathus* which they have accepted as masculine without exception, among them the purist of purists, Dr. J. Cabanis who is responsible for *Hemignathus procerus*. Finally, giving a few examples from the fishes, I quote *Hybognathus* accepted as masculine by Girard, Jordan and Gilbert, *Cochlognathus* by the same authorities, and last but not least *Syngnathus* proposed as a masculine by Linnæus himself and so accepted by all subsequent ichthyologists. In fact, it is probably not too risky to say that not until Cope discovered that the unmutated *gnathos* is feminine (reversing his own previous practise), were any of the mutated composites treated as feminine. It is also safe to say that most of the illustrious men who adhered to the masculine gender, when so indicated by the original proposer of the name, knew what they were about and showed proper "respect to the Greek language."

LEONHARD STEJNEGER

EVOLUTION OF BACTERIA

I WAS greatly interested in Professor Buchanan's article in SCIENCE[1] entitled "The Evolution of Bacteria." It is not my intention at the present time to take up at length those points raised by him which are admittedly matters of opinion. In matters of classification, there are many possible interpretations of available facts, which can not be easily proved or disproved. The conclusions reached were based on the facts at hand, though it was admitted at the outset that the facts were inadequate. The final answer to these questions can not be obtained at the desk, but in the laboratory. Most of the questions concerning bacterial relationship and descent can be tested experimentally by a study of their metabolic and antigenic characters, and it is such investigations that my article was intended to stimulate.

Dr. Buchanan did, however, raise certain questions of fact which require some comment. In my argument in favor of the primitive character of bacteria the unique combination of the ability to subsist on simple inorganic compounds plus an extreme sensitiveness to sunlight, which excluded aid from that source, was advanced. This combination does not obtain in either plant or animal cells. Cells so constituted as to live on simple inorganic compounds without the aid of an external source of energy may, it seems to me, reasonably be considered as primitive. The sulphur bacteria, mentioned by Dr. Buchanan, contain a pigment which protects them from sunlight and which according to Englemann apparently functions somewhat like the chlorophyl in plants. Molisch dissents from Engelmann's view but claims that these bacteria must have organic food for their nutrition. Why they should be considered more primitive than the prototrophic bacteria is, therefore, not altogether clear.

In regard to the source of the volatile acids and alcohols for bacterial nutrition, I might refer to Kaserer's[2] report of nitrifying bacilli which convert $(NH_4)_2CO_3$ to formic acid and free N, or nitrates. These compounds are not, therefore, necessarily the product of carbohydrate fermentation.

The author draws the inference that by utilization of CO_2 I had in mind oxidation. It requires no profound knowledge of chemistry to realize that such a thing is not possible. What was implied throughout was an ability on the part of the cell to assimilate CO_2. Instances of such assimilation are numerous and this power is particularly evident among the nitrogen-fixing bacteria, the energy apparently being obtained from the oxidation of the N with a simultaneous reduction of the CO_2.

Reports of prototrophic denitrifying bacteria are admittedly not "common and well known." They have, however, been described by Hiltner and Strömer.[3] Somewhat more

[1] SCIENCE, 1918, N. S., XLIII., 320.

[2] *Cent. f. Bakt.*, II. Abt., 1908, XX., 401.

[3] *Ref. Bot.*, 1904, XCV, 157.

advanced types flourishing in inorganic media containing nitrates and ethyl-alcohol have been described by Hohl[4] and by Burri and Stutzer.[5]

Because a group has not been extensively studied is no proof that it is not common. It is sufficient that representative types have been described. The group may well be common and yet not well known. The diphtheroids, the aciduric bacilli, the cellulose fermenters, are quite common, but were not well known five to ten years ago.

The resemblance between the red and yellow bacilli and the red and yellow cocci is only a superficial one. They produce pigments of the same chrome, but the pigments produced by the two classes of bacteria are *not* of the same type. The pigments produced by the cocci belong to the lipochrome group, give the typical lipocyanin test and their production is not affected by temperature. The pigments produced by the red bacilli do not give the lipocyanin test and their production is markedly affected by temperature. There are in addition marked metabolic differences between these two groups of organisms. The *B. prodigiosus* and related bacilli are more actively fermentative and many produce gas—largely CO_2. They as a rule liquefy gelatin actively while the red cocci as a rule do not. The bacilli are facultative anaerobes, the cocci are almost strict aerobes.

The ability on the part of *B. aerogenes* to fix nitrogen was reported by Lohnis[6] who studied the behavior of a considerable number of bacteria in this respect.

In conclusion I grant that my thesis has not been proved. Neither has it been disproved. If it stimulates investigation along these lines the paper will have been justified.

I. J. Kligler

ORGANIC CHEMICALS FOR RESEARCH, OR THE NEED OF A PHILANTHROPIST

Professor Roger Adams has recently published in these columns[1] an account of the admirable work which the laboratory of organic chemistry at the University of Illinois is doing to keep up the supply of certain organic chemicals for research and industrial needs. However, when one compares the limited list which that laboratory is manufacturing with the lists in the catalogues of German chemical firms, the realization comes home that the rarer organic preparations are no longer available and probably will not be available as long as the war lasts, and that, unless some measure is taken to prevent such an occurrence, Germany will again regain her trade in this line after the war.

It is well enough to *say* that we will not use German-made goods, but there would appear to be only one alternative, *i. e.*, the cessation, or at least the slowing up of research in organic chemistry if these essential starting materials are not available, or if they are available at relatively enormous prices.

The question therefore arises in my mind: "Why can not some man of wealth make his name blessed by endowing a laboratory which shall prepare these rarer organic chemicals against the needs of research work?" Undoubtedly the German supply houses sold many of these products at a loss before the war, counting the loss as a necessary part of their advertising propaganda, which was meant to build up the idea that Germany was the great chemical center of the world. Our commercial firms, unfortunately, do not see things in that light, and usually refuse to follow paths where a sure and handsome profit does not lead them.

If some man of wealth can not be found to whom this suggestion would appeal, what is there to prevent one of our research foundations from supplying the need? How could research and discovery be better furthered in this particular field of science than by furnishing the essential basic materials to a host of research workers in our colleges and universities? If such a plan as is herein proposed were adopted the United States would without doubt secure and retain first rank in the field of organic research. The initial cost would be comparatively small as measured by the scientific results, for the in-

4 *Land Jahr. der Schweitz,* 1906, 510.

5 *Cent. f. Bakt.,* II. Abt., 1895, I., 257.

6 *Cent. f. Bakt.,* II. Abt., 1907, XIX., 87.

1 Science, 47, pp. 225–228, March 8, 1918.