methods of preparation, etc., and was handled chiefly by assignments, thus turning the class into a zoological society.

The reaction of the students was most interesting. Time after time they remarked that they had no idea zoology had so many practical ramifications and could be made so interesting. For some of the students, this was their first course in zoology; others had studied zoology from one to three years in various colleges.

As nearly as I could sense the feeling of the students, they ended the course with a conviction that zoology does not consist solely of theory, Latin names, fresh and preserved animals, and chromosomes, but is actually a part—and an interesting and important part—of their daily life. To some instructors, students' interest in work is evaluated chiefly by the "marks" given; for the benefit of this class of instructor I may add that twelve students received a mark of "A"—which was based on a most critical study of the reaction by and results of the individual members of the class. So high a mark to such a large proportion of a class will seem absurd to many instructors—but even an instructor must play the game fairly with the student and by no stretch of my pedagogic conscience did I feel justified in lowering the marks, for the students had made good.

Toward the end of the term, the class elected three "honorary members," and a tree on the campus is to be dedicated to each of these three men, namely, Professor Irving Fisher (Yale), Dr. L. O. Howard (U. S. Department of Agriculture, retired), and Professor Henry B. Ward (University of Illinois). These elections were based on reviews (presented to the class) of the work of these three men in connection with public health and public health zoology.

From the results of the experiment at Rollins, I can heartily recommend public health zoology as a live subject, of interest and value to college students.

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REGARDING THE C FORMS OF KUHN

UNDER the title, "Über Bakterien und Pettenkoferien," there has recently appeared a small volume[1] by Ph. Kuhn and Käte Sternberg, of Dresden, dealing with bacterial variation and the Pettenkofer bodies (Pettenkoferia), and summarizing earlier observations in this field made since 1919.

I venture to call attention of bacteriologists interested in variation phenomena to the studies of Kuhn, first, because they have an important bearing on the work of myself and associates with the G-forms of bacteria; and secondly, because Kuhn's publications are not commonly known in this country. The matters of special interest treated by this investigator deal with morphological variation and his conception of the parasitism of bacterial cells by a foreign microorganism believed by him to be related to the Myxomycetes. For these parasites Kuhn has coined the name, "Pettenkoferia." Although he has extended, in an ingenious manner, this view of parasitism to include the phenomena of the bacteriophage (alleged destruction of bacteria by attack from the minute and filtrable "spores" of the Pettenkoferia), this unique portion of his exposition does not concern us further at present. I have dealt with this aspect of the problem in detail in an earlier publication.[2]

Kuhn's delineation of variation among the Bacteriaceae is restricted chiefly to the field of cell morphology, and here he has focused attention on five different morphological cell types which he depicts as follows:

A-forms (ameboid forms): These are chiefly round or oval bodies which may sometimes attain the astonishing size of nine microns. They are often ameboid and, in reality, represent the parasitized bacterial cells (Pettenkofer bodies). They seem to be identical with the "giant cocci," "zygospores," "balloon bodies," etc., frequently seen and sometimes reported by courageous bacteriologists for many years. They also include at least some of the so-called "involution forms" of earlier years.

B-forms (Bakterienformen): These are represented by the common rod and spiral forms that are regarded by bacteriologists as the "normal" forms of the species. These develop from the slow upgrowth of the C-forms.

C-forms (Kokkenformen): These are chiefly coccus forms although the morphology is variable, and some of the bodies are very minute. Colonies of these forms are extremely small and frequently microscopic. The C-forms arise from the B-forms.

D-forms (dendritische Formen): These are thick filaments and rods giving root-like branches that are produced by the partial fusion of independent cells or filaments. The morphology is irregular and bizarre. These forms occur among B- or F-forms.

F-forms (Fädenformen): These forms are identical with what bacteriologists term "filaments," "thread forms," or much elongated bacteria. They often produce mycelial structures. They commonly develop from the B-forms.

The designations mentioned above were employed by Kuhn to indicate the varying morphology of the cells but were not, with the exception of the C-forms,

[1] Ph. Kuhn and Käte Sternberg, "Über Bakterien und Pettenkoferien," pp. 1–52, Taf. I–XV. Gustav Fischer, Jena, 1931. See also: *Centralbl. f. Bakteriol.*, Abt. 1, Orig., 1931, Vol. 121.

[2] "The Twort-d'Herelle Phenomenon," *Jour. Inf. Dis.*, 42, 263–434, 1928.

definitely associated with colony features or with other specific characters.

It is possible, however, to detect from his more complete descriptions the correlation of his B-forms with the cells of the S type colony and culture; and of his F-forms with the cells of the R type colony and culture. In my experience his D-forms are also most commonly found in R cultures, and I know of no special colony form that is characteristically associated with them. It seems probable that Kuhn's A-bodies (Pettenkoferia) have been most commonly observed by others in association with a type of growth that has been termed "mucoid." These forms are occasionally seen in *B. coli, B. typhosus, B. paratyphosus, B. anthracis* and presumably other species. Mr. Klimek in this laboratory demonstrated them in cultures of the Shiga bacillus on plates undergoing lysis. He also produced them by the action of lithium chloride, as Kuhn had done earlier.

These possible correlations between Kuhn's morphological cell types and colony form need not concern us further at present. A special significance, however, attaches to his "C-forms"; and a consideration of this point is the chief reason for the present communication dealing with Kuhn's studies.

Although I was familiar with his earlier observations and conclusions insofar as they were related to the bacteriophage phenomenon, I had not caught the true significance of his C-forms, perhaps because he reported few data on their filtrability. The matter was first brought to my attention by Dr. Schmidt-Kehl, of Würzburg, late in 1931. Since that time I have been in correspondence with Prof. Kuhn, who, in the meantime, has had opportunity to review our work on the G-forms.[3] I have, in addition, examined his most recently published work, as well as reprints of certain papers published in 1929 and 1930, which Prof. Kuhn kindly sent me.

Kuhn has not reported a special study dealing with the filtrability of his C-forms. But he mentioned the circumstance that he had succeeded in passing through Berkefeld N candles the C-forms of *B. coli, B. typhosus, B. suipestifer* and *B. diphtheriae.* In ten other species he observed C-forms but the filtrability of these was not discussed. I have no doubt, however, that all of them would have proved filtrable. Despite the few data on filtration reported by Kuhn, a careful review of his published works has convinced me that the G type cultures described by us in 1931 are identical with the C-forms described by Kuhn. They are similar in manner of production (in part), in the type of colony produced, in cell morphology, in viability, in filtrability (in part), in staining characteristics (gram-positive elements in young G cultures of gram-negative bacterial species),[4] in cultural details, in lack of virulence, in resistance to bacteriophage, and in matters concerning their reversion to the "normal" type—a phase of the subject to which Kuhn has devoted special attention and with considerable success. After recently reviewing the report of our work, Kuhn shares this opinion regarding the identity of the two culture forms. It is thus not without interest that, in approaching this problem from quite different angles, we have arrived at a common result, although with different interpretations of the phenomena observed.

I cannot agree with Kuhn regarding the interpretation of these variation phenomena among bacteria (a category of variation which he reduces from a pleomorphism to a dimorphism, embracing only the B- and C-forms). I cannot agree when he states that bacteria multiply only by simple fission, for I believe that reproduction by the formation of gonidia is now well established; and it was because we believed that we could recognize the relation between the gonidial granules and the filtrable forms that we designated them "the G type cultures." Furthermore, I can not accept Kuhn's conclusions regarding the significance of the Pettenkofer A bodies, and their relation to bacteriophagic lysis.

Despite these differences in interpretation, however, I believe that the observations recorded by Kuhn are, in themselves, of much value and significance. I desire, therefore, to make a somewhat belated acknowledgment of his important contributions to our knowledge of this new culture type which stands, as I believe, in an intermediate position between the filtrable, virus-like bodies and the more commonly recognized S and R type cells of many, if not all, bacterial species.

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[3] Philip Hadley, Edna Delves and John Klimek, "The Filtrable Forms of Bacteria," *Jour. Inf. Dis.*, 48, 1–159, 1931.

[4] This has also been found true of certain G-forms studied by Sherman (personal communication).

WHALING IN NORTHEASTERN JAPANESE WATERS

AT present the largest whaling station in Japanese waters is located in the Kurile Island group northeast of Kokkaido on the island of Etorofu. On the east coast of this island, in the Bay of Wannippu, whales from northern waters congregate during July and August for feeding and breeding. As far as known, this locality is one of the few places where both breeding and feeding is combined into one area. At times as many as a hundred whales have been known to come to this district in one week. It is thought that certain diatoms play an important rôle in attracting the whale to this isolated region. The