on the distribution of the organisms. Interesting work was in progress on intracellular digestion in medusae. In plant physiology Mlle. Vera Bersook was working on the rate of photosynthesis in algae.

The physiological work is greatly aided by a very complete hydrographic survey which has been in progress for several years. The station by motor ship sends expeditions on a triangular course of survey to 76° N. Lat. in February, May, August and November of each year.

Botanical instruction under Mlle. Titiana Voblikoff is concerned mainly with the classification and distribution of algae and lichens. There is a substation branch in the Hibini Mountains where collections of plants other than the arctic flora may be made.

Research is in progress through the whole year. The Arctic does not freeze in this region, owing to the warm waters of the Gulf Stream and owing to the action of a 13-foot tide. The main portion of the instructional work is given to three parties of students, each party spending five or six weeks in residence at Alexandrovsk.

The station publishes a series of reports in addition to journal articles. These may be had in exchange.

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THE ETIOLOGY OF EUROPEAN FOUL-BROOD OF BEES

THE attention of the writer has been directed to a communication from Denis R. A. Wharton appearing in SCIENCE, November 11, 1927, similar to one published in *Nature*, August 27, 1927, dealing with the cause of the disease of bee larvae commonly known as European Foul-brood, and the possible rôle of *B. alvei* (Cheshire and Cheyne) as an etiological factor. The article in question is based on data obtained, in part, by Mr. Wharton while temporary assistant under the writer's direction in the Division of Bacteriology, Central Experimental Farm, Ottawa, the publication being unauthorized, and, in the opinion of the writer, somewhat premature, particularly in view of the desirability of a thorough preliminary verification of the results obtained.

The organism isolated from diseased brood, which in pure culture was found to be capable of transmitting the disease, appeared to be closely related to, if not identical with, *Streptococcus apis* described by Maassen[1] but capable of considerable morphological variation showing types which are impossible to distinguish microscopically from what is commonly called *B. pluton* (White)[2] which is usually stated to be the exciting cause of the disease. The claim of White, however, may be said to be based on indirect evidence, on the basis of microscopical and inoculation tests with impure cultures, *B. pluton* apparently not having been obtained in pure culture. The similarity of certain stages of *Str. apis* in pure culture with the appearance of *B. pluton* in diseased material raises doubts as to whether the latter can be said to exist at all.

In obtaining the organism in pure culture from the comb containing larvae dead of foul-brood, a preliminary enrichment medium appears essential. Our most recent experiments have shown the most suitable substrate yet employed to be one containing peptone 1 per cent., K_2HPO_4 0.05 per cent., honey 1 per cent., yeast 1 per cent. and agar 0.15 per cent., slightly acid (pH = 6.2 approx.) A preponderance of the "*pluton*" form over *B. alvei* or other "secondary invaders" in the raw material is desirable if the coccus form is to be readily established. After two or three transfers the organism may be readily obtained in pure culture by regular plating methods.

Respecting the rôle played by *B. alvei*, experiments on the life-cycle of this organism are still in progress. Results so far obtained indicate that *B. alvei* is to be regarded as more than a secondary invader as is now usually stated. Depending on the nature of the substrate, upon the period and temperature of incubation, this organism exhibits a pronounced polymorphism which indicates that the typical rod forms and endospores most commonly encountered are but stages in the life history of the organism. The development of coccoid forms of *B. alvei* is particularly pertinent to the question of the etiology of European Foul-brood. Recent experiments were made with a culture of *B. alvei* which had been kept for over two years with occasional transfers on nutrient agar and nutrient dextrose agar. On these media as well as on solid substrates containing yeast, endospore formation is prompt, and further morphological changes are seldom. On a medium composed of peptone 1 per cent., K_2HPO_4 0.05 per cent., dextrose 0.5 per cent., saccharose 0.5 per cent., agar 1.5 per cent. (pH = 6.8), the type of growth is very different, being more transparent in character and endospore formation much lessened, being even absent on repeated transfers. After establishment of *B. alvei* on this substrate, subsequent plate cultures kept at room temperature for 3 to 5 weeks have repeatedly given rise to coccoid forms which in morphology and group

[1] Maassen, A. "Zur Aetiologie der sogenannten Faulbrut der Honigbienen." *Arb. aus d. Kaiserl. biol. Anst. f. Land. u. Forstw.* Bd. VI, Heft. 1, 53–70. 1908.

[2] White, G. F. "The cause of European Foul-brood." *U. S. D. A. Bur. Ent. Circ.* 157. 1912.

arrangement can not be distinguished microscopically from the forms which were found to be capable of transmitting the disease. So far attempts to stabilize this coccoid form of *B. alvei* have been unsuccessful, its separation by replating having resulted either in a return to the original rod type or a failure to grow on the medium employed. These difficulties in connection with the stabilization of new forms have been already emphasized by Löhnis and Smith.[3] These authors have shown the possibility of stabilizing coccoid cells from *Azotobacter,* while Cunningham and Jenkins[4] have obtained a coccus from cultures of *B. amylobacter* (A. M. et. Bredemann). That a similar stabilization of a coccoid form of *B. alvei* is feasible, is reasonable to presume, and its accomplishment would lend support to the hypothesis regarding the identity of *B. alvei* with the organism responsible for the infection in foul-brood, and furnish interesting light regarding the relationship of developmental phases of pathogenic bacteria to virulence. With all work concerned with etiology and pleomorphism, however, too much emphasis can not be laid upon the necessity for repeated confirmation of results. The writer would have preferred to withhold even this preliminary communication which is given reluctantly in view of the outlined circumstances.

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CONCERNING MAN'S ANTIQUITY AT FREDERICK, OKLAHOMA

AMONG the several recent reports of evidences of Pleistocene man in America, the case of Frederick, Oklahoma, must be received with caution. In 1926 the owner of a fossil-bearing gravel pit at this place unearthed several artifacts. The site was first examined and reported by J. D. Figgins, H. J. Cook and O. P. Hay,[1] and later by C. N. Gould, C. E. Decker and the writer.

The gravel pit has been sunk into a stratum of gravel and sand which caps a ridge a half mile wide and several miles in length. The stratum is from ten to twenty-five feet deep and lies on beds of Permian age. The ridge is the highest point for some miles around, the red beds falling away to the Red River. All observers are agreed that the gravel bed is of Pleistocene age; the presumption being that it was deposited in a valley bottom, subsequent erosion of the surrounding areas having left it in its present high position.

The artifacts are two arrowheads or blades and five possible metates or mealing slabs. According to Mr. Holloman, the owner, one blade was from the very bottom of the gravel, he having picked it up from loose material at the foot of the pit face as it was torn down by workmen. The second was at a somewhat higher level, four to eight feet. Mr. Holloman stated that he scratched this artifact from the face of the pit with his fingers. The slabs, identified as metates by Mr. Figgins, were taken from a level of a foot or two above the blades. All observers are agreed on the honesty of Mr. Holloman's representations.

Figgins, Cook and Hay concluded that the human artifacts are original constituents of this Pleistocene gravel bed as it was first laid down. Before this verdict becomes generally accepted, I should like to broach several problems.

No scientific man has seen the gravels in the immediate vicinity of the spot where the finds were made. These were all found within a short distance of one another, near the center of the gravel pit which now extends over several acres. We do not know the original position of the surface at this point with respect to the artifacts. The deposit is considerably eroded. There is the possibility that these artifacts lay on the surface of a depression, were subsequently covered by wash, and have only a specious claim to the antiquity of the near-by fossils.

As against this possibility is the fact that I was told that no artifacts have been found on the surface in the vicinity. On the other hand, it is quite possible that they may yet be found. The ridge presents the only body of suitable material for flaking blades for miles around and at the same time affords a wide view of the surrounding country.

The artifacts themselves are equivocal. The blades are clearly artifacts, resembling modern Indian forms, but the metates are questionable. It is difficult to decide from Mr. Figgins' illustrations whether the slabs were fabricated, and I have not seen the originals. They may be water-worn boulders. While at the time Mr. Figgins wrote that no other stones of a similar nature had been found, our party saw several slabs, clearly water-worn, which suggests the possibility that some of them had been selected as metates because of their close resemblance to such forms.

[3] Löhnis, F., and Smith, N. R. "Studies upon the lifecycles of the bacteria—Part II: Life history of Azotobacter." *Jour. Agr. Res.* 23, 401–432. 1923.

[4] Cunningham, A., and Jenkins, H. "Studies on *Bacillus amylobacter* A. M. et Bredemann." *Jour. Agr. Sci.* 17, 109–117. 1927.

[1] J. D. Figgins, "The Antiquity of Man in America" (Natural History, 27, 1927, 229–239). Harold J. Cook, "New Geological and Paleontological Evidence bearing on the Antiquity of Mankind in America" (*loc. cit.*, 240–247). Oliver P. Hay, "Early Man in America" (*Science News-Letter,* 12, 1927, 215–216).