further investigations and to supply a reliable and much needed aid. W. H. Hunter

U. S. Department of Agriculture

Abwehrfermente. Das Auftreten blutfremder Substrate und Fermente im tierischen Organismus unter experimentellen, physiologischen und pathologischen Bedingungen. Von Emil Abderhalden. Fourth, considerably enlarged edition. Published by Julius Springer, Berlin, 1914. Pp. xxiv + 404; with 55 text-figures and four plates.

In the fourth edition of this book, which first appeared about two years ago as a modest pamphlet, especial stress has been laid upon the necessary technique for demonstrating the specific ferments which form according to Abderhalden when any body-alien, tissue-alien or blood-alien proteid, carbohydrate or fat is brought into intimate contact with the tissues of an animal organism.[1] Numerous drawings accompany the text and detailed instructions are given for the various preparations and manipulations which must always be carried out with rigid aseptic precautions and with adequate controls. Sources of error are exhaustively treated and indeed are so numerous that perhaps any failure could be explained by some slip in technique. This technical part occupies one half of the book, the other half being devoted to an exposition of the theory and its numerous stimulating corollaries.

It is unfortunate that the method has not been simplified, for its difficulty is probably the main cause of the disagreement which still exists among competent investigators about the availability of Abderhalden's methods in the serodiagnosis of organic functions.

The widespread attention which Abderhalden's important work has aroused is well shown by the appended bibliography, which, though incomplete, numbers more than 300 titles.

The book is written with expository skill and with charm, and will be read with interest and profit even by those who are in scientific disagreement with its teachings. John Auer

Rockefeller Institute

[1] See the review of the second edition, Science, 1913, N. S., XXXVIII., No. 988, p. 820.

Sun Lore of All Ages. By William Tyler Olcott. G. P. Putnam's Sons. 1914. Pp. xiii + 346. Illustrated.

The setting of the dimmed sun in the west at night and its rising, refreshed and glowing, in the east on the following morning, presented a mystery to the early peoples of the world: to the dwellers in ancient Egypt, to the Incas of Peru, and to the Indians of our western plains. This mystery has been solved in many ways and has given rise to numberless legends, traditions and superstitions. These traditions Mr. Olcott has traced, the legends and superstitions he has collected and compared, and has formed the whole into a very readable and attractive book. The work, which is a worthy successor to the author's "Star Lore of All Ages"; is well printed, beautifully illustrated, and forms an attractive addition to any library.

Chas. Lane Poor

HEMOGLOBINOPHILIC BACTERIA

The hemophilic or more properly hemoglobinophilic bacteria comprise a rather large group of bacilli which grow only in an artificial medium containing hemoglobin. This group does not include the many bacteria that, while growing better in media containing blood or blood serum, will also grow in media not containing hemoglobin. Its representative organism and by far its most important member is the influenza bacillus (*B. influenzæ*) which was discovered by Pfeiffer (hence commonly called Pfeiffer's bacillus) in the respiratory tract of patients afflicted with influenza during the great pandemic in 1889–90. Not only did he discover and isolate this organism at that time but he definitely proved its hemoglobinophilic character a property of bacteria hitherto unknown.

In his classical paper[1] in which he reported these researches he also described other organisms differing in certain respects from the true influenza bacilli, but similar in being hemoglobinophilic. These he called pseudoinfluenza bacilli. Since then these pseudo forms, which

[1] *Zeit. f. Hygiene,* 1893, 13, p. 357.

have also come to be referred to as influenza-like bacilli, have been found especially in the upper respiratory tract in a great variety of diseases. They are frequently met with, for example, in measles, whooping cough, bronchitis, diphtheria, chickenpox, pulmonary tuberculosis, bronchiectasis, pneumonia, and occasionally, as the writer has shown, in apparently normal throats. These bacilli are all very similar, indeed, practically identical, and more recent work seems to indicate that they are also probably identical with the true influenza bacillus differing from it only perhaps in respect to virulence.

Bacilli of this group vary greatly in this respect. As an illustration may be cited the organisms of this type which not uncommonly cause acute meningitis in children. They are found in immense numbers and often in pure culture in the spinal fluid and in the meninges of such patients. They seem to be identical with the true influenza bacilli, having, however, a much higher degree of virulence for animals. In rabbits, for example, after inoculation they may produce death by true septicemia, a result usually not possible to obtain with ordinary doses of Pfeiffer's bacillus.[2]

A further point of interest in connection with all the above bacilli is the fact that when grown on media in the presence of other bacteria, for example, streptococci, staphylococci, etc., they multiply more rapidly, their colonies are larger and their virulence for animals is increased. In other words, they clearly show, to a marked degree, the property of symbiosis.

Several other varieties of hemophilic bacilli differing in certain respects and especially in relation to symbiosis have been described by a number of observers. Friedberger[3] found in the preputial secretion of dogs such an organism, a very minute, gram negative, non-symbiotic, non-pathogenic bacillus. Several years ago the writer[4] described a somewhat similar bacillus isolated from the pathological urine, in three patients in which there was evidence that it had a causal relationship to the infectious process, and since then C. Koch[5] has described an identical bacillus which he believes to have been the causal organism in a number of cases of puerperal infection.

Recently the writer obtained a bacillus from a large abscess of the shoulder joint in an infant a few months old. Not only cultures of pus from the abscess obtained by aspiration, but also cultures of blood obtained from the median basilic vein gave a pure growth of the minute bacillus which was strictly hemoglobinophilic and which resembled closely the influenza bacillus in all respects except in its symbiotic property. The same bacillus was grown from the bronchial secretion and it was probably from this source that the organism first entered the circulation and later localized in the shoulder joint.

In the literature there are a few other isolated instances where bacteria of this general type have been encountered.

These bacilli are interesting in that they are pure parasites, for the very evident reason that only in animals can they find the hemoglobin which, so far as we know, is absolutely necessary for their existence. And since they are not spore formers and are all very delicate organisms, their length of life outside the animal body is very short, probably a few days at the most.

The rather remarkable and extreme adaptation which they have undergone in relation to hemoglobin is also an interesting and important biological phenomenon. While hemoglobin seems indispensable for their growth certain closely related respiratory pigments, for example, hemocyanin and hemerythrin, which occur in the blood of some of the lower animals and appear to have a function similar to hemoglobin in the higher forms, can not be utilized.[6]

The exact rôle which hemoglobin plays in their metabolism is not known. They seem to be able to use this substance about equally

[2] Cohen, *Ann. de l'Inst. Past.*, 1909, XXIII., 273.

[3] *Cent. f. Bakt.*, I., 193, Orig. 33, p. 401.

[4] *Jour. of Infectious Diseases*, 1910, 7, 599.

[5] *Zeit. f. Geburtsh. u. Gynäkol.*, 1912, LXIX., 634.

[6] Davis, *J. Inf. Dis.*, 1907, 4, 73.

well from nearly all the higher forms of animal life, though the hemoglobin from the pigeon as a rule gives a somewhat more abundant growth. It is doubtful whether the hemoglobin is necessary on account of its nutritive properties, because extremely minute quantities in media suffice for growth. The phenomenon may be, therefore, a catalytic one; but further study along this line is needed to prove this point.

There are other points concerning these bacteria which need further investigation, for example, the phenomenon of symbiosis above referred to. In this regard many bacteria occurring in the lower animals should be studied and we should also study and record more thoroughly than has been done, the properties of the non-pathogenic bacteria in this respect.

This group of organisms it seems to me has not received as much attention as it deserves by bacteriologists in general. To illustrate this, I might call attention to the fact that in the very excellent and serviceable descriptive chart for bacteria prepared by the Committee on Methods of Identification of Bacterial Species and endorsed by the Society of American Bacteriologists no provision has been made for recording the properties which bacteria manifest toward blood. This not only applies to the group of hemophilic bacteria but also to many bacteria which have the property of hemolyzing blood and therefore commonly called hemolytic bacteria. Hemolysis is an important characteristic of certain bacteria, for example, streptococci, cholera vibrios, etc., and being fairly constant and quite readily determined by several methods it has come to be of real practical value in the identification and differentiation of organisms.

David John Davis

University of Illinois

SPECIAL ARTICLES

ARTIFICIAL DAYLIGHT FOR THE MICROSCOPE

An examination of the laboratories for students, investigators and private workers with the microscope in our country will show that a very large number can not employ daylight, but must depend on artificial light, although increasingly in biology and pathology stains of all shades and combinations are used to color the objects studied to bring out their structural details.

As daylight is the form of light for which the human eye was developed in the course of its evolution, and as it is the only light which gives to the eye the true color values of the objects in nature, and the multitudes of artificially colored objects in the industries, arts and sciences, naturally many efforts have been made to render artificial light more like daylight.

The accompanying diagram shows very strikingly the difference between daylight and the light from a nitrogen-filled tungsten lamp. The lamp-light is *relatively* too strong in all the colors beyond the violet, and the difference becomes very great in the green and the red. In the other artificial lights commonly used, except the arc, the difference from sunlight is even greater.

As can be readily seen, in order to render any artificial light like daylight, the values of the various colors of the spectrum must be like those of daylight; and this can be attained only by reducing the excess of the red, green and other colors in the spectrum of the artificial light in such proportion as to make the energy curve of its spectrum like that of the sun.

Until very recently all the efforts to make a light filter or screen for artificial light which would transmit light having daylight qualities by which colors could be detected and discriminated with the same certainty as in daylight, were unsuccessful.

During the last two years Dr. Henry Phelps Gage, working in the laboratories of the Corning Glass-works, with the facilities there found, has developed a glass filter which renders the light from a nitrogen-filled tungsten lamp almost exactly like daylight.

In his own words:

> The investigation was started with the idea that a very close approximation to the theoretical requirements would be necessary, and the results have justified the belief that the most perfect approximations are the best.