only those of du Bois-Reymond and of Beetz are familiar to the average reader nowadays, but in spite of the aristocratic indifference of some of the older representatives of science in Berlin, the Society grew rapidly. Among the fifty-three members who joined in the first year, we find the names of Dr. Helmholtz, Lieut. Werner Siemens and G. H. Wiedemann, while Kirchhoff and Clausius joined in the following year. A period of wonderful fertility was beginning for German physics, and practically every name of note during that period can be found in the lists of the Society.

In 1882 began the publication of the *Verhandlungen*, which, from being merely a record of meetings and short notices, later, in 1899, became a reputed journal for the printing of original papers, particularly valued for its quick publication. Meanwhile, the *Fortschritte der Physik*, published by the Society, became celebrated for the care and accuracy of its short abstracts of original papers in physics appearing in all countries. The fifty years celebration held in Berlin in January 1896 under the presidency of one of the founders, du Bois-Reymond, gave evidence of the prosperity of the Society, the membership of which then numbered about three hundred. The first series of photographs taken by Röntgen with his newly-discovered rays was shown, and experimental demonstrations were given by, among others, E. Warburg, Arons, Aschkinass, Neesen, Rubens, Goldstein, Nichols, W. Wien and F. Kurlbaum—a very respectable list of names!

The new life of the Society, as the *Deutsche Physikalische Gesellschaft*, may be said to have been initiated under the influence of a discourse which Planck—a name long respected and beloved among physicists the world over—gave in December 1900 on the laws of radiation. His famous paper in which the conceptions of the quantum theory were first given to the world appeared a few months later. On the experimental side Goldstein and Rubens were addressing the Society on the fundamental investigations for which their names are best known. At the beginning of the War, the Society numbered more than seven hundred members, and the *Verhandlungen* were publishing papers of the first importance.

After the War, the Society initiated fundamental changes, which increased its influence both inside and outside Germany. Local branches were founded in all the chief centres of physical research throughout the country, and, in conjunction with the newly founded society for technical physics (*Deutsche Gesellschaft für technische Physik*, in the foundation of which, if I may obtrude a personal note, my old friend Hausser, whose death in 1933 at the early age of forty-seven years was so widely lamented, played a prominent part), yearly meetings were arranged, somewhat similar to our British Association meetings, but for physics only. The most recent of these meetings was held last September at Bad Pyrmont, and nearly five hundred physicists attended.

Changes which were widely felt outside Germany were made in the publications of the Society. There were in 1920 two extensive publications which gave abstracts of the world literature in physics; the *Fortschritte der Physik* and the *Beiblätter* of the *Annalen der Physik*. In place of these a single publication was issued, the *Physikalische Berichte*, which has attained a high reputation, outside as well as within Germany. The abstracts are, in general, exceedingly good, and appear promptly. In the same year, 1920, the *Verhandlungen* were discontinued, and in their place appeared the *Zeitschrift für Physik*, under the auspices of the Society. This publication is so well known to physicists in Great Britain as not to need commendation.

The Society is a powerful agent for the promotion of physical knowledge and for international accord and co-operation in the search for scientific truths. It now numbers some fourteen hundred members, of whom almost a third live outside Germany. Its work was never more important than now, and on its ninetieth birthday, which is being celebrated in Germany as a jubilee, it will receive the congratulations and good wishes of physicists of all nationalities.

E. N. DA C. ANDRADE.

Obituary

DR. THEOBALD SMITH, FOR.MEM.R.S.

WITH the death on December 11 of Dr. Theobald Smith, there has passed away a great figure in the science of animal pathology. Much of his life was spent in research on veterinary science, and his work illustrates the natural intimate connexion between human and veterinary medicine, for his researches were of so accurate and fundamental a character that they made far-reaching additions to knowledge of disease both in man and the lower animals. The breadth of his outlook was remarkable and many branches of pathology have been enriched by his keen insight.

Theobald Smith was born at Albany, N.Y., in 1859, and after taking the degree of Ph.D. at Cornell in 1881 and of M.D. at Albany in 1883, he was appointed director of the Pathology Laboratory of the Bureau of Animal Industry in the U.S. Department of Agriculture in 1884, and his earliest work was recorded in the annual reports of that department.

From 1896 until 1915 he was director of the Pathological Laboratory of the Massachusetts Board of Health and was professor of comparative pathology at Harvard University from 1896 until 1915, when he was appointed director of the Animal Diseases Branch at Princeton of the Rockefeller Institute, where he was emeritus professor at the time of his death.

The quality of Theobald Smith's work was recognised throughout the world, and in 1932 he received the Copley Medal of the Royal Society. He was a foreign member of the Royal Society, the Paris Academy of Sciences, the Danish Royal Society and honorary member of many other scientific societies. He was awarded the Manson Medal of the Royal Society of Tropical Medicine of London, and received many other scientific honours.

The best known of Theobald Smith's discoveries was that of the relation of ticks to the disease known as Texas fever or red-water of cattle. In 1889 Smith and Kilborne accurately described the causal protozoon, *Pirosoma bovis* (*Babesia bigemina*) and in 1893 they showed that the disease was transmitted from one animal to another by the tick *Boophilus* (*Margaropus*) *annulatus*. This was the first instance in which a protozoal disease of a mammal had been proved to be transmitted by an arthropod. The cycle of the protozoon was complicated by the fact that the tick, after sucking the blood of an infected animal, fell to the ground and laid its eggs on the grass, and not until the eggs had hatched, after weeks, or months, were fresh cattle infected by the bites of the larval ticks. By this work many obscure features of this serious plague of cattle were explained and several entirely new factors in epidemic and epizootic disease were disclosed.

The time when Theobald Smith began his work was one of rapid advance in bacteriology, especially in the direction of describing new bacteria associated with special diseases. His observations were often of striking originality and related rather to the manner of action of bacteria, but they were often unheeded and forgotten, to be rediscovered later by others. The discovery of new phenomena appears to have been his chief interest though the subjects at which he worked had eminently practical aims, and his career illustrates the fundamental value of informed and intensive observation by those engaged in work on practical issues. It has come as a surprise to many to learn that with D. E. Salmon in 1886 he showed that a culture of bacteria killed by heat if inoculated into a warm-blooded animal—a bird—gave protection against a lethal dose of the same living micro-organism. This was the first recorded use of a dead vaccine, though the discovery is commonly attributed to Pfeiffer, who in 1896 began a long series of fundamental experiments on the same subject. Another early observation, reported in 1895–96, was the occurrence of a "peculiar disease" with deep and subcutaneous hæmorrhages causing the death of guinea pigs in four to eight weeks if they were fed only on oats and bran without any green food. This appears to be the first description of scurvy in the guinea pig, which has been used as a valuable indicator of scorbutic diets in research on vitamins in recent years. Smith, however, did not mention the similarity to human scurvy, but was concerned to show that this deficiency in the food led to the death of animals inoculated with a bacterium innocuous to guinea pigs fed on a normal diet.

In 1889 Smith began a series of investigations into the chemical products and growth requirements of bacteria, which were continued for many years and led to results of much practical and theoretical value in bacteriology. The chief of these observations were on the differential fermentation of sugars, the reducing power of bacteria, and the oxygen and carbon dioxide needs of different species and races of these micro-organisms. Among the characters of bacteria which most interested him was their capacity for variation in virulence and in other ways. In 1895–96 he published a paper on the existence of two kinds of tubercle bacilli exemplified by strains from a bear and a bull respectively, and in 1896 he correctly described the differences between human and bovine strains and the forms of disease which they produced, anticipating Koch's better-known statement on the same subject in 1901.

Another early but neglected observation, published by Smith with Reagh in 1903, concerned the non-motile varieties of certain motile bacteria, and the distinct agglutinins which were produced in animals for the flagella and bodies of the bacteria. These important facts were rediscovered in 1917 by Weil and Felix. Smith made a number of new observations on the culture of the diphtheria bacillus and on its toxin, and in 1910 he showed that balanced mixtures of toxin and antitoxin could be used to induce immunity to infection. In this way he laid the foundation of the present methods of protecting man against diphtheria.

Smith's zeal for the advancement of knowledge for its own sake is seen in the story of his discovery in 1904 of anaphylactic shock in the guinea pig resulting from a second injection of horse serum. The symptoms had often been seen by others and wrongly interpreted. This discovery he communicated to Ehrlich by letter, and the first publication on the subject was by Otto in 1906 in a paper on "Das Theobald-Smithsche Phänomen der Serum-überempfindlichkeit".

In 1922 appeared his work on the first milk or colostrum of cows which, if taken in the first two or three days of life, protected calves from otherwise dangerous infections. From among his numerous other original investigations may be mentioned those on the form of streptococcal mastitis of cows which may convey serious infections to man through the milk, on the forms of contagious abortion in cattle due to *Brucella abortus* and to the *Spirillum abortus* which he discovered, and on sarcosporidia. He continued at work in apparent health until last summer.

In 1934 were published Smith's Vanuxem lectures on "Parasitism and Disease" in which he summed up the history and theories of parasitism and recorded his mature reflections on this fascinating theme, with little or no reference to the share which he himself had taken in its development.