injection can not tell the whole story, and one must know what becomes of the bacilli rather widely scattered in the subcutaneous tissues. The reason that so many more of the accessory, late nodules develop on the right side lies in the fact that the right inguinal nodes, always massively caseous from the primary right inguinal inoculation, offer more of a block to the drainage of the bacilli of the second inoculation than the normal or more nearly normal left axillary nodes.

Numerous studies of the Koch phenomenon, made during the fifty years and more since Koch first described it, have shown that in the previously infected animal there is not only restricted dissemination of reinjected tubercle bacilli, but reduction in their numbers and some change in their form. This has been found by Rist and Rolland, Kraus, Willis and many others. We have counted the bacilli in the sections of all the secondary tubercles, both the early ones and the later, and have found but few bacilli, one or two, up to five, in tuberculous lesions many times as large as the original primary tubercle that contained fifty or sixty bacilli. Moreover, many of these bacilli have been long and beaded, as Sewall had described the organisms of healing lesions and attenuated cultures years ago. With the development of the multiple late lesions, there were ultimately many more residual bacilli on the right side than on the left, for every tubercle has shown at least one bacillus. The nodules were at varying distances from the primary lesion, but they complicate the experiment and we must devise a plan which will obviate this difficulty. The fate of the bacilli, either their death or their attenuation, seems to us the crux of the Koch phenomenon or the immune reaction.

Recent studies on the reactions of the body to acid-fast organisms have stressed the factors which are common to all these organisms. Tuberculous lesions form after the injection of acid-fast organisms whether the bacilli are virulent or avirulent, as well as whether the bacilli are living or dead. Lesions from living, virulent bacilli progress in animals that are susceptible to the strain. Lesions from attenuated, avirulent or dead bacilli regress. Similar lesions can also be produced by lipoids extracted from all types of tubercle bacilli, virulent or avirulent, or from bacillary residues. The tuberculo-proteins have also been shown to have much in common. An example of this is to be found in the fact that the tuberculin prepared by the government for the testing of cattle is made not from bovine strains with which the cattle are infected, but rather from three virulent human strains. It is probable that human strains were selected because they are less apt to show loss of virulence under cultivation than are bovine strains. When we come to know the materials that differentiate the strains from one another and the virulent from the avirulent forms, it may be possible to probe deeper into the mechanism by which the more virulent strains survive in the infection. We already know that even susceptible animals have some power to degrade the virulence of tubercle bacilli. The mechanism of this degradation of virulence is the enigma of the Koch phenomenon.

In the last manuscript of Dr. Sewall is another sentence which I wish to quote; it refers to this long, difficult and unfinished task of solving the Koch phenomenon. He wrote: "It seems important that discrete facts spontaneously occurring or artificially established continue to be assiduously collected and arranged in a way to establish the inevitable sequence and hence a meaning." How true these words, and how well they express the adventure which is research to which he devoted his energies with joy to the very last day of his life!

OBITUARY

SIGMUND GRAENICHER

DR. GRAENICHER died on September 16, having been in poor health for some years. He was a naturalist in the broad sense, especially interested in entomology. He was born at Natchez, Mississippi, on April 29, 1855, of Swiss parents. His mother and father died within a week of each other of yellow fever, when he was only three months old. In his early childhood he was in the loving care of an old Irish couple, but when twelve years old he was sent to Switzerland to be educated. His uncle, to whom he was consigned, wished him to be an engineer, and accordingly he attended engineering courses at Stuttgart and in the Polytechnikum at Zurich. On the death of his uncle, Graenicher felt free to give up the engineering, for which he had little inclination, and to devote himself to biological subjects. He studied marine life at Nice, and obtained his Ph.D. at Basel in 1884. Expecting to return to the United States, he entered the field of medicine and after working for a time at Bern, he took his degree "Summa cum Laude" at Munich in 1888. He had in the meanwhile been married, and the couple came to Milwaukee, where Graenicher took up the practice of medicine. Very soon, he became associated with the Museum of Natural History at Milwaukee, which in those days was especially known from the brilliant work of Dr. and Mrs. Peckham on spiders and wasps. Graenicher began by building up the collection of fishes, which he found to consist of only two specimens. For years he worked as honorary

curator, and was also active in the work of the Wisconsin Natural History Society. In 1909 he gave up the practice of medicine and became curator of invertebrate zoology at the museum. In this position he actually covered the whole field of biology, and when he left it was necessary to find a zoologist and a botanist to continue his work. In 1916 he retired from the museum and moved to Florida, largely on account of his health. He established himself at South Miami, making a home out of a veritable wilderness, and in so doing probably overtaxing his strength, so that he was a semi-invalid from about 1926. In 1925 he was able to visit Switzerland.

It is difficult to estimate the value and influence of such a man, but it was great and still continues. Essentially an out-of-door naturalist interested in the relations and interactions of all forms of life, seeing life as a whole, he was of a type now too rare. His zeal knew no bounds, and what he did was only limited by his time and strength. He began to publish in 1903 and 1904 on the bees of the large genus *Andrena*. These had been intensively studied by Robertson at Carlinville, Illinois, but Graenicher found that in his more northern locality many of the species were different and new to science. The study of these and other bees included investigations of their life-histories, their parasites and their relation to the flowers visited. Many discoveries were made, and our knowledge of the structure of bee larvae and of the parasitic habits of several native bees is derived from Graenicher's writings. The work on bees and flowers led naturally to consideration of other flower visitors, and thus special attention was given to certain families of Diptera. Certain flower-loving beetles (*Nemognatha*) were also investigated. In 1935 appeared an elaborate paper on the bee fauna and vegetation of Wisconsin, and in 1930 a similar paper gave the results of his work in the Miami region of Florida. I have a list of 25 papers published by Graenicher, nine of them issued by the Wisconsin Natural History Society.

There have not been many workers in this country who have studied the flower-visiting insects intensively in a particular locality. We think of Graenicher in Wisconsin, Robertson in Illinois, Lovell in Maine. This kind of work offers rich rewards in the way of discoveries, in any part of the country, and would doubtless be more popular if better understood. It is advanced "nature study," of broad cultural value, but demanding much time and labor. It should be especially valuable to those who teach biology in our high schools. It must be promoted by men of the Graenicher type, who combine enthusiasm with knowledge and are not afraid of a fact because it is not mentioned in the books. Unfortunately, no really adequate book on the subject is available at the present time. The existing records furnish a basis for such a book, but it is very difficult for any beginner to assemble or find the papers in which they are printed. Is there not some publisher who will produce for us a work of the same general character as Rayment's "Cluster of Bees," lately issued in Australia? The necessary author or authors could probably be found, and perhaps the work might be ready in a few years. A similar work on ants, as a memorial to Wheeler, has been suggested.

Graenicher's body was cremated; he wished that there should be no regular services at the time of his funeral, but hoped that his friends might assemble one day on a pleasant afternoon under the trees and speak kindly of him. These friends are widely scattered, but perhaps the above account may serve to stimulate such conversation in many places. For the main facts concerning Dr. Graenicher's life I am indebted to his daughter, Mrs. Sylva G. Martin.

T. D. A. COCKERELL

UNIVERSITY OF COLORADO

RECENT DEATHS AND MEMORIALS

LORD RUTHERFORD, director of the Cavendish Laboratory of the University of Cambridge, died on October 19, at the age of sixty-six years.

DR. FRANK MORLEY, since 1900 until his retirement as professor emeritus in 1929 professor of mathematics at the Johns Hopkins University, died on October 17 at the age of seventy-seven years.

SAMUEL HUME BECKETT, professor of irrigation investigations and practice at the University of California, died on September 17 at the age of fifty-four years.

DR. JOHN NAPOLEON BRINTON HEWITT, linguist and ethnologist of the Bureau of American Ethnology, Smithsonian Institution, died on October 14. He was seventy-seven years old.

HENRY KENDALL MULFORD, president of the Mulford Colloidal Laboratory, Philadelphia, and director of the research and biological laboratories of the National Drug Company, died on October 15 at the age of seventy-one years.

SENATOR ALESSANDRO LUSTIG, formerly professor of general pathology in the University of Florence, known for his work on bubonic plague and sanitation, died on September 23. He was seventy-nine years old.

DR. MAX HOLLRUNG, professor of plant pathology at Halle, died on May 5 in his seventy-ninth year.

FRANK STEPHENS, pioneer west coast biologist, first