

runners in medicine what they are to us. Without a wide and deep social vision the doctor of the future will not be what he should be. Medicine is becoming more and more social. Its function is becoming more and more one of prevention. And a deeper insight into human nature, and a keener understanding of all the sciences, particularly the biologic, will be demanded of the man who will succeed.

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*PROFESSOR THEOBALD SMITH AND A NEW  
OUTLOOK IN ANIMAL PATHOLOGY*

THE recent announcement of an additional endowment to the Rockefeller Institute for Medical Research, for the establishment of a department of animal pathology, marks a far-seeing and helpful recognition of the importance of a phase of research now scantily supported, yet full of promise for the physical and economic welfare of mankind and the well-being of animalkind also. But as the success of such an undertaking is after all more a matter of men than of money, the news that the projected department is to be organized and conducted by Professor Theobald Smith, of Harvard University, is of the happiest augury.

Though long in the foremost rank of the notables of science in America, the work of Professor Smith has not often secured, or suffered, popular exposition. But he has had the uncommon satisfaction of seeing, many times, the lines of thought and research which he has opened lead sooner or later to far-reaching theoretical development and practical achievements.

Thus while Dr. Smith was yet a subordinate in the Bureau of Animal Industry in Washington, he had occasion to study the Texas fever of cattle, then the cause of great economic loss to the farmers and cattle-men of that as well as other states, and of countries the world over. He found at last that the disease was incited by a protozoan parasite so small that it found a spacious abode within the purlieus of a single red cell of the blood, which it ruthlessly destroyed.

Smith and Kilborne announced also that this piroplasma, as it was called, is conveyed from animal to animal through the intervention of a cattle tick in which the protozoan undergoes a developmental cycle upon which the perpetuation of its kind depends. They further learned that cattle recovered from the fever had become immune, and though well, might indefinitely carry the piroplasma in the blood and be a perpetual source of infection for cattle fresh from another district.

This surprising, unprecedented, and, as it seemed to many at the time, unnecessarily complex and rather preposterous mode of infection made good its claims, and Texas fever leads the line of infectious diseases in men and animals, in which some insect acts as intermediary host and sole conveyancer of infective microbes from their sources to fresh victims. Thus in malaria and in yellow fever it is the mosquito which is to blame, and its suppression in any country insures virtual emancipation from these diseases. Thus have Cuba and Panama been rescued, and the way is open for the control of other tropical infections in other lands. Thus also the infective agents of plague and typhus and other communicable maladies are harbored and dispersed by insects which are the vulnerable links in the chain of infection often most easily broken through sanitary control.

The story of all these practical achievements in disease prevention through the knowledge and control of insect pests, leads back twenty years and more to the hot and gloomy garret in Washington, then the laboratory of the Bureau of Animal Industry, and to Dr. Smith's parasitic cattle tick harboring its own invisible protozoan parasite. And Texas fever no longer exacts its toll from man or beast; or if it does it is the man's fault. These immune cattle, bearers of the, to them, innocuous parasite, head the procession of "carriers" of infective agents, in which humans are now known to hold a conspicuous place, and are the bugbears of preventive medicine to-day.

Almost as soon as Koch had shown the world how easily and accurately to cultivate bacteria, more than thirty years ago, in the very

earliest of the eighties, the laboratories got intensely busy in the search for new species of germs; and as fast as forms were discovered which incite disease, the knowledge of how they look and what they do and how they may be restrained or destroyed was turned to the service of man and beast.

But the researches were not long content to spy upon the performances of the germs. What the living threatened body does to protect itself against them when once they gain a foothold became a subject of wide and fruitful inquiry. So the facts and doctrines and guesses relating to immunity and to infection, either natural or acquired, came to the front.

Pasteur had got some wonderful results in the experimental conference of immunity to infection, by gradually adapting animals to disease-inciting germs, which were living, but whose virulence and potency had been artificially reduced. It was then supposed that only the subtle action of the living germ could conjure forth the remarkable protective power apparently created in artificial immunity. Many others were at work on these and kindred lines; Dr. Smith among them. But he noticed, and was the first with Salmon to announce in 1886, that animals could be immunized not only by living germs but by cultures of these which had been sterilized and every vestige of life destroyed.

This announcement did not seem to start even a ripple in the bacteriologic pool. But the thing was in the air. There were many busy workers, and sooner or later such a record helps more than is commonly realized another explorer who is heartened to find his pathway not quite untrod.

Very soon it had been shown that immunity to diphtheria may be secured in animals not only by the living germs, but by the sterile products of their life processes. Thus with the names of Loeffler, Behring, Roux, Yersin and many others, opens the story of diphtheria antitoxin and its marvellous benefactions to mankind.

And so again, every horse which is turned to the uses of suffering mortals and gets his dosage of sterile diphtheria culture broth for

the manufacture of antitoxin, is but another exemplar of the principle which first crystallized in the light of the response which Dr. Smith's pigeons made to the sterile hog-cholera bacillus cultures, at that early day, close to the dawn of the bacteriologic era in biology and medicine.

Dr. Smith has devoted a great deal of time and energy to the study of diphtheria and other antitoxins, both as professor of comparative pathology at Harvard and as the director of the antitoxine and vaccine laboratories of the Massachusetts State Board of Health. As is the case with most acute observers in these uncharted fields of bacteriology and immunity, he has encountered many striking phenomena which the lore of the time had not satisfactorily classified or accounted for. One of these carries a little story.

When Ehrlich was in this country in 1904, Professor Smith called his attention to the singular fact that guinea-pigs which he was using to test diphtheria antitoxin, sickened and died upon being injected with normal horse serum several weeks after they had been injected with diphtheria antitoxin. Guinea-pigs usually do not mind normal horse serum at all. Such an extraordinary sensitiveness to normal serum, following earlier injections seemed something new and unaccountable, and when Ehrlich got back to Frankfort he gave the problem to Dr. Otto, who labored with it and presently wrote a paper on what—with an attitude of undismay toward stately adjectives that is characteristically German—he called the “Theobald Smithsche Phänomenon.” Nowadays the yearly lists of the achievements of research in infection and immunity fairly swarm with studies on “anaphylaxis,” a phase of immunity of which Professor Smith's guinea-pigs afforded one of the first recorded examples.

In the early days of bacteriology Dr. Smith called attention to the value of a bent glass tube, closed at one end, such as was already in use by the chemists, for the purpose of cultivating many types of bacteria and studying their biological characters. This is of especial value in the culture and study of the class of

bacteria known as anaerobic, whose activities are intolerant of the presence of oxygen. "Smith's culture tube" has long been held in high esteem in the outfit of the bacterial laboratory.

But as early as 1890, Dr. Smith called attention to the fact that anaerobic bacteria are exacting not only in their relations to oxygen, but in their food requirements also; and he suggested, and proved, that attention to the latter gave promise of important results in the study of this class of germs. He then, and has repeatedly, urged that the addition to the fluid media in the tubes in which such organisms are commonly grown, of small pieces of sterile animal organs, such as the kidney, fulfil the required nutrient conditions. The repeated hint remained practically unheeded for some twenty years. Then through its adoption Noguchi, at the Rockefeller Institute, was able for the first time to cultivate the spirochete which is the inciting agent of syphilis, as well as several others of its class which have hitherto resisted all the wiles and blandishments of the most accomplished bacteriologists, in the framing of the conditions of culture and the tender of food. With these cultures available Noguchi has made practicable and safe a test—the luetin test—for the most subtle and obscure forms of syphilis. Thus the way is now open for the more ready detection of this sinister disease, for the study on a solid basis of the conditions under which it is manifested; how its protean characters are determined; and what rational methods for its cure may be conducted. Similarly, scarcely more than a year ago, Flexner and Noguchi, by an adaptation of Dr. Smith's long ignored suggestion about the food requirements of anaerobes, have been led to the discovery of the nature of the virus of infantile paralysis, isolating it in cultures maintained through many generations and clearing the way toward a hopeful outlook for the prevention and perhaps the cure of this pitiful malady.

One of Professor Smith's striking achievements is the establishment, through long and patient studies, of a type of the tubercle bacillus which has become especially adapted to

cattle and now is known as the "bovine type" of the tubercle bacillus. The delimitation of this organism and its differentiation from the human type have made possible a series of exact researches by others on the frequency of the occurrence of the bovine bacillus in man. And thus to-day those who are engaged in the long and stubborn fight against the spread of tuberculosis are on firm ground when they enter the field of meat and milk contamination, to determine the measures which must be taken to safeguard them at their source.

These are some of the landmarks in Dr. Smith's achievements during this quarter of a century of incredible activities on every hand, in the discovery of microbic disease incitants, of the things they do, and the reactions of those individuals of the higher sort who in the vicissitudes of life may become their hosts and their victims.

As the eye ranges over the stately bibliography which marks these years of Dr. Smith's scientific activities, it rests upon many titles with stories in them, of a period or a halting point, in the growing knowledge of disease and its incitants, upon which the author's wide range of thought, his unventuresome sagacity, and breadth of vision have cast helpful and inspiring light.

While Professor Smith gets down to the humdrum details of exact research and record when it is necessary—and it often is necessary in all the ups and downs of the common road of fruitful biological research—the quality which is perhaps most characteristic is the larger view impressed upon all his problems. The biological point of view, if the reader please, in which the individuality of the living thing Dr. Smith sees bears in every feature the marks of its heredity and environment. The tubercle bacillus, for example, is to him not something which has just happened, in the human and animal kind. The bacillus gets his day in court, and is as much a part of the scheme of things as is his more imposing host. What happens when they meet in a many-sided conflict of adaptation, and the problems which gather about it are to be

solved only by sustained attention to all its many aspects.

This larger vision, the ability to set the pace on a high plane, the capacity for work, the power of constructive leadership—these are the qualities which lead those who know Professor Smith and his achievements to rejoice that he is now to center his activities in a field so full of promise as is animal pathology to-day; and this with the opportunities which the Rockefeller Institute affords those who share its aims, to carry forward their chosen work unhurried and unhindered.

T. M. P.

#### SCIENTIFIC NOTES AND NEWS

DR. S. J. METZER, head of the department of physiology and pharmacology of the Rockefeller Institute for Medical Research, has been elected president of the Association of American Physicians in succession to Dr. Simon Flexner.

At its annual meeting, held on May 13, the American Academy of Arts and Sciences voted to award the Rumford Premium to William David Coolidge for his invention of ductile tungsten and its application in the production of radiation.

THE Franklin Institute, Philadelphia, on May 20, presented its Elliott Cresson medals to Dr. Edgar Fahs Smith and Dr. Orville Wright. Addresses were made on "Scientists from the Keystone State," by Dr. Edgar Fahs Smith and on "Stability of Aeroplanes," by Dr. Orville Wright.

HONORARY degrees are to be conferred by the University of Glasgow on Dr. Archibald Barr, late regius professor of civil engineering and mechanics in the university; Colonel Sir William B. Leishman, F.R.S., professor of pathology in the Royal Army Medical College, and Sir Ernest H. Shackleton.

ON May 4, a company of men and women, forest lovers, gathered in Harrisburg, at an informal luncheon, to present a testimonial to Dr. J. T. Rothrock on his retirement from the Pennsylvania Forestry Commission. There were sixty-five present, among whom were

Governor J. K. Tener; Mr. John Birkinbine, president of the Pennsylvania Forestry Association; Mr. A. B. Farquhar, president of the Pennsylvania Conservation Association; Mr. J. Horace McFarland, president of the American Civic Association; President H. S. Drinker, of Lehigh University, president of the American Forestry Association; Mr. C. F. Quincy, chairman of the executive committee of the American Forestry Association; Professor J. A. Ferguson, director of the forestry department, Pennsylvania State College; Hon. R. S. Conklin, commissioner of forestry, Pennsylvania, and Dr. S. R. Dixon, state health commissioner of Pennsylvania. The governor presented in behalf of two hundred and fifty donors, a beautiful loving cup, and Mr. Farquhar, Dr. Drinker and Mr. Conklin spoke of Dr. Rothrock's work and personality. Dr. Rothrock spoke feelingly in reply.

At the annual meeting of the Boston Society of Natural History the following officers were elected for the ensuing year: *President*, Charles Sedgwick Minot; *Vice-Presidents*, Robert T. Jackson, Nathaniel T. Kidder, William A. Jeffries; *Secretary*, Glover M. Allen; *Treasurer*, Edward T. Bouvé; *Councillor for two years*, Alfred C. Lane; *Councillor for three years*, Thomas Barbour, Henry B. Bigelow, Miss Cora H. Clarke, William G. Farlow, George H. Parker, John E. Thayer, Charles W. Townsend, William F. Whitney. Reports were made on the work and progress of the year and an illustrated paper was presented by Dr. Hubert Lyman Clark on his experiences as a member of the Carnegie Institution's expedition to Torres Strait and the Great Barrier Reef of Australia. The two annual Walker Prizes, awarded for the best memoirs submitted on subjects in natural history, were voted as follows: a first prize of \$60 to Miss Marjorie O'Connell, A.M., of the department of geology, Columbia University, for her essay on "The Habitat of the Eurypterida"; and a second prize of \$50 to William J. Crozier, of Cambridge, for his essay on "The sensory reactions of *Holothuria surinamensis*."