NATIONAL ACADEMY OF SCIENCES

FREDERICK PARKER GAY

1874—1939

A Biographical Memoir by

A.R. DOCHEZ

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For some men fortune is favorable in determining the time at which they are born. Perhaps not very frequently but occasionally the spirit and interests of their period are fortuitously adjusted to the future development of those qualities within themselves which later become manifest in their creative activities. Such a man was Frederick Parker Gay. In the broad sense he was a biologist and he contained within himself, and throughout his life cultivated assiduously, two important aspects of that science which are essential to the progressive enlargement of its point of view and to the understanding of the basic components which are essential to the development of its endless potentialities. Dr. Gay had that training in and appreciation of exact experimental procedures so necessary for the reliable determination of facts and their relatedness and the perceptive sensibility of the artist so important in discovering the pattern which is the hidden foundation upon which the facts are arranged. All too frequently to the ordinary mind this integrated arrangement seems to be somewhat chaotic in nature.

Frederick Parker Gay was born in Boston, Massachusetts, on July 22, 1874. His parents were George Frederick Gay and Louisa Maria Parker. On both sides his American ancestry went back to the early 1600s and contained representative names of New England, names with which much of the early distinction and achievement of this country is associated. Thus the stock from which he sprang was replete with integrity, energy, and consciousness of high purpose, characteristics which have fashioned the sound and well-articulated skeleton which gives structural stability to this country.

In his youth Dr. Gay's interests were many and various and he exhibited a certain orientation toward the adventurous. While at school his versatility was manifested by his interest in baseball, sailing, chess and music, an interest which later became an important preoccupation of his life. In the summer

of 1894 he went on an Arctic expedition conducted by Dr. Frederick Cook and on his return suffered shipwreck on the coast of Greenland. On his safe arrival home he wrote a description of his experiences for the Boston newspapers.

During his junior year at college, Dr. Gay's health broke down and he embarked on an instructive trip around the world, returning to graduate with his class at Harvard University in 1897. Whether a love of travel resulted from this experience or whether he was fulfilling an already existing impulse, at all events he indulged this taste frequently during his life. Shortly thereafter he again journeyed around the world in 1899, this time as an assistant with a Johns Hopkins University Medical School commission for the study of bubonic plague and certain other diseases in the Philippine Islands. About thirty years later he returned to the same islands to study leprosy as a member of the Leonard Wood Memorial Commission. On his first trip to the Philippines he went as a voluntary soldier with the American forces to fight against Aguinaldo and participated in the capture of Antipolo.

Dr. Gay graduated from the Johns Hopkins Medical School in 1901. Since at that time the science of bacteriology was an integral part of that branch of medicine concerned with morbid anatomy, his early instruction was obtained under the supervision and guidance of the pathologist. An award of the first fellowship of the Rockefeller Institute for Medical Research opened for him the position of assistant demonstrator in pathology at the University of Pennsylvania, a position which he occupied from 1901-1903.

Gay had been accustomed to spending his summer vacations in Europe and this, in conjunction with his growing interest in the fundamental problems of microbiology, influenced him to seek association with one of the great masters of the science of that day, Jules Bordet in Brussels. From this stimulating personality Gay received inspiration which was to affect his thinking and activities throughout the rest of his life. Under the influence of Bordet he turned from his more purely bacteriological studies of dysentery, arising out of his early experience in the Philippines, to the serological phenomena accompany-

ing immunity, a collateral branch of microbiology that at the time was in the first stages of its development. This division of microbiology was later to become of great importance and significance for the full understanding of the series of events that accompany the struggle between host and infecting microorganism and that determine to a large extent the favorable or unfavorable outcome of infectious disease. At first Gay's attention was devoted to a study of the alexin (complement) fixation reaction, a specific test for infection with a variety of microorganisms. This field of investigation was in its infancy at the time but later was to become an immunological reaction of great practical and theoretical importance. The interest aroused by this experience persisted throughout his life and represented the initiation of a long and versatile series of contributions to the science of immunology. His enthusiasm for the subject decided him to translate into English and to publish, in 1909, his first book: "Studies in Immunity," by Bordet and his collaborators.

On Gay's return to the United States he first served as bacteriologist to the Danvers Insane Hospital in Massachusetts, 1906-1907, and later as instructor in pathology, 1907-1909, at the Harvard Medical School. At this time he developed a lifelong and fruitful friendship with Elmer Ernest Southard, the distinguished psychiatrist, a relationship for which he later expressed his deep appreciation by the preparation and publication, in 1937, of Southard's life and letters, under the title of "The Open Mind," a book whose excellence exhibits the breadth and variety of Gay's intellectual and humane interests. This friendship was productive also in the field of science, for with Southard as a collaborator he carried on a long and detailed study of anaphylaxis, a phenomenon which at the time was attracting widespread interest but of which the broad significance was only beginning to be indicated.

Up to this time, 1910, bacteriology had not yet achieved administrative and teaching independence as a scientific discipline in the medical schools of this country but was still under the direction and control of departments of pathology. Growth and expansion under these circumstances had, however, been

rapid and significant and many important contributions to the knowledge of disease had been made. In this connection, it is a matter of some interest that in 1910 Gay was appointed Professor of Pathology at the University of California, although his experience in pathology as such was somewhat limited and his principal interest and all his publications lay in the field of bacteriology and immunology. While at California and with a department of his own his broad interests were manifested by a rapid expansion of the field of his activities. Studies during this period were concerned with the nature of antibodies, the mechanism of their formation, and their practical application to the diagnostic problems of infectious disease. Parallel with these studies research on the effectiveness of variations of antigenic structure and of methods of application of antigens for the purpose of inducing antibody formation were actively carried on. A number of specific infectious diseases, such as poliomyelitis, pneumonia, meningitis, influenza, hemolytic streptococcus infection, and typhoid fever, were extensively investigated from the standpoint of bacteriology, immunology and etiological diagnosis. The study of typhoid fever particularly occupied his attention and resulted in a number of original contributions dealing with the carrier state in typhoid fever and its experimental production in rabbits, the usefulness of typhoid vaccine both for purposes of prophylactic immunization against the disease and as a method of shortening its course by intravenous injection during the acute phase of the fever itself. In an effort to devise a reaction of significance for the purpose of indicating resistance against typhoid fever, Gay and his co-workers were led to develop the typhoidin test, which consisted in the intracutaneous injection of products of the typhoid bacillus. A positive reaction indicated local hypersensitivity to the organism and when positive appeared to be correlated with immunity to the disease and when negative to lack of resistance to infection. The test was also used to measure the efficiency of prophylactic vaccination. The interest arising from these studies led, in 1918, to the publication of a book entitled "Typhoid Fever," an attempt at exposition of the total problem of the disease. Its aim was to treat historically the

development and present status of our knowledge concerning this important malady as viewed from the standpoint of its mechanisms. The range of subject matter was very comprehensive, extending from modes of infection in typhoid fever through all its multifarious aspects to the various methods thought to be possibly efficacious in its treatment.

Toward the end of Gay's stay in California he succeeded in developing at that University bacteriology and immunology as independent sciences separate from pathology, a separation which led to his appointment, in 1921, as Professor of Bacteriology and Director of the newly organized department. In 1923, Gay left the University of California and came to Columbia University as Professor and Executive Officer of the Department of Bacteriology, a department already distinguished both as to achievement and leadership and which had attained independence from pathology as early as 1909.

Gay at once took advantage of his new opportunities for the purpose of improving and expanding his teaching facilities, giving special attention to the development of graduate instruction leading to the degree of Doctor of Philosophy in Bacteriology awarded by the Faculty of Pure Science. The candidates for this degree were wisely limited in number in order to correspond with the demand for such graduates in the academic world.

Attracted by Gay's leadership the staff of the department grew rapidly in size and concurrently the investigative interests, by virtue of his broad experience, expanded to cover all the most important aspects of the fields of bacteriology and immunology. The breadth of these interests is well illustrated in the large monographic textbook, published in 1935, by Gay and his collaborators, entitled "Agents of Disease and Host Resistance." The two divisions of scientific thought which are implied in the title of this book, which recounts the interaction of disease causes and the defenses against them, are inextricably interwoven. Agents of disease are either inaminate, like poisons and the various forms of physical injury, or animate, consisting of very small microorganisms such as bacteria, fungi, protozoa, rickettsiae, and the filterable viruses. Gay directed his own at-

tention and that of his department to the study of these agents of disease and, at the same time, to the phenomena of resistance or immunity against infection with such organisms. Exploration roamed over a large portion of both of these extensive fields.

The great variety of subjects that were comprised in Gay's experience and knowledge are illustrated in the numerous publications from his department on the subject of the filterable viruses of poliomyelitis, encephalitis, cowpox, tobacco mosaic and bacteriophage, a type of virus that destroys bacterial cells by causing them to undergo solution. The general field of bacteriology was also extensively covered by studies of protozoa, spirochetes, rickettsiae, infections due to anaerobic bacteria and such oral diseases as dental caries and Vincent's angina. Investigation carried on also dealt with such general subjects as serological and cellular immunity, the relationship of hormones and vitamins to resistance to infection, bacterial mutation, the mode of action of bacterial toxins, anaphylaxis and other forms of protein and bacterial hypersensitivity, chemotherapy and certain non-specific agents such as lysozyme which also effect the destruction of bacteria. Gay himself was especially interested in both local and general immunity and the tissue mechanism in the body which results in antibody formation. The role of the white cells of the blood in resistance to infection had been clearly shown originally by Metchnikoff. The experiments of Gay and his collaborators showed clearly that although the circulating cells are important, they are not nearly so important with certain virulent bacteria, like the hemolytic streptococcus, as are the fixed and semi-motile mononuclear cells of what is called the reticulo-endothelial system. Years of study by him and his associates have brought into prominence those cells which not only are able to dispose of bacteria that resist the leucocytes but also would seem to have an important function in forming the antibodies of the blood serum. His concept was that a return to the consideration of the significance of these cells in acquired immunity, as well as in natural resistance, is of great importance.

Gay's conception of his own science, that of bacteriology, as exemplified in his life interests and work is best expressed in

his own words: "The science of today and of tomorrow is in its very nature incomplete and imperfect; it is only in retrospect that a science approaches orderliness and perfection. To most of us for most of our lives the fascination and hope of a science lie in its fragmentary present and future. The desire to supplement our incomplete knowledge of today is what drives us to hypothesis and continued experiment. Now and again one of our guesses will yield a fundamental truth to the edifice we are forever building. What then is the future of bacteriology? Does it lie in adapting blindly to our work the larger bodies of fact and method of what we call a more fundamental science like chemistry? I venture to think that the progress of each science lies in discovering new methods of its own as it always has. The modern study of viruses, although largely in the hands of bacteriologists, has developed new biological, chemical, and physical approaches and brought us closer to an enlarged, though by no means final, interpretation of life itself. In the study of the historical background of our science lies a check on over-emphasis on any one line of investigation, as well as a stimulus to renewed attack."

The variety and range of Gay's interests in medicine were the mirror of a sensitive mind that sought understanding of and expression in a number of fields of human experience unrelated to science. He early acquired a love of the classics, an influence that persisted throughout his life and that gave him a discriminating appreciation of words, their exact meaning and derivation. This attainment endowed his lectures with a quality of scholarly refinement and perfection of arrangement and expression that made a deep and lasting impression on young medical students. This artistic talent also found an outlet in his appreciation of literature and especially of poetry, the latter leading him once to pose the question whether one good sonnet might, perhaps, not be worth more than a sheaf of scientific papers. Belonging also to this side of his personality was his love of music and his deep satisfaction in the companionship of those of his friends who were distinguished musicians.

Gay's early experience in Arctic exploration initiated his impulse for adventure and travel which he later satisfied by

numerous trips to both near and distant parts of the earth. He was a charter member of the Explorers Club. He made three journeys around the world, the last of which began with a survey of leprosy for the Leonard Wood Memorial Commission for the Eradication of Leprosy for which he visited Honolulu and Japan and all the leprosaria in the Philippines, spending two months at Culion, the largest leper colony in the world. At this time he served as Chairman of the Advisory Committee on Research of the Leonard Wood Memorial. This spirit of adventure and interest in the unusual was reflected in the multiplicity of his approaches to the scientific problems of medicine.

Gay, by virtue of his distinguished position in research and medical education, shared generously in the honors and rewards that science bestows on its more outstanding devotees. Through his early affiliation with Bordet he was a member of the Société Belge de Biologie. He was also a Commander of the Order of the Crown of Belgium and served as exchange professor from Columbia University to the Belgian universities. He served as a Major in the Medical Corps of the United States Army in World War I and from 1917-1918 as a member of the Division of Medical Sciences of the National Research Council functioning as its Chairman and later as Chairman of its Medical Fellowship Board. In 1929 he served on the Board of Directors of the Columbia School of Tropical Medicine in Porto Rico, and in 1932 he received the degree of Doctor of Science from George Washington University. He was a member of many prominent scientific societies in America and frequently served as their president. Gay was elected a member of the National Academy of Sciences in 1939.

Gay had a natural love of the land, especially of his native soil of New England. This he satisfied by the devoted care of his farm at New Hartford, Connecticut, where he manifested an absorbing interest in everything that grew. He spent much time motoring through the countryside and getting a picture of his ancestral background; of pioneer migrations and the trades and skills that developed the Yankee character.

A man with such diversified gifts of mind and soul attracted a wide circle of devoted friends and associates. This affectionate regard, which all who knew him intimately learned to share, was sometimes difficult for others to understand whose association with him was only brief. Gay was somewhat retiring, and his nature had in it a certain shyness which did not permit an easy approach in establishing human relationship. Superficial impressions of this kind, however, do not do justice to a warmheartedness of character that was capable of forging such strong bonds of affection with those who were close to him.

Gay died on July 14, 1939, and in the words of a friend and associate, "His years of service were dedicated to the accomplishing of aids and benefits to mankind through patient and careful scientific research, and the full life of the man and the scholar is fittingly summed up by the brief inscription placed upon the simple granite monument over his ashes in the historic Town Hill Cemetery at New Hartford, Conn., banked by laurel and evergreens and overlooking the country hillsides:—

'To know, to search and to seek out wisdom'."

The assistance of Professor Claus W. Jungblut in the preparation of this memoir is gratefully acknowledged.

KEY TO ABBREVIATIONS USED IN BIBLIOGRAPHY

Amer. Jour. Hyg.=American Journal of Hygiene
Amer. Jour. Med. Sci.=American Journal of the Medical Sciences
Ann. Inst. Past.=Annales de l'Institut Pasteur
Arch. Int. Med.=Archives of Internal Medicine
Arch. Path. Lab. Med.=Archives of Pathology and Laboratory Medicine
Aust. Jour. Exp. Biol. Med. Sci.=Australian Journal of Experimental Biology and Medical Science
Boston Med. Surg. Jour.=Boston Medical and Surgical Journal
Bull. Hist. Med.=Bulletin of the History of Medicine
Calif. State Jour. Med.=California State Journal of Medicine
Centralbl. f. Bakt.=Zentralblatt für Bakteriologie
Columbia Univ. Quart.=Columbia University Quarterly
Ergebn. d. Immu.=Ergebnisse der Immunitätsforschung
Internat. Clin.=International Clinics
Johns Hopkins Hosp. Bull.=Johns Hopkins Hospital Bulletin
Jour. Amer. Med. Assn.=Journal of the American Medical Association
Jour. Bact.=Journal of Bacteriology
Jour. Biol. Chem.=Journal of Biological Chemistry
Jour. Exp. Med.=Journal of Experimental Medicine
Jour. Immunol.=Journal of Immunology
Jour. Infect. Dis.=Journal of Infectious Diseases
Jour. Lab. Clin. Med.=Journal of Laboratory and Clinical Medicine
Jour. Med. Res.=Journal of Medical Research
Med. Commun.=Medical Communications
Physiol. Rev.=Physiological Reviews
Prac. Lib. Med. Surg.=Practitioners Library of Medicine and Surgery
Proc. Assn. Res. Nerv. Mental Dis.=Proceedings of the Association for Research in Nervous and Mental Diseases
Proc. Soc. Exp. Biol. Med.=Proceedings of the Society for Experimental Biology and Medicine
Sat. Rev. Lit.=Saturday Review of Literature
Trans. Assn. Amer. Phys.=Transactions of the Association of American Physicians
Trans. Congr. Amer. Phys. Surg.=Transactions of the Congress of American Physicians and Surgeons
Trans. Fifteenth Internat. Congr. Hyg. Demog.=Transactions of the Fifteenth International Congress of Hygiene and Demography
Univ. Calif. Chron.=University of California Chronicle
Univ. Calif. Publ. Pathol.=University of California Publications in Pathology
Univ. Penna. Med. Bull.=University of Pennsylvania Medical Bulletin

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