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ERWIN FRINK SMITH—PIONEER PLANT PATHOLOGIST

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> "Those who dwell in the clearer light of the next generation will build better than we have done and will scarcely realize how slowly and painfully many of us have groped about for what seems to them so plain." E. F. Smith (16)

Erwin Frink Smith was born on January 21, 1854 in Gilbert Mills, New York. In this town, noted for its flour mills, he developed his quest for nature and keen powers of observation. Many boyhood hours were spent watching the mills and meditating on the "prisoned god" he heard in the grinding of the mill wheel. Many more hours were spent along brooks and mill ponds of the countryside exploring and observing the animal and plant life he loved. It was in this setting that he formed a lifelong consciousness of an obligation to the Creator.

At the outbreak of the Civil War, Smith's father, Ransellor King Smith, enlisted with Company K of the 184th New York Infantry. While his father was away, young Smith had the good fortune to be influenced by Miss Ida Holmes, a friend and schoolteacher. She helped him develop an intelligent love of nature and loaned him books by Tennyson, Longfellow, and Dickens, and copies of *Atlantic Monthly*, *Harper's Magazine*, and others. Books and journals of scientific as well as literary interests were included in his reading and, indeed, for many years both literature and science tempted Smith as choices for a career. His interests were so broad that even after choosing science, he had difficulty in selecting among botany, medicine, chemistry, physics, and geology (9).

The family moved to Michigan in 1870, where Erwin, at age eighteen, first entered the public schools in Hubbardston. Several years later, the family moved to a farm in North Plains Township. This allowed Smith, full-bearded at age 22, to enter high school at the county seat, Ionia. The principal, Anson P. DeWolf, recognized Smith as an exceptional student of "unusual intelli-

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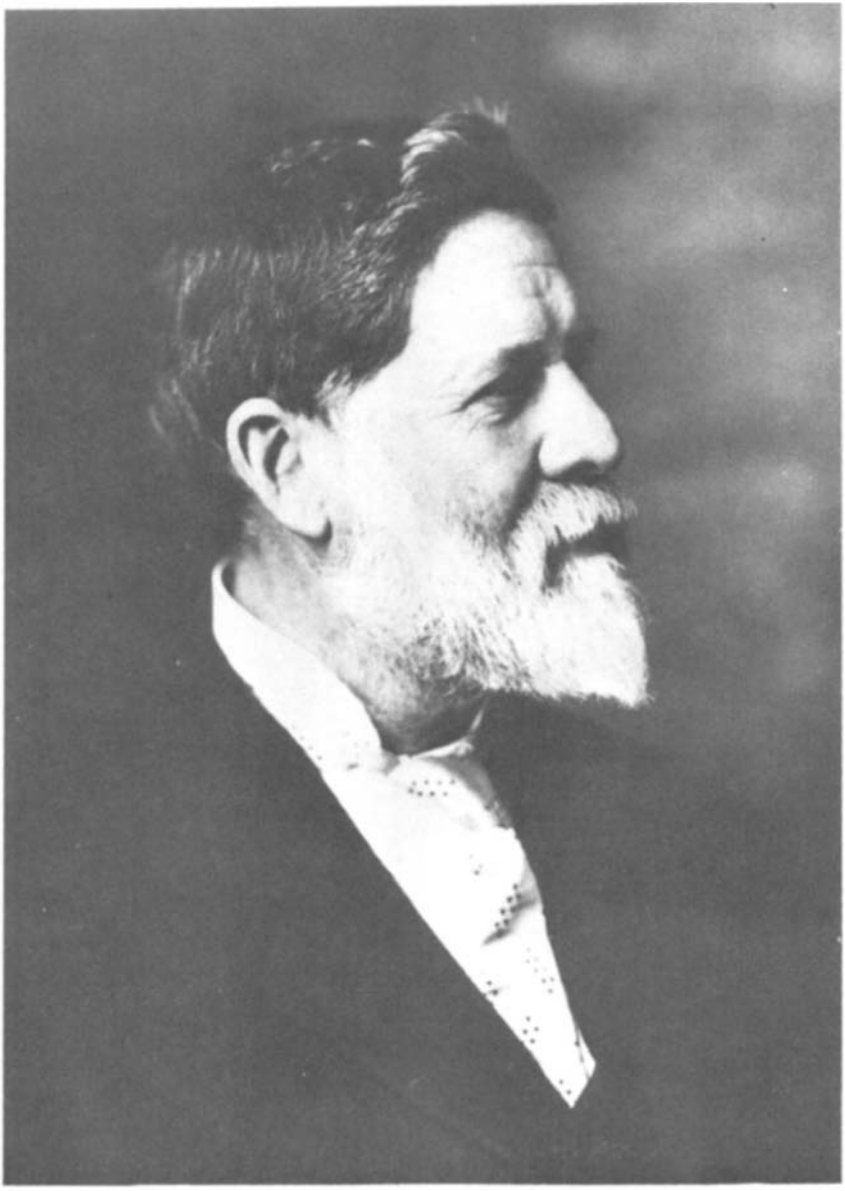

Erwin Frink Smith

gence, courteous bearing, and evident acquirements" (5) and granted him "full permission to come and go as the spirit moved." By this time Smith had acquired an extensive knowledge of French with the tutoring of Charles F. Wheeler, the local druggist, who was also an outstanding amateur botanist. It was with Wheeler in 1881, the year after Smith graduated from high school, that he published "The Flora of Michigan" (24).

After high school, Smith was employed by the State Board of Health at Lansing, and took up irregular studies at the Michigan Agricultural College (9). After this, he enrolled at the University of Michigan and obtained a bachelor's degree in 1886. Three years later, he was awarded the doctor's degree for his work on peach yellows. The young L. R. Jones was a visitor at Smith's doctoral exam, and this experience encouraged Jones' entry into plant pathology. Jones (5) later stated, " . . . throughout these unconventional relations in lower schools, college, and university alike, he (Smith) was recognized as having unusual intellectual interests and scholarly abilities. Fortunately, at all stages he also met with liberal-minded teachers and wise advisers, who gave encouragement and aid in his irregular educational programs and related problems."

Smith began work in Washington, D.C. on September 20, 1886, as assistant to F. L. Scribner in the Mycological Section of the Division of Botany, US Department of Agriculture. Most of his early career (1887–1892) was spent investigating peach yellows and peach rosette.

Smith spent many long summer days searching for the cause of peach yellows, a devastating disease in Delaware and Maryland. He traveled from orchard to orchard and area to area by buggy, stage coach, or, for long distances, by train to Michigan. His careful and painstaking investigations and lengthy notes indicate enthusiasm, diligence, and thoroughness in his attack on the problem. He showed that yellows was not due to winter injury, root aphids, overbearing, or exhausted soils. He also confirmed that yellows and peach rosette could be spread by grafting and budding. It was frustrating to Smith not to be able to discover the cause of these diseases. He wrote in 1922, "After some years, I abandoned this research and devoted my time to other subjects, mainly, as I have often said, to save my reputation, but really because the problem appeared to me to be insoluble in our then state of knowledge." Before Smith's death, Kunkel (7, 8) showed that peach yellows was caused by a leafhopper-transmitted "virus"; today the causal agent is recognized as a mycoplasma.

During his early years in Washington, Erwin F. Smith mastered the European literature on mycology, particularly with respect to plant diseases. From 1894 to 1910, he worked on Fusarium diseases of melons, cotton, cowpeas, tomatoes, potatoes, and cabbage. His paper "Fungous Infestation of Agricultural Soils in the United States," (12) published in *Science,* was the first paper

on the subject and opened a way for Orton and others to develop resistant lines of most of the crops named above.

Smith also critically reviewed the possibility that bacteria were important causal agents of plant disease in the early 1890s, and, with the exception of pear blight, found a lack of reliable data that could compare with that in the fields of animal pathology and fermentation. As L. R. Jones (6) said, " . . . one who knew Smith's marvelously alert mind, keen intuitions, religiously patient thoroughness, can easily understand why he soon decided that he must perfect his bacteriological technique and learn all that was possible of the nature and relations of bacteria." Thus, he had found a challenge and accepted it.

In 1892, he began his first work on bacterial diseases of plants. His selection of this as an area of research was undoubtedly influenced by his association with M. B. Waite, who had brought the pure culture methods of bacteriologists to Smith's attention when he left Burrill's laboratory to join the federal staff in 1889. Further influence probably came from Theobold Smith and Veronus A. Moore, who worked next door to E. F. Smith in the US Department of Agriculture on infectious diseases of animals.

Smith's first paper on bacterial diseases of plants dealt with bacterial wilt of cucurbits (11). After this, publications on specific bacterial diseases followed with critical, characteristically thorough and detailed technical descriptions of the organisms involved.

Although Smith was convinced of the disease-inducing capabilities of bacteria, not all scientists were believers in bacteria as plant pathogens. One such was the German, Alfred Fischer. From the later 1890s until 1901, Smith carried on a heated controversy with Fischer (1). In his "Vorlesungen über Bakterien" (Lectures on Bacteria) in 1897 (3), Fischer stated that bacteria had not been proven to cause plant diseases. Smith drew on his scientific evidence and excellent knowledge of the German language to publish his replies to Fischer in the *Certralblatt für Bakteriologie* (13, 14, 15). Objectively, the Smith-Fischer controversy proved nothing; no new evidence was advanced by either side. Fischer merely restated the current thought of many European workers (1, 4), and Smith reacted with a thorough and exacting restatement of the proof that bacteria could cause plant disease. Fischer's scientific and personal status in Europe was not diminished by the controversy. Smith's reputation, greatly enhanced by the controversy, established him as a leader in American plant pathology and the field of bacteriology. American plant pathology, as a whole, gained recognition in Europe as a result of the exchange. Years later, Smith regretted the polemic, but believed he had followed the only scientifically just and proper course in the controversy.

Smith's work on bacterial diseases was wide-ranging, but always executed with painstaking exactness. The knowledge gained from Smith's work and the work of his many assistants in the laboratory and field was supplemented and

enhanced through information gained from extensive conversations held with human, animal, and plant pathologists during three European journeys.

Erwin F. Smith had a keen analytical mind and ability to synthesize and evaluate this knowledge, which encompassed the entire field of bacterial plant pathology. His comparative consideration of bacterial plant pathogens culminated in his exhaustive three-volume treatise (16, 17, 18) published in 1905, 1911, and 1914. A portion of the material for a fourth volume was in manuscript form at the time of his death, but has not been published. Some of the essential points to have been covered in the fourth volume are included in Smith's textbook, *Bacterial Diseases of Plants* (20) published in 1920. Smith dealt with over 100 bacterial diseases of plants in the treatise.

Erwin F. Smith was challenged and fascinated by all bacterial diseases of plants. He had a consuming interest, however, in crown gall—the plant cancer. He was first concerned with the etiology and control of crown gall and then with its morphology. Fascination with this one disease was based on his conviction that crown gall and animal cancer were of analagous etiologies. Smith devoted the final years of his life to the areas of tumor formation, formative stimuli, and growth inhibition in general. Fittingly, in 1913, he received a certificate of honor from the American Medical Association for his work on "Cancer in Plants."

Erwin F. Smith was not only an active researcher but also took great pride in the presentation of his work and enjoyed scientific discussions. His breadth of interest and recognized leadership abilities are evident in the scientific societies in which he held membership and of which he was president. He was president of the Society for Plant Morphology and Physiology (1902), Society of American Bacteriologists (1906), American Association for the Advancement of Science, Section G (1906), Botanical Society of America (1910), American Phytopathological Society (1916), and the American Association for Cancer Research (1925). In further recognition of his contributions he was elected as a fellow of the American Academy of Arts and Sciences and a member of the National Academy of Sciences.

Erwin F. Smith, an undisputed leader in the field of bacterial plant diseases, has been justly called the Father of Bacterial Plant Pathology. Although he probably would not have accepted this title during his life-time, inwardly he might have thought it fitting. He was certainly not the only scientist investigating bacterial diseases of plants at the time, but his personal resources, analytical mind, insatiable drive for scientific truth and knowledge, and indomitable enthusiasm, coupled with the resources of the US Department of Agriculture, gave him the opportunity to be the leader in his field.

During the eighteenth annual meeting of the American Phytopathological Society in December, 1926, a dinner was given to honor Smith. He was presented with an engraved brochure containing signatures of 172 members of

the society and visiting pathologists. The dedicatory statement read, "To Erwin Frink Smith, scientist, linguist, poet, friend, who for forty years has devoted his life's service to the broad field of pathology, in grateful appreciation we the members of the American Phytopathological Society dedicate this testimonial." Also included were summaries of the three addresses of the evening given by F. V. Rand, longtime research associate, L. R. Jones, speaking for plant pathology, and W. H. Welch, speaking for human and animal pathology.

Erwin's interests were by no means summed up in his scientific activities. The life and work of Pasteur were fascinating to him, as reflected in several papers he wrote about Pasteur, (10, 21, 22) and in his translation into English of Emile Duchlaux's *Pasteur: Histoire d'une Esprit* (2) (with the help of his assistant, Miss Florence Hedges). Smith may even have thought himself the "Pasteur" of bacterial plant pathogens. Perhaps his distinguished beard gave a hint of this thought.

Smith maintained a wide range of interests outside his laboratory and strove to "defend himself from the harmful results of specialization." As Rodney H. True (23), Smith's longtime associate in the Federal Service, said,

> "He developed a knowledge of French, German, and Italian literature that opened to him worlds of intense pleasure. Often have I seen him pursue some theme from language to language with an enthusiasm and facility that showed how deeply he read and thought. He read his Bible in a copy of the Vulgate; and Dante was a favorite with him in Dante's own great language. Goethe was often quoted in the original. Seldom have I known a man, whatever his training and field of work, who brought such joy and understanding to the works of great writers. His library was a sort of map of his mind. In it were all manner of noble things."

His love of nature in all of its many facets continued throughout his life. A glimpse of this love is found in a privately printed volume of poetry and prose entitled *For Her Friends and Mine: A Book of Aspiration, Dreams and Memories* (19). The volume, published in 1915, was dedicated to Smith's first wife, Charlotte May Buffet Smith, who had died after an extended illness in 1906.

Erwin F. Smith passed from this life on April 6, 1927 in his home in Washington DC at the age of 73. He was survived by his wife of 13 years, Ruth Warren Smith. In accordance with his known wishes, his ashes were scattered over the waters at Woods Hole, Massachusetts from a promontory where he had loved to sit and muse. He had written his own epitaph: "Be then my scroll : lies one beneath this sod to whom all nature voiced the living God."

American pathologists and pathologists throughout the world were saddened by his passing, but his work continues as a pioneering landmark in our science of plant pathology.

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