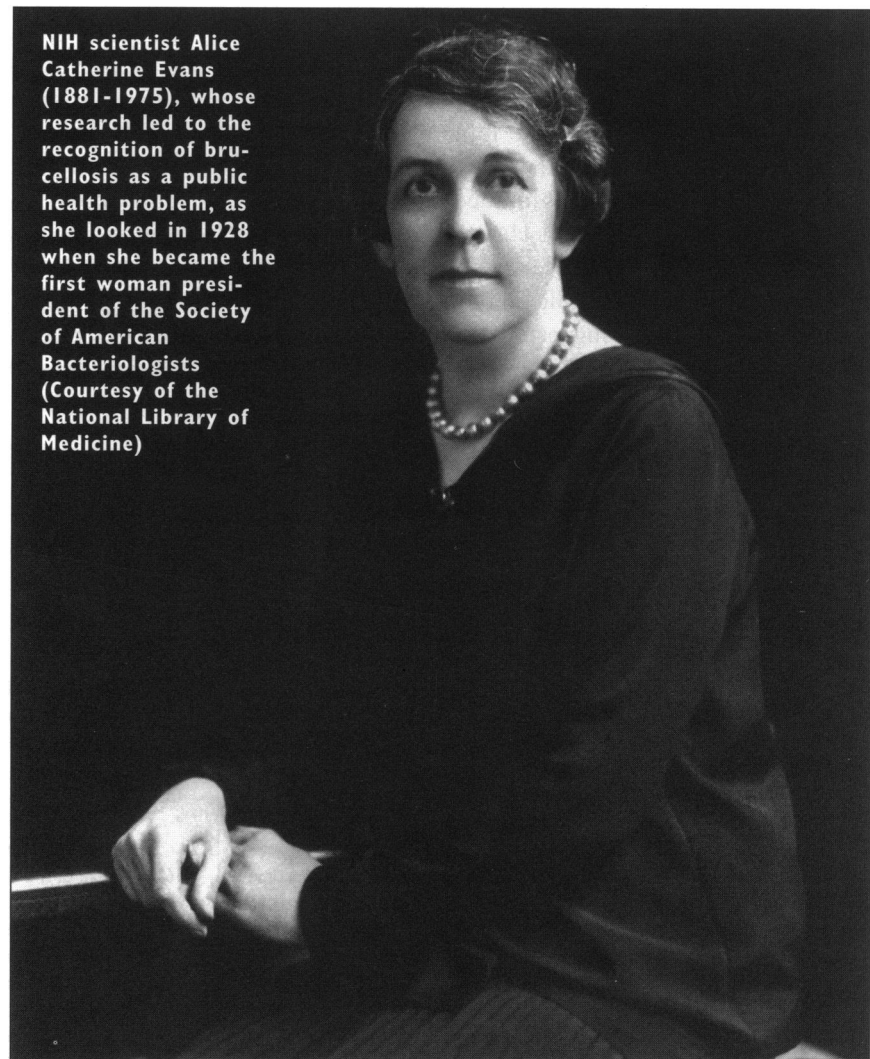


Alice Evans, An Early Woman Scientist at NIH

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Alice Catherine Evans (1881–1975), one of the first women scientists to work at the National Institutes of Health (NIH), made several important contributions to biomedical research. Born on January 29, 1881, on a farm in Pennsylvania, Evans received her secondary education at a private school, the Susquehanna Collegiate Institute, where she played on a women's basketball team at a time when the sport was still widely seen as "unladylike." Lack of financial means prevented her from attending college. Teaching was one of the few professions open to women at the time, so after graduating from Susquehanna in 1901, Evans became an elementary school teacher.

Evans's life changed when she learned about a free two-year course for rural teachers at the College of Agriculture of Cornell University. The program trained teachers in nature study so that they might foster in rural schoolchildren a love of nature and an appreciation for their country



NIH scientist Alice Catherine Evans (1881–1975), whose research led to the recognition of brucellosis as a public health problem, as she looked in 1928 when she became the first woman president of the Society of American Bacteriologists (Courtesy of the National Library of Medicine)

life. Using the money she had saved in four years of teaching to pay her subsistence expenses, Evans enrolled in 1905. Students in the two-year course joined the regular agriculture students for basic studies courses, and Evans found herself taking classes with a number of distinguished members of Cornell's faculty. Her interest in science, especially biology, was so stimulated by the

nature study course that upon its completion she decided to continue on at Cornell for a B.S. degree in agriculture. Her study was made possible by a scholarship and by a College of Agriculture policy that waived tuition in order to train more leaders for the nation's agricultural industry.

Most of the majors available in the College of Agriculture were branches of applied science, such as

horticulture and dairy science. As these subjects did not interest Evans, she chose to specialize in the most basic science-[EN DASH]oriented major, bacteriology, a discipline that was still in its infancy.

In 1909, Evans applied for and was awarded a scholarship for graduate work at the College of Agriculture of the University of Wisconsin. The scholarship, for a student specializing in agricultural chemistry or bacteriology, had never been given to a woman. Evans received her M.S. degree from Wisconsin in 1910. Professor Elmer V. McCollum, who later achieved fame as the discoverer of Vitamin A, encouraged Evans to continue her graduate studies for a Ph.D. degree. Evans declined the opportunity because her five years of higher education had been both a financial and physical strain, and at the time a Ph.D. did not seem to be a prerequisite for success in a scientific career.

Another opportunity opened at this point for Evans to pursue scientific research. The Dairy Division of the Bureau of Animal Industry, U.S. Department of Agriculture (USDA), was expanding its research staff. Because of space limitations at the USDA laboratories in Washington DC, temporary arrangements were being made for research to be carried out on a cooperative basis at several agricultural experiment stations associated with state universities. The USDA provided the salaries of the investigators, and the state provided laboratory facilities and oversight. Although the scientists hired under this program were Federal civil service employees, they were selected by the professors at the experiment stations who were in charge of the projects. Professor E.G. Hastings of the University of Wisconsin Department of Bacteriology offered Evans the Federal position as bacteriologist on the team that was searching for methods to improve the flavor of cheddar cheese. She accepted, beginning work in Madison on July 1, 1910.

In July 1913, Evans left Madison when she was called to Washington DC to work in the newly completed laboratories of the USDA's Dairy Division. On her way east, she stopped at the University of Chicago to meet with faculty in the Department of Bacteriology. One of the faculty members was surprised to learn that she had a position with the Dairy Division; he had visited the Division's Washington laboratories a short time earlier and had been told that they did not want any women scientists. When Evans arrived in Washington, she found that the USDA employed a number of women scientists, but only one had preceded her in the Bureau of Animal Industry and had remained only a year or two. Evans concluded that her own hiring was essentially an accident. It had apparently not occurred to Bureau staff that a woman might be selected by one of the state experiment stations. Having been employed for three years as a civil service employee, however, Evans could not be readily dismissed. She later recalled: "According to hearsay, when the bad news broke at a meeting of BAI officials that a woman scientist was coming to join their staff, they were filled with consternation. In the words of a stenographer who was present, they almost fell off their chairs."

Despite the inauspicious circumstances of her arrival, Evans found that the Dairy Division was a good place to work. Her immediate supervisors and her coworkers did not seem to share the antagonism of higher officials in the Bureau toward women scientists. While serving as a junior collaborator on investigations already in progress, Evans was also assigned a problem of her own, a study of the bacteria that multiply within the cow's udder and are excreted in milk.

Evans soon found her attention drawn to one particular species of bacteria, the causative organism of contagious abortion (Bang's disease)

in cows, then designated *Bacillus abortus*. The earlier reports on the isolation of this organism from apparently healthy animals had warned that these bacteria might be hazardous to human health, and Evans decided to investigate this possibility. She consulted with Adolph Eichorn, Chief of the Bureau's Division of Pathology, about whether he knew of any example of an apparently healthy animal having bacteria in its milk that were harmful to people. Eichorn informed her that milk from seemingly healthy goats could carry *Micrococcus melitensis*, an organism causing human undulant fever, or Malta fever.

Evans compared the characteristics of *M. melitensis* and *B. abortus* and found that they behaved remarkably alike in the culture tests used at the time for the identification of bacteria. She also arranged for comparative tests of cultures of both organisms on pregnant guinea pigs, in which both organisms caused three of four animals to abort. Her findings were reported at the 1917 meeting of the Society of American Bacteriologists and published the following year in the *Journal of Infectious Diseases*. In reporting her results, Evans raised the question of whether this close relationship between the causal organisms of human undulant fever and bovine contagious abortion might mean that the bovine organism, if present in raw milk, could also cause disease in humans.

Her results were greeted with skepticism. It was argued that if the two organisms were really that similar, this fact would have been noted by earlier investigators. Presumably the fact that Evans was a woman, relatively unknown, and without a Ph.D. degree counted against her credibility. In addition, the apparent absence of undulant fever in this country argued against the idea that the two microor-

Chronicles

ganisms were practically identical and thus both capable of causing the disease. It was later shown, however, that undulant fever is far more common in this country than had been realized. Milder forms of the disease resemble influenza, and severe cases were often mistaken for typhoid fever, malaria, or other diseases.

The dairy industry particularly objected to Evans's claims that raw milk might be the source of disease, and resisted recommendations that all milk be pasteurized. Strangely enough, the most vocal scientist opposing Evans's views was Theobald Smith, the eminent bacteriologist who had been one of the first to isolate *B. abortus* from milk and who had warned of its possible pathogenicity in humans. The opposition of a scientist as prominent as Smith supported those who doubted Evans's work. She refused to back down on her convictions, however, and over the course of the 1920s her results were confirmed in several laboratories around the world. Another bacterial genus, *Brucella*, was introduced to include the bacteria then designated as *M. melitensis* and *B. abortus*, and the name brucellosis came into use to describe the disease caused by infection with this organism (replacing terms such as undulant fever and Malta fever). The work of Alice Evans played a pivotal role in the recognition of brucellosis as a significant public health problem and in the acceptance of the need to pasteurize milk.

In 1918, wanting to aid in the war effort, Evans inquired of the Hygienic Laboratory (forerunner of the National Institutes of Health and part of the Public Health Service) whether her

services might be of use in connection with war work. She learned that a position in bacteriology was open in the Laboratory, and she applied and was accepted for the job. She joined a team working to improve the serum treatment for epidemic meningitis.

The Hygienic Laboratory was under the direction of George McCoy,



Alice Evans (right) is shown here about 1940 with fellow NIH bacteriologist Ida Bengston, who is probably best known for isolating a new strain of botulism bacillus. (Courtesy of the Media Arts Branch, Program Support Center)

who went out of his way to hire women scientists and to encourage and support their work. Evans was one of the first of a group of exceptionally capable female scientists hired by McCoy, beginning with the appointment of bacteriologist Ida Bengston in 1916. In spite of the generally supportive environment created by McCoy, however, women scientists at the Hygienic Laboratory still tended to earn less and to be promoted less readily than their male counterparts.

At the Hygienic Laboratory, Evans continued her studies on brucellosis (as it was later called), and in 1922 she contracted the disease herself as a result of her research. For the next 20 years, her health was impaired, with periods of incapacitation alternating with periods of partial or complete recovery. Since chronic brucellosis was not recognized at the time, Evans at first had to put up with suggestions that she was suffering from imaginary

or pretended ills. One can only speculate as to whether her gender was a factor in this. When she was undergoing surgery for another reason in 1928, however, doctors found lesions from which *Brucella* were cultivated, thus supporting the diagnosis of brucellosis. Her own later research helped to provide a better understanding of the chronic form of the disease.

While her work on brucellosis was her most important research accomplishment, Evans also made contributions to the study of other infectious diseases, such as meningitis and streptococcal infections. She retired in 1945 from the National Institute (later Institutes) of Health, which had been created from the Hygienic Laboratory in 1930. Never one to back down on her beliefs, Evans protested in 1966, at the age of 85, that the disclaimer of communist affiliation on the Medicare application violated her right of free speech. In January 1967, the

Department of Justice conceded that this provision was unconstitutional, and it was never enforced.

Evans's accomplishments were recognized through various honors. In 1928, she was elected the first woman president of the Society of American Bacteriologists. She also received honorary doctoral degrees from the Women's Medical College (later the Medical College of Pennsylvania), Wilson College, and the University of Wisconsin. She died at her retirement home in Alexandria, Virginia, in 1975, at the age of 94, after suffering a stroke. ■

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