CHARLES THOM [1]
1872–1956

KENNETH B. RAPER

(WITH PORTRAIT)

With the death of Dr. Charles Thom at his home in Port Jefferson, New York, on May 24, 1956, the Mycological Society of America lost one of its most colorful and most productive members. For more than half a century he was a consistent contributor to mycological literature, publishing many of his researches and addresses in the Society's journal, MYCOLOGIA. Although he was best known to mycologists for his monumental studies on *Aspergillus* and *Penicillium,* he was a scientist with exceptionally wide interests and experience who was equally at home in the dairy, the canning factory and the cotton field. His interests in all biology stemmed naturally from his early contacts with many outstanding biologists who implanted in him a thirst for discovery and scholarly pursuits which never waned. His broad experience resulted in part from the various official positions which he held during his long career in the United States Department of Agriculture (1904–1942), but more particularly from an exceptional intellect and an insatiable curiosity that was applied to every assignment. He grew up in an area just removed from the Frontier where a good education was not obtained without sacrifice, hence was highly prized. He early learned the true value of long hours of work, of mental and physical discipline and of independence in thought and action, and he unrelentingly marshalled these attributes to fashion a professional career with many facets, yet singularly devoted to scholarship and public service.

Charles Thom was born on a farm just north of Minonk, Illinois, on November 11, 1872. He was the fifth of six sons (two died in infancy) of Angus Sutherland Thom, who as a boy of sixteen had

[1] The preparation of this memoir has been greatly facilitated by autobiographical notes compiled by Dr. Thom and by personal papers, reprints, and correspondence made available to me by his family following Dr. Thom's death. In a single instance his words are paraphrased from memory; otherwise the quotations are taken from the above material or from his publications. Technical reports and addresses distributed by the U. S. Department of Agriculture only in mimeograph form are omitted from the list of publications.

CHARLES THOM
Gainesville, Florida, January 30, 1950.

moved in 1848 with his family by wagon train from Ohio. His mother, Louisa Electa Herrick, arrived in Illinois eight years later with her family from Indiana, having moved there in 1838 from Northern Virginia. The Thoms were, as Dr. Thom often related, of Scotch-Irish ancestry and "persistently Presbyterian"; his mother was of English and Quaker descent. Neither of his parents possessed much formal schooling, but they were people of scholarly instinct who were determined to secure for their sons the education that they had been denied. Dr. Thom's mother taught him to read and gave him elementary instruction in arithmetic, geography and grammar before he entered public school at the age of eight. The local high school fell short of college preparation and in 1889 he entered Lake Forest Academy (Illinois) where he came under the influence of R. A. Harper, then an instructor. He enrolled in Lake Forest College two years later. These were years of exceptional inspiration which exerted a profound and lasting influence upon his life and work. Harper was teaching botany, Wm. A. Locy was professor of zoology, and in Thom's junior year John M. Coulter became president of this small college. After graduation he spent one year teaching high school in Danville, Illinois, but returned to Lake Forest in 1896 and became the first graduate student to take an advanced degree (M.A., 1897) with Harper. The summer of 1897 was spent at Woods Hole before going to the University of Missouri where he was both instructor and graduate student. There he worked with Howard Ayers who further kindled his enthusiasm for biological research. He received his doctorate in 1899 with a dissertation on "The process of fertilization in *Aspidium* and *Adiantum*," his being the first Ph.D. degree to be awarded by that institution. He remained at Missouri for three more years, teaching botany during the school year and spending his summers elsewhere. One of these was spent collecting plants in the Ozark Mountains of Missouri and another in the swamps of southeast Missouri; the third found him in Erwin F. Smith's laboratory in Washington, D. C. An interest in the fungi engendered by Harper was greatly enhanced by these experiences and in the summer of 1902 he moved to Cornell University as a graduate assistant in mycology with George F. Atkinson. B. M. Duggar and H. H. Whetzel were there at the same time, and in company with these eminent mycologists-to-be his dedication to this field of study became firmly established. That his life's work should follow the course which it did was determined by a circumstance which, in characteristic fashion, he relates as follows:

"In February, 1904, Professor Atkinson was asked to name a dairy mycologist for a project in cheese ripening. He looked around his laboratory and fixed on me to be sent, rather peremptorily offered me the nomination, then wrote a letter. I saw that letter long afterward. He wrote approximately this: 'I know no man in America that is qualified in Dairy Mycology. I know nothing about it myself but if I had time, I could learn it, but I am too busy. Thom has training enough and brains enough to learn it and he needs the job.' I resigned my petty but perfectly orthodox academic job at Cornell and went." [2]

The job was with H. W. Conn of the Storrs (Connecticut) Experiment Station where a project had been initiated on mold-ripened cheeses. Thom soon found his assignment to be far more than straight mycology, for while a specific mold was central to the production of a particular type of cheese the problems of manufacture were much more involved. Thus he became an applied microbiologist, but one who never lost sight of the essentiality of thorough, painstaking taxonomic research, and it was in this latter area that he made what will probably prove to be his most lasting contributions to science. In beginning his work at Storrs he first isolated the molds from imported Camembert and Roquefort cheeses—which he was expected to duplicate and manufacture in the United States. He turned to the then existing mycological literature and found a plethora of latin names but without agreement as to usage and without descriptions adequate to reveal the characteristics of the molds to which they had been applied. Thus, in 1906, he was led to describe *Penicillium camemberti* and *P. roqueforti.* For purposes of comparison he had isolated a dozen or more other Penicillia, and being equally unable to relate these satisfactorily to the older literature, he began his monographic studies on this ubiquitous genus. These studies brought him in frequent contact with W. G. Farlow and Roland Thaxter at Harvard, and it was the latter who urged him to "clean up the mess in *Penicillium* and *Aspergillus.*"

The first important step in this direction was taken in 1910 with the publication of his "Cultural Studies of Species of Penicillium." In this he renounced the prevailing practice of describing members of this genus from their natural habitats and turned to defined, reproducible media and the comparative examination of cultures grown in the laboratory. The soundness of this approach is witnessed by the fact that nearly a half-century later virtually all of the species described in 1910 are still

[2] From "Molds, mutants and monographers." *Mycologia* **44**: 61–62. 1952.

recognized as valid taxons. The next step came in 1915 with the publication of "The *Penicillium luteum-purpurogenum* group," for in this brief paper he advanced the notion that the assignment of molds possessing common basic characteristics to groups and series was, for most practical purposes, of greater importance than identification to species. The merit of this concept has been amply demonstrated many times but nowhere more forcefully than in the search for superior penicillin-producing molds during World War II.

Dr. Thom's work at Storrs was singularly successful, for he succeeded in introducing practical processes for the manufacture of Camembert and Roquefort cheeses in the United States before his work was moved to Washington, D. C., in 1913. Visualizing an opportunity for greater service, he accepted the following year the position of Mycologist in Charge of the Microbiological Laboratory, Bureau of Chemistry, which was charged with the enforcement of certain aspects of the Pure Food and Drug Act enacted by the Congress eight years earlier. Thom took the position that the criteria for judging the quality of foods and the approval of processing methods should extend beyond actual toxicity and danger to health. He maintained that "sight, taste and smell were given to man to keep him from eating rotten food, and that decomposed and heavily contaminated materials were intrinsically offensive and always bore evidence of mishandling." The courts supported his position, and the confidence with which we today unthinkingly purchase canned or otherwise processed foods from our grocer's shelf is a silent tribute to the effectiveness of the campaign waged by Thom and his associates. From conversations with him years later, I doubt that he was ever happier than when arguing a case in court. (He would have made an excellent prosecuting attorney.) One of many antecdotes will illustrate the ingenuity of his approach—the case involved tomato catsup: As he took the witness stand Thom quietly placed on the railing of the jury box two partially rotten tomatoes. Naturally, these were regarded with considerable curiosity. Upon leaving the stand as he finished testifying, he pointed to them and asked, "Should the American people have to eat them in their catsup?" The jury agreed. Thom remained in this position until 1927, and the principles evolved and established for the food industries were summarized in the book, *Hygienic Fundamentals of Food Handling,* published with A. C. Hunter in 1924.

Mycologically, these were very productive years. James N. Currie, chemist, had followed Thom from the Cheese Investigation, and he was now joined by the mycologist, Margaret B. Church. Molds were encountered at every step in the harvesting, handling and processing of

many foods, and, as in the cheese laboratory and factory, most prominent among these were species of *Aspergillus* and *Penicillium.* With Miss Church he published a series of papers on different groups of the Aspergilli, further emphasizing the primary importance of the group characteristics in these fungi. These studies culminated in the publication of their monograph, *The Aspergilli,* in 1926. Meanwhile, Thom and Currie had given particular attention to the black-spored species comprising the *Aspergillus niger* group. They had early detected unusual metabolic activity in these fungi and in 1916–17 demonstrated that certain of these molds if cultivated under appropriate conditions would produce very substantial amounts of citric acid. Within five years a large factory had been constructed and the first major mold fermentation had become firmly established. With Thom's collaboration, other investigators in a different branch of the Department of Agriculture (H. T. Herrick, O. E. May, P. W. Wells, A. J. Moyer and L. B. Lockwood) subsequently took up this line of investigation to extend the still lengthening list of such industrial fermentations.

From 1927 until his retirement in 1942, Dr. Thom was Mycologist in Charge of the Division of Soil Microbiology, first in the Bureau of Chemistry and Soils and after 1934 in the Bureau of Plant Industry. Concurrent with his investigations of the Aspergilli, he continued his taxonomic studies of *Penicillium.* Because of the larger dimensions of this genus, its more voluminous literature, and the greater difficulties encountered in differentiating groups, series and the species which comprised these, publication of his monograph, *The Penicillia,* was delayed until 1929. This new book, like the one on *Aspergillus* before it, immediately achieved universal recognition as the standard reference work on *Penicillium.* As Dr. Thom moved from one official assignment to the next he took his growing culture collection with him, for he was never satisfied to base decisions upon published descriptions alone if there was any possibility of obtaining living cultures of the actual molds studied by his predecessors. In this he was highly successful, and when I joined him in 1929 to assume the responsibility for their maintenance, these accessions numbered well over one thousand, including scores of types. The reader will readily understand why these cultures later became the nucleus of the Culture Collection which the U. S. Department of Agriculture subsequently instituted at its Northern Regional Laboratory in Peoria, Illinois, and why the writer, as Thom's protégé, was given the opportunity of organizing and directing that collection. It is most fortunate for mycology and for applied microbiology that, for nearly four decades, Thom had the vision and the energy to carry

forward his taxonomic investigations on *Aspergillus* and *Penicillium* over and above his assigned duties as the responsible scientist in each of his succeeding positions. The handsome dividends resulting from his selfless devotion to this ideal are today self-evident.

Dr. Thom retired from active service in the Department of Agriculture in 1942 at age seventy, but in the years immediately preceding this I had joined him in the publication of researches on the *Aspergillus nidulans* and *A. glaucus* groups. A considerable number of new forms had been isolated in our laboratory and elsewhere and it was realized that those sections of his earlier monograph did not adequately present the ascosporic members of these two groups. By 1943 it was evident that similar treatment should be accorded other sections of the genus as well and, with Thom then a collaborator to the Northern Laboratory, we published the *Monograph of the Aspergilli* in 1945. Four years later, with financial support from the National Science Fund and with the invaluable aid of Dorthy I. Fennell, a completely rewritten volume on *Penicillium* was published under the comparable title, *Manual of the Penicillia.* Thom's interest in these fungi never diminished, and his bibliography reveals that one of his last contributions to science, published in 1954, concerned itself with the evolution of species concepts in these two singularly important genera of molds. Thus, a study modestly begun by a young man groping for an understanding of two molds that he had isolated from cheese gradually developed into a lifetime of productive research with incalculable benefit to all mankind. Whereas these investigations were important in themselves and stand as models of what should be done for scores of other fungus genera, their greater importance perhaps lies in the new and enlarged dimensions they created for all of microbiology. It is no exaggeration to say that the current stature of the antibiotics industry can be traced directly to the early researches of Thom and his associates.

Two inadequately publicized incidents may be cited in support of this notion. Fleming had discovered penicillin in 1928 and had published his classic paper in 1929, identifying the responsible mold as *"Penicillium rubrum."* Harold Raistrick, who had long collaborated with Thom, subsequently took up the study of this mold and its antibacterial substance. He submitted the culture to Thom who correctly identified it as representative of the cosmopolitan species, *P. notatum* Westling. Later, when more productive strains were urgently needed, this correct diagnosis gave invaluable direction to our quest for such cultures. Equally important, it was Thom who recommended that our Government's research program on penicillin be centered in the newly

established Northern Regional Research Laboratory in Peoria. Had Thom, the world's recognized authority on *Penicillium,* been a less unselfish man he might easily have suggested that this work be placed in his laboratory at Beltsville, and in so doing possibly have delayed his impending retirement from the U. S. Department of Agriculture. For reasons which he could evaluate better than anyone else he made his decision unhesitatingly. If Dr. Thom ever felt that he should have received greater recognition for his contribution to the success of this program he never expressed this publicly.

Charles Thom was a pioneer in other areas as well. In collaboration with Harry S. Bernton, M.D., of Washington he was one of the first to demonstrate the role of common saprophytic fungi as the incitants of allergic reactions in man. Due in part to this and because of his earlier role as a Government official charged with the responsibility of establishing sanitary practices in the nation's food industries he was invited to become a member of the Washington Academy of Medicine, a unique tribute to a non-medical man.

In 1934, with Harry Humfeld and H. P. Holman he was instrumental in developing the "*Chaetomium* Test" for the evaluation of fungicides and other protectants used to extend the usefulness of awnings, tarpaulins, etc. This was designed to provide at least a partially quantitative test, and although it has now been supplemented and in substantial part superseded by other methods it merits the distinction of having first demonstrated that something more reproducible than guesswork could be applied to these problems. The researches thus instigated paid rich dividends during World War II when the armed forces were faced with serious losses from the deterioration of all types of material.

One of his greatest contributions to applied microbiology was made during his years as Chief of the Division of Soil Microbiology, namely the development of a practical means of controlling the so-called Texas Root Rot of cotton, caused by *Phymatotrichum omnivorum.* In characteristic fashion, upon assuming this position Thom immediately familiarized himself with the vast literature upon the microorganisms of the soil, their interrelationships, and what was then known concerning the useful application of these to agronomic practices. For many years the cotton root rot had been a scourge in much of the best cotton growing regions of the Southwestern States. By careful observation and analyses he and his associates, notably Marie B. Morrow and Francis E. Clark, determined that *Phymatotrichum* could not thrive in environments characterized by a diverse and active microflora. First, they

discovered that the fungus could be "contained" if readily decomposable plant materials were added to the soil as amendments during the growing season, and subsequently it was discovered that the pathogen could be controlled if the cotton plants were plowed under immediately after harvest, thus in effect rotting out the rot before it overwintered. This is now standard agronomic practice throughout the Southwest and *Phymatotrichum* is no longer a limiting factor in the areas where it formerly was rampant.

Dr. Thom made many direct and important contributions to mycology and to microbiology in its broadest sense. His indirect contributions to these fields were perhaps equally significant. He gained much from his contacts with outstanding biologists, and as he became an established scientist, he was always willing to give of his time and counsel to everyone who sought his opinions and advice, and they were legion. Working in Washington at the crossroads of a nation's scientific effort, a steady stream of investigators with diverse interests and problems passed through his laboratory. Many of these were the "greats" of that period, and many were young scientists just starting their careers. To each he gave unstintingly of his time, and in the ensuing conversations the course of untold research investigations were influenced and oftentimes redirected. Although direct and outspoken in his writings and sometimes almost brusque in his speech, Dr. Thom loved people and by his own admission preferred talking with a fellow scientist more than the theater, the movies, the concert hall or the day's best-seller. During his active career in the Department of Agriculture Thom identified thousands of cultures for other investigators all over the world, taking little cognizance of the credit that he might or might not receive. He was withal a selfless and devoted public servant.

Dr. Thom was most considerate of those who worked for and with him. This is not to say that he encouraged laxity or procrastination; quite the opposite, for having learned early to discipline himself he naturally expected the same conduct of his colleagues. He had worked hard for his education and for his place of eminence in his profession and he quite naturally expected others to do the same, otherwise they should have chosen some other field of work. In dealing with his professional staff he was scrupulously careful not to take advantage of his position as Chief. He practiced as he believed that every man should carry his own share of the load, and, having done this, he should receive due recognition for his professional knowledge and for his contributions to the solution of the problems at hand. Commenting upon

one tendency which seems to be growing in some research organizations, he had this to say:

> "I wrote my own manuscript. The ghost writer is deemed essential to the literary reputation of some types of public men. His existence in American political fields has become so well known that his exploiters are beginning to get the contempt they deserve. In the scientific service, he is also present but superfluous. Those who live on the job with a man are not received. I long ago established the rule that I would sign nothing which I could not write. It is easy to write a letter of transmittal to carry forward what your assistants produce. To me, it is essential to self-respect."

He was most anxious that the younger men in his employ have every possible opportunity to improve their position by additional education, and often at considerable inconvenience to himself and his researches, as in the writer's case, he arranged for them to take leaves of absence that they might work for higher degrees. They were urged to take advanced courses in the night classes offered in the universities of Washington and in the Graduate School of the Department of Agriculture which he had helped to organize and in which he offered courses from time to time. He firmly believed his father's dictum: "Without an adequate education a man is soon pumping a dry well."

Dr. Thom belonged to many professional societies, and in the affairs of most of these he took an active part, for he strongly believed that a man owed it to his profession to support its journals and to do everything possible to promote the active interchange of ideas among its advocates. Only a few of these associations will be cited. He was a charter member of the Mycological Society of America and its president in 1953. He was for nearly 50 years a member of the Society of American Bacteriologists and its president in 1940. He was the temporary chairman of the organizing committee and the first president of the Society for Industrial Microbiology. He was at one time president of the Botanical Society of Washington and also of the Washington Academy of Sciences. He was a charter member of the American Dairy Science Association and died in May before its Golden Anniversary Meeting in June, at which he had been invited to speak. He was a member of the National Academy of Sciences for nearly two decades, having been elected in 1937. One of the most appreciated honors that came to him was an invitation for his wife and him to visit Spain in 1947, where he was elected an honorary member of the Consejo Su-

perios de Investigaciones Cientificas and presented with a gold medal in recognition of his outstanding services to microbiology and medicine.

During his *un*retiring retirement after 1942, Dr. Thom acted as consultant to a number of industrial laboratories, and was a frequent guest speaker on university campuses and at local and national meetings of many societies and trade associations. The breadth of his knowledge and experience, the picturesqueness of his speech and his wide acquaintance with fellow scientists—none of whom were either idolized or feared—made him a popular lecturer. Such lectures were always entertaining—but to amuse his audience was never their primary purpose, for woven into their very fiber were basic and obvious truths always presented with pointed relevance to the topic being discussed. The spirit of these can be surmised in the addresses and special lectures which are listed among his published papers. Dr. Thom was a biologist first and foremost, and he deferred to no other profession in its contributions to man's progress.

Dr. Thom was an ardent prohibitionist, a conservative in politics, and a deeply religious man. Like his forebears, he was a staunch Presbyterian and wherever he lived took a very active part in the activities of the local church. Because it reflects the sincerity of this other facet of his life and, more particularly, because it reveals the philosophy by which he lived, the following *credo* found in his papers is quoted. The page is entitled, "A personal prayer of thanks toward the evening of life":

> "Father in Heaven, I thank Thee for the opportunities of a long life; for parents who gave of themselves that I might be better prepared to live and serve; for teachers who showed the way to usefulness; for health and strength that made it possible to do the day's work uninterrupted for many years; for a clear smoothly working mind equal to the demands of life; for friends who lent help when help was needed; for work that called for daily attention; for the fortitude that never faltered though at times the vision was not clear; for faith that found joy in the work of today and confidence to prepare for tomorrow; for chances to help men upward toward higher ideals and better living; for home, and wife and children and the privilege of serving; for state, and community relations; for a measure of thy spirit that has sustained me even in mistakes and error; for the ability to leave the future to the promise—'Where I am there ye will be also.'
>
> "So let me go on each day in service, confident that for this day

my place is here, and that when Thou shall call me elsewhere Thou wilt substitute Thy strength for mine.

"Let me rejoice then in what Thou hast given, and may those I leave behind forget to weep in the joy that Thou has given me so much to share with them while here.—Amen."

Charles Thom lived a very full and rewarding life. His health remained exceptionally good until a few months before his death, and he lived to see the fulfillment of many dreams which provided deep satisfaction for his latter years. At his request, he was buried in Storrs, Connecticut, a community which he never ceased to regard as "home." It was there that he began his professional career; it was there that he built his first house and there that his children were born. He is survived by his son, Charles Richard, an attorney in Port Jefferson, New York, and two grand-daughters.

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