

*George H. Hepting***George Henry Hepting***September 1, 1907 — April 29, 1988*By Ellis B. Cowling, Arthur Kelman, and
Harry R. Powers, Jr.

GEORGE HENRY HEPTING GREW up in the city environment of Brooklyn, but early in his life he developed a deep love for and scientific interest in forestry. He became America's most skilled scientist in the theory and practice of forest pathology. He studied how long-lived forest trees, unlike most plants, cope with the long-term changes in their biological, physical, and chemical environments. He devoted his remarkably energetic life to learning, understanding, and teaching how trees survive disease stresses induced by biotic and abiotic agents in forest nurseries, as individual trees, in young sapling stands, in naturally regenerated and planted stands, in old-growth forests, and in landscapes and watersheds. Hepting focused his innovative spirit, curiosity, and high intelligence in seeking the ways to use this understanding to develop practical management practices that would reduce or minimize disease losses and deterioration of wood in service. From the research he and close coworkers completed have come many tangible benefits. Throughout his life, he was devoted to maintaining the rich heritage of this country's forests and wildlife resources in national, state, and city parks and trees in residential, commercial, and recreational landscapes--resources that are important not only economically but also for the spirit and aesthetic quality of life in America.

George Hepting was born in Brooklyn, New York, on September 1, 1907. After attending public schools in Brooklyn, he completed his undergraduate studies in forestry at Cornell University in 1929. One of Hepting's most inspiring undergraduate teachers was a plant pathologist, H. H. Whetzel. In an unpublished autobiography Hepting described how he decided to become a forest pathologist:

Two of my required courses were general plant pathology and forest pathology. Through these courses I came under the influence of Professor H. H. Whetzel. I soon found myself developing a strong interest in his courses. The ills of trees, like the ills of mankind, fascinated me. I was astounded to learn that in the short space of twenty-five years a disease (chestnut blight) carried from the Orient had started in our chestnut trees in New York and had swept completely through the eastern states to Alabama, on its way exterminating this valuable species. White pine blister rust, the Dutch elm disease, and many others were well on their way to destroying millions of dollars worth of timber and street trees in a matter of a few years. Here was something for me. Here was a field of work in which a man would work with trees. I discovered that the U.S. Department of Agriculture had a Division of Forest Pathology with about fifty technical men scattered the length and breadth of the country doing research on tree diseases, and that an occasional state or university had a man or two who spent some time on tree diseases. This handful of men armed with the limited knowledge of a new profession was trying to solve the multitude of problems in forest pathology. In addition to the hundreds of native diseases that did a tremendous amount of cumulative damage, serious new major diseases were appearing in the country at an alarming rate of about one every five years. I resolved to be a forest pathologist, if I could find a place in this tiny field. Professor Whetzel encouraged me and offered me valuable assistance. This time I knew the kind of work that I would be doing and that I would

like it.

Prior to the completion of his Ph.D. at Cornell in 1933, Hepting joined a tiny cadre of scientists in the U.S. Department of Agriculture that was charged with protecting the forests of America against disease. He remained with the Division of Forest Disease Research after he received his doctorate on a forest pathology problem and rose through the ranks from field assistant in 1931, through chief of the Division of Forest Disease Research at the Southeastern Forest Experiment Station from 1953 to 1961, to principal research scientist affiliated with the Forest Service's Washington office from 1962 to 1971 (assigned mainly to the Southeastern Forest Experiment Station in Asheville, North Carolina). He retired from the Forest Service as chief plant pathologist in 1971. From 1967 through 1984 he served as a visiting professor in the Department of Plant Pathology and the School of Forest Resources at North Carolina State University. He died on April 20, 1988.

During much of his life he had to cope with a series of illnesses requiring surgery and hospital stays with continuing complex medical problems and twice daily medications that would have drastically limited the productivity of most individuals. Few people other than close colleagues and family members were ever cognizant of the full extent and seriousness of these problems. Because of Hepting's strong will and remarkable personal courage, he always remained fully committed to his profession and related responsibilities.

Although deeply involved in his professional life, Hepting greatly enjoyed one hobby, the selection and polishing of unique gemstones. As was typical of all his activities, he perfected his techniques and became very knowledgeable and recognized for his proficiency in this field.

In 1936 George Hepting married Anna Love, who predeceased him on May 13, 1986. Both are buried in the Lewis Memorial Cemetery in Asheville, North Carolina. Hepting is survived by six family members: his sister Aimee Hepting of Syosett, New York; sons George Carleton Hepting of New York City and John Bartram Hepting, who was named for John Bartram, a distinguished horticulturist and world-renowned botanist of Philadelphia and a direct ancestor of Anna Love Hepting.

The Department of Plant Pathology at North Carolina State University maintains a complete file of his nearly 200 scientific publications, his extensive library of nearly two thousand reprints and books, and copies of the fascinating and often humorous autobiographical resumé of the first half of his career.

The range of problems in which Hepting became involved represents a remarkable scope in terms of the diversity of fungi involved and complexity of the factors to be considered in developing effective means of reducing losses. Only a few examples of his many contributions will be noted in detail.

Hepting's first research project was on heart rot of forest trees. He determined the impact of fire scars, basal wounds, and stump sprouts on infection and spread of decay in many species of trees. He was the first to describe the remarkable mechanisms with which trees restrict the development of decay and discoloration in stems to "tissues extant at time of wounding." This phenomenon is now known as compartmentalization. His work on the hardwood decays and their origins resulted in a Farmer's Bulletin that established a set of sound principles for effective disease management of eastern hardwood forests. This bulletin was used extensively by the Civilian Conservation Corps as a guideline for management of federal forests, and it still serves as a basic guide for foresters in management of hardwood forests.

Before and during World War II, he studied fungal discolorations in felled timber and lumber of southern pines. He also quantified the impact of discolorations and decay on the strength of wood veneers used in military aircraft. In his unpublished autobiography, he described his novel experiences in this new area of research:

We in forest pathology did not have to look for war problems; they fell into our laps from all directions. Wood was a major war material and we in the Division of Forest Pathology had the greatest fund of information on wood's defects of any group in the nation. We knew about wood decay and how to prevent it.

Under his direction the tiny group of men and women in his division immediately shifted the emphasis of their work from tree disease investigations to studies of problems of wood in service. The Navy and Coast Guard wanted information on the prevention of decay in wooden boats and they also planned to build some wooden airplanes and gliders. The Army was already building all-wood training planes and was considering wood gliders. Furthermore, they had costly wood decay problems in buildings, truck bodies, and bridge timbers.

By the time of World War II, there was a critical shortage in aircraft metals. Most of the available light metals were to go into combat planes--bombers and fighters--so that the great bulk of thousands of training planes would have to be made of wood. Gliders, of which we were to require a great number, were also to be made largely of wood. Yellow poplar, one of the most important aircraft veneer species, is subject to many discolorations in the living tree. Early in the war, most of this colored poplar wood was being discarded from the aircraft grades on suspicion that it was weak. Nobody knew for sure whether or not it was weak, but the manufacturers did not trust it, and the Army did not like the looks of it. I was asked to undertake a study to determine whether the discolorations so common in yellow poplar really indicated decreased strength of wood. I immediately went to several veneer mills and obtained hundreds of samples, including all of the common discolorations and normal-colored wood as well. We carefully matched each discolored stick with an adjacent normal-colored stick and sent the samples to the Forest Products Laboratory for testing. When the results were analyzed, we found that the great bulk of discolored wood was normal in strength, and that only

brown, indicating rot, were weak. These problems were released promptly to the veneer industry, the aircraft industry, and the Army. The harmless discolorations were then accepted. The production of poplar aircraft veneer went up 25%.

Wooden gliders were being turned out in quantity. Since our training fields each had from one hundred to several hundred aircraft, space to house these great numbers of airplanes could not easily be provided. Therefore, they generally remained in the open all of the time, exposed to the elements. Since most of the kinds of wood used in aircraft were known to decay readily under conditions of high moisture and warmth, and since there was no tendency among manufacturers to treat this wood chemically against decay, it seemed to us that some serious decay problems might develop in our Army airplanes. In December of 1942 I asked my chief, if he would let me go into the field and study the problem of deterioration in wooden military airplanes and gliders. He agreed that sooner or later the armed services would run into trouble from decay in aircraft, so he assigned me to this work and ordered me to report to the Army Air Forces Materiel Command at Wright Field, to make arrangements for my surveys at Army fields.

Hepting visited dozens of Army airfields in the East, South, and Middle West, checking the all-wood airplanes and wooden parts of others for signs of decay. Subsequently Hepting and his group discovered a number of factors leading to decay problems and developed procedures to eliminate or reduce them. Technical orders were issued to improve stringency of inspection and cleaning of drains in all wood aircraft. Hundreds of planes were grounded for repairs, and the prospects of serious accidents were considerably reduced. Revised specifications were made for airplane manufacturers on improving the design of drainage systems. Thus, through the efforts of Hepting and his research group, the deterioration problems in wood aircraft were corrected early in the war. The importance of this major contribution to one phase of the war effort has not been fully recognized. Upon completion of this excursion into problems of deterioration and decay of wood products in the armed services, Hepting and his staff devoted their research to a series of problems affecting forest trees in the south.

Littleleaf disease of southern pines proved to be one of his greatest challenges. He organized research teams to investigate different aspects of the problem and stimulated both industry and government to support these efforts. In the end, he determined that the little-leaf disease resulted from a progressive deficiency of nitrogen induced by a complex interaction among certain soil conditions, feeder-root pathogens, land-use practices, and stand density that developed in many short-leaf pine stands as the trees increased with age.

A destructive wilt disease of mimosa began to cause high mortality in this species in North Carolina in the late 1930s. In Hepting's investigation of the problem he identified the causal fungus as a previously undescribed species of *Fusarium*; his report on these studies was one of the first descriptions of a tree disease caused by a species in this taxonomic group. In the several decades that followed it was not possible to develop a means of preventing the spread of this pathogen, and the disease essentially eliminated mimosa from the District of Columbia to Alabama. In recognition that the only effective means of control was the development of resistant cultivars, Hepting and Richard Toole screened thousands of mimosa genotypes after World War II and discovered a number of highly resistant selections. From these selections the cultivars "Charlotte" and "Tryon" were developed and patented. As required by law, the patent was assigned to the Secretary of Agriculture, who released it to the nursery trade through the American Nurserymen's Association. Several decades after the release of these cultivars, they were still being widely planted, and they continue to be resistant to this day.

Hepting and coworkers discovered a number of previously undescribed diseases that were damaging southern tree species, including the pitch-canker disease of southern pines, and identified the specific causal fungi. Subsequently they found that pine trees inoculated artificially with the pitch-canker fungus were stimulated to induce oleoresin flow with desirable results. This procedure was patented and used commercially.

When the oak wilt disease began to spread in the southern United States, Hepting assumed a leadership role in a national effort to gain an understanding of the biology of the pathogen and manner of dissemination. He designed and supervised large-scale surveys to determine the extent of spread into Tennessee and western North Carolina. During these efforts he discovered the role of mating types in the life history of the oak wilt fungus, a finding that he considered one of his most personally satisfying scientific achievements.

In mid-career Hepting had a key role in resolving a controversy involving the use of antibiotics for control of white pine blister rust. In the late 1950s a U.S. Forest Service technician, employed in the white pine blister-rust control project in Idaho, published a series of papers in which claims were made that an antibiotic (Actidione BR) sprayed as a basal application on blister-rust cankers followed by a second antibiotic (Phytoactin) could effectively prevent development of the rust fungus. Hepting became very skeptical of these findings. Studies were initiated by members of his staff (Harry Powers and others) to determine independently the effectiveness of these compounds on white pines. In sharp contrast to the findings in Idaho, Powers' results indicated that application of antibiotics might reduce sporulation of the rust fungus, but they did not eradicate the rust fungus in established infections. Actidione also was tested in the Southeast for the control of fusiform rust, a destructive disease of southern pines similar to white pine blister rust in its effects on pine trees. Results obtained in these studies were also negative.

In 1960 Hepting and a group of Forest Service administrators and one non-Forest Service pathologist, Arthur Kelman, then on the faculty of North Carolina State University, visited the established test plots in Idaho and Washington, including areas where Phytoactin had been applied by costly aerial sprays. In the course of this survey, it became clear that the prior claims for effectiveness of antibiotic sprays could not be substantiated. In some plots evidence was found that a hyperparasite of the rust fungus (*Tuberculina maxima*) had become established in rust cankers and suppressed the growth of the rust fungus. Apparently the effects of the hyperparasite on the rust fungus in the cankers had been overlooked and mistakenly attributed to the

presumed effects of the antibiotic. Based on these findings and Hepting's insistence on the need for the effective experimental controls and proper design and interpretation of results, a major costly federal program was discontinued, resulting in savings of many millions of dollars. It should be noted that initially Hepting was severely criticized for raising questions about this rust control program, which was widely praised as an innovative control measure designed to save the highly valuable white pine stands of the western United States. However, Hepting had the courage to persevere until the evidence was obtained to justify fully his conclusions that data on control lacked validity.

In his administrative role Hepting directed pioneering research on annosus root rot, soil fumigations in forest nurseries, and the role of ozone and other photochemical oxidants as causes of disease in forests. His 1963 paper on climate and forest diseases is considered the authoritative treatise on climatology and plant pathology. He developed the first computerized system for information retrieval in forestry and his 1971 text, "Diseases of Forest and Shade Trees in the United States," provides the most comprehensive encyclopedia of knowledge on these topics. He wrote a definitive history of the failure of efforts to control chestnut blight and of similar attempts to control the Dutch elm disease after these diseases were introduced into North America. In 1997, six years after retirement, he wrote with E. B. Cowling an historical resume of achievements and future progress in forest disease research. This publication also describes the impact of Hepting's contributions on the advancement of forest pathology, nationally and internationally.

On periodic visits to the campus while he held the post of visiting professor of forest pathology and forestry at North Carolina State University, he presented seminars and consulted with graduate students and faculty. In these sessions he provided encouragement, made critical assessments of research in progress, and served as a wise mentor and valuable source of knowledge. Hepting considered this phase of his career one of the most rewarding experiences of his professional life. In the evaluations by graduate students of their contacts with Hepting, they ranked their exposure to his wisdom and sharp wit as one of the highlights of their graduate education.

He was a cofounder of the Southwide Forest Disease Workshop, which is still the outstanding forum for forest pathologists in this region. It provided for the first time an opportunity for government, university and private industry research scientists, and related workers, as well as graduate students, to share information on research in progress and to develop the personal relationships that foster progress in cooperative research programs. His leadership in this and related activities resulted not only in strengthening forest disease research in the U.S. Forest Service but also in the universities in the southern United States. The conference indirectly had a role in the establishment and funding of industry-sponsored graduate fellowships in forest entomology and pathology. Hepting also had an influential role in the increased participation of forest pathologists in international forestry policy discussions and in the activities of the American Phytopathological Society, including the establishment of the subject matter committee on forest pathology. He was an associate editor of *Phytopathology* and for a number of years was a member of the Editorial Board of *Annual Review of Phytopathology*. He also served on several committees of the National Academy of Sciences and edited the National Research Council text entitled "Principles of Plant Disease Control."

Hepting's achievements in forest pathology were recognized by many honors and awards. In 1969 he became the first forester elected to the National Academy of Sciences. He also received the Superior Service Award of the U.S. Department of Agriculture (1954) and the Barrington Moore Award for Outstanding Achievements in Forestry Research (1963). He was elected a fellow of the Society of American Foresters (1965) and of the American Phytopathological Society (1966). He received the first Southern Forest Pathologist Achievement Award (1967), the U.S. Department of Agriculture Merit Award for Achievement in Cost Reduction for development of an effective electronic literature retrieval system for forest pathology (1967), the Delta Airlines "Flying Colonel" Award for Service to Aviation (1972), the International Shade Tree Conference "Authors Citation Award" for his handbook on "Diseases of Forest and Shade Trees in the United States (1974), and the Weyerhaeuser Award for Outstanding Historical Writing from the Forest History Society (1974).

In the course of his career Hepting traveled extensively and completed research assignments in Europe, Puerto Rico, Haiti, and the U.S. Virgin Islands. He also served as a consultant to the forest products industries of New Zealand and Australia.

Few investigators in the forest sciences were able in a lifetime to make as many major contributions as Hepting did in solving diverse, complex problems. He had the ability to identify primary causal factors and rapidly gain the depth of understanding of disease situations that enabled him to devise practical approaches for management practices. Long before the concepts of integrated pest management became fashionable, Hepting emphasized the need to integrate disease hazard evaluations and knowledge of disease development processes into economically and biologically sound forest management systems. He also championed the need for basic research as a foundation for practical understanding and management of disease in forests. His role in the Timber Resources Review of 1953 also permanently changed our perception of the nature and magnitude of disease losses in forests.

Hepting was not only an effective leader in terms of his specific administrative assignments, but he was also an effective spokesperson for forest pathology and forestry in the United States. At the peak of his career he also became a recognized and influential international authority on forestry in the broad sense. In making an assessment of his career he stated:

It seems to me that there can be few walks of life in which a man following a specific occupation would lead a more varied existence than he would as a forest disease researcher. Within this seemingly restricted field, I have, over a period of 20 years been a rock breaker, a timber cruiser, a bacteriologist, an aircraft technologist, a lumberjack, a pathologist, a statistician, and an administrator. My territory has, from time to time, included much of our forestland from the Canadian border to the Gulf of Mexico and west to Texas and the Great Plains.

He had a remarkable ability to stimulate and challenge coworkers and professional colleagues to do their best, to see the larger

picture, to share their ideas with others, and to help "make forest pathology pay." He was also willing to speak frankly and critically when he thought the occasion demanded. In this connection he insisted that his associates maintain the same high standards of scientific integrity and quality that he always demanded for himself in his own individual research endeavors. For these and other personal qualities, he earned the high regard and deep respect of his coworkers and members of his profession.

WE ACKNOWLEDGE WITH APPRECIATION receipt of comments and letters from colleagues and former students who knew, appreciated, and were inspired by George Hepting. In particular we wish to thank the following individuals who shared their impressions of Dr. Hepting with us: Andrew Campbell, Alex Shigo, T. Kent Kirk, Robert Zabel, Arthur Verrall, Charles Berry, William Waters, Glenn Snow, Robert Patton, James Stewart, John Skelly, John Rishbeth, Kathleen Moore, and Arthur Schipper.

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