1880 to 2010: The administrative route from an independent plant pathology unit at Geneva to integration with Ithaca---

The New York State Agricultural Experiment Station, often called the Geneva Station, was established by the state legislature in 1880 as an independent institution to promote agriculture in New York through scientific research. In 1923 the Geneva Station officially became a unit of the College of Agriculture. At that time "professional staff" at Geneva became members of the faculty but it was not until 1943 that they received professor titles. Ten years later the president of Cornell officially approved the Station "subject-matter units" being designated as departments. Finally, in 2010 the Department of Plant Pathology at Geneva joined with the department at Ithaca in the newly named Department of Plant Pathology and Plant-Microbe Biology.

1884

J. C. Arthur was hired at Geneva as a botanist to study plant diseases, making him the first "plant pathologist" hired by a state agricultural experiment station in the United States. Notably, two years later he received the first doctorate in "the Sciences" granted by Cornell University. Arthur conducted pioneering research on fire blight, but left after four years and later became famous for his work on rust diseases.

1894

F. C. Stewart was hired as a mycologist and assigned to a substation on Long Island that had been established by the director of the Geneva Station, which in 1946 was administratively shifted to Cornell's College of Agriculture in Ithaca. He transferred to Geneva in 1898 to become Head of the Division of Botany, a position he held for 38 years. He is best remembered for discovering a disease of corn called Stewart's Wilt.

1936

The Division of Botany was divided into two divisions, with one being the Division of Plant Pathology, with O. A. Reinking as Head. Some of the research responsibilities were transferred to the Department of Plant Pathology in Ithaca at that time, with major emphasis at Geneva remaining diseases of fruit crops and processing vegetables.

1936-1944

W. H. Rankin was hired and his limited success in controlling mosaic disease of raspberry plants by rouging led him to conclude that breeding for resistance held the most potential. Breeding for resistance to diseases of fruit and vegetable crops later became an important thrust of programs at Geneva that continues to the present.

During this period J. M. Hamilton began developing laboratory facilities to determine the "practical mode of action" of fungicides and best usage practices to control diseases of tree fruits, in addition to carrying out extensive field tests that led to fungicide recommendations used by tree-fruit growers throughout the Northeastern U. S. He saw the beginning of the era of organic fungicides and he, and later M. Szkolnik, carried on this work for many years.

In 1939 J. G. Horsfall resigned from Geneva to join the Connecticut Agricultural Experiment Station after a remarkable ten years of research during which he developed fungicide seed treatments. He later became director of the Connecticut Station, a member of the National Academy of Sciences, and co-author of the five-volume publication, *Plant Pathology: an Advanced treatise.*

G. L McNew was also a plant pathologist at Geneva during Horsfall's time there. He left in 1944 and from 1949 until 1974, he was Managing Director and Distinguished Scientist at the Boyce Thompson Institute, which is now located on the Cornell campus in Ithaca.

1968

The department at Geneva moved into three floors of a new research facility with modern, well-equipped laboratories including electron microscopes, growth chambers and walk-in mist chambers, as well as spacious greenhouses attached to the building. Following this, several plant pathologists were hired to develop research programs using emerging technologies, and programs began to shift from a crop focus to a pathogen-discipline focus directed toward understanding and managing diseases of fruit and vegetable crops.

1973

A four-person steering committee involving faculty from both Geneva and Ithaca, including J. E. Hunter, chairman of the Department of Plant Pathology at Geneva, established the framework for Cornell's Integrated Pest Management Program. The extensive evaluation of fungicides for diseases of fruit and vegetable crops that had been carried out over many years and a long history of research on the biology of fungal pathogens of these crops by pathologist at Geneva and Ithaca were essential components of advisory systems used by the IPM program to increase the likelihood that pesticides were used judiciously and integrated with other control practices when feasible.

1968- Present: Contributions by senior faculty

The hiring of new faculty and the availability of modern research technologies and facilities have resulted in some significant contributions made by plant pathologists at Geneva, of which a few examples follow:

R. M. Gilmer was co-author of a study that demonstrated pollen transmission of necrotic ringspot and prune dwarf viruses in sour cherry trees, which helped to explain the rapid spread of these viruses in commercial orchards. His research on virus diseases of grapevines and his leadership resulted in the establishment of a grapevine disease certification program that reduced the chance of grape growers buying virus-infected plants.

In 1969, W. T. Schroeder and R. Provvidenti reported what is probably the first known occurrence of resistance to a fungicide, in this case benomyl, by the fungus causing powdery mildew of cucurbits. Shortly thereafter M. Szkolnik and J. D. Gilpatrick, discovered that the fungus causing apple scab disease had become resistant to the fungicide dodine (Cyprex). These discoveries opened a new era of concern as more cases of resistance to modern organic fungicides began to occur worldwide.

Beginning in 1970 H. S. Aldwinckle initiated a forty-year cooperative program with tree-fruit breeders using traditional breeding methods that led to the development of several apple cultivars and rootstocks with multiple disease resistance. Importantly, he also showed that by using molecular methods and a transformation system he developed, cultivars can be genetically modified to be resistant to fire blight and apple scab diseases without losing their unique characteristics.

From 1968 until 1995, R. Provvidenti discovered and characterized 70 resistance factors that were singly inherited (dominant or recessive) in cultivated vegetables and related wild species to 21 viruses causing diseases of 17 species of vegetables. Many of these genes have been incorporated by breeders in public ad private institutions in the United States and abroad into new cultivars.

D. Gonsalves used mutation technology to produce a mild strain of the ringspot virus that destroys papaya trees and inserted some of the mild strain's genetic material into the DNA of papaya using the gene gun developed at Geneva. Regenerated plants carrying this modified genetic material were resistant to the ringspot disease. Through Gonsalves' persistent effect over many years, the federal government approved these genetically modified papaya fruit being marketed commercial—the first instance of this for a fruit crop. Gonsalves' efforts saved the papaya industry of Hawaii and this approach to modifying fruit crops is now being used by others in an attempt to save other fruit crops where no source of resistance has been found in nature and no alternative control measures are available.

A sequence of discoveries at Geneva led to improved understanding and control of powdery mildew of grapevines, the most important disease of the world's most widely grown crop. These include R. C. Pearson and D. M. Gadoury discovering that cleistothecia are the primary source of inoculum causing this disease; R. C. Seem and Gadoury showing that the period of susceptibility of grape berries is much shorter than previously thought; and W. F. Wilcox determining that pruning practices can alter the microclimate in the grape canopy enough to have a big impact on disease development. These discoveries have been confirmed in many places and are thought to influence control practices widely.

H. C. Hoch used nano- and microfabrication technologies to study how pathogenic bacteria and fungi interact with their hosts. He discovered that several species of fungi respond to topographical signals on leaf surfaces for growth orientation and initiation of appressoria. He also used micro-fabricated artificial xylem vessels to study how bacteria grow, migrate and develop biofilms.

H. R. Dillard learned that the fungus causing anthracnose disease on tomato fruit can also cause a serious disease on roots, and that small sclerotia produced by this fungus can survive in soil for over five years. She also learned that flee beetles transmit the pathogen causing alternaria leaf spot of cabbage and that wounds made by tools and insects release plant nutrients needed for *Sclerotinia sclerotiorum* to infect cabbage leaves.

Since 1972 G.S. Abawi has carried out a broad-based research program on soil-borne diseases of vegetables. He has concluded that using good soil management practices to improve "soil health" is an effective management strategy. This has led to his participation in a Cornell multidisciplinary extension team that conducts extension education programs about good soil-management practices throughout the northeastern U. S. He also has studied fungicide treatment of vegetable seeds and diseases caused by nematodes and their control.

T. C. Burr began a program on bacterial diseases in 1975 and showed that the bacterium causing crown gall of grapevines and necrosis of grape roots can survive in grape tissue debris, in wild grapesvines and in propagating material. He also showed that antibiotic resistance to the pathogen, *Pseudomonas syringae,* is transferred via a plasmid between bacteria.

D. A. Rosenberger conducted studies each spring in eastern New York to provide tree-fruit growers with advice for controlling diseases of these crops, and he conducted research leading to operators of fruit storage facilities to use improved sanitation practices that limited diseases that can develop in storage. He also studied some unusual fruit diseases, including some that were exacerbated by use of the herbicide glyphosate.

J. E. Hunter demonstrated that drop nozzles on spray booms direct fungicide sprays to blossoms inside the canopy of snap bean plants, which is where initial infection

occurs that leads to white mold disease. Other field studies revealed the time limit for systemic fungicides to be applied after ascospores initiate the infection process on bean blossoms. In cooperation with a plant breeder, he developed a technique to detect partial or low levels of resistance to white mold and released lines with this characteristic to commercial breeders.

Programmatic shifts at Geneva from 1884 to 2010

Before the 1970s, faculty at Geneva held 100 percent research appointments although most provided considerable support for growers of fruit and vegetable crops. Gradually some professors were assigned a percentage of their time to the extension function, with all of the fruit pathology extension responsibility being shifted from the Ithaca campus to Geneva in the mid 1970s. In 1984, for the first time, a professor was hired at Geneva with a significant commitment of time to develop an extension program for diseases of vegetable crops.

In 1990, the director at Geneva, J. E. Hunter, a plant pathologist and former chair of the department, wrote a policy stating that in some situations it might be desirable for faculty at Geneva to become involved with teaching courses on the main Cornell campus. Today a course in field plant pathology is led by a professor at Geneva and another professor has occasionally taught a course in nematology. And, the number of plant pathology graduate students doing research at Geneva has increased from one in 1973 to around 20 when H. S. Aldwinckle was department chair. Also, faculty from both campuses serve on the curriculum and graduate student selection committees, which further strengthens the involvement of faculty at Geneva with the educational mission.

The gradual involvement with faculty at Geneva in all three functional areas of college programs--research, extension and education--has helped smooth the path for merging the two departments of plant pathology at both campuses shortly after each changed their name to the Department of Plant Pathology and Plant-Microbe Biology.