Our Mission

GENEVA supports New York's agricultural industries with research and extension programs that help:

- **Improve the competitiveness and profitability of growers and processors of fruit and vegetable crops;**
- **Develop more environmentally sound agricultural practices in New York;**
- **Increase market share for New York producers;**
- **Provide consumers access to wholesome, high quality, and reasonably priced foods produced in New York;**
- **Attract and retain agricultural, food and biotechnology companies to New York;**
- **Promote establishment of start-up companies based on technology developed at GENEVA.**

Vital Statistics

- Established in 1880
- Four academic units; five support units
- Outlying labs in Fredonia and Highland
- 303 employees (186 on state funds):
  - 50 professors and program leaders
  - 41 other Ph.D.-level scientists
- 51 graduate students
- 28 visiting scientists in residence
- 900-acre campus, including:
  - 850 acres of farm land for research
  - 1 acre of greenhouse space
- 623,000 square feet of buildings
- Annual budget of $21.1M ($11.3M funded through SUNY)

For More Information

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"Agricultural Progress Through Research"

http://www.nysaes.cornell.edu

New Program Leaders - 1999

Dr. Phil Griffiths, plant breeder in Horticultural Sciences, concentrates on breeding new varieties of cauliflower, broccoli and cabbage that are disease- and pest-resistant.

Dr. James Shupp, assistant professor of pomology in Horticultural Sciences, conducts research and extension programs on apples and other tree fruits at The Hudson Valley Lab in Highland, NY.

Dr. John Roberts, assistant professor in Food Science & Technology, teaches a course in Processing of Fruits and Vegetables in addition to conducting research and extension on vegetable process engineering.

Dr. Courtney Weber, assistant professor in Horticultural Sciences, directs Cornell's small fruit breeding program.

Award Winners - 1999

Dr. Terry Acree, Food Science & Technology, Fellow of the Agricultural and Food Chemistry Division of the American Chemical Society.

Dr. Malcolm C. Bourne, Food Science & Technology, Honorary Fellow of the Australian Institute of Food Science & Technology.

Dr. Karl J. Siebert, Food Science & Technology, American Society of Brewing Chemists' (ASBC) Award of Distinction.

Dr. Mike Villani, Entomology, NYS Turfgrass Association's Citation of Merit, the highest award for contributions to the NYS turf industry.

Dr. Stephen Reiners (Horticultural Sciences), **Dr. Curt Petzoldt** (IPM), and **Dr. Mike Hoffmann** (IPM), Entomological Society of America's Outstanding Extension/Regulatory Display.

Partnership with Industry

GENEVA technology can be licensed from the Cornell Research Foundation for commercial development.

Patent Activity: July '98-June '99
20 Foreign patents filed
0 Foreign patents issued
13 U.S. patents filed
7 U.S. patents issued

Julie Kikkert utilizes the gene gun to introduce genes into plant tissue. The gene gun is a patented, landmark invention of GENEVA scientist John Sanford and colleagues on the Ithaca campus.

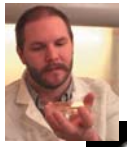
Discovering Fundamental Knowledge for Future Applications

Research support specialist Patricia Marsella-Herrick prepares to harvest yeast strains that produce insect sex pheromone precursors.

Next Generation Insecticides: Molecular genetics and bioinformatics are being employed to investigate insect biology to improve future control practices and delay insecticide resistance. By investigating gene-encoding components of the insect nervous system that are insecticide target sites, new insecticidal compounds will be developed. Several insect genes that have been isolated in this program have been patented by the Cornell Research Foundation and licensed by the agrochemical industry to facilitate their use in the search for new insecticides.

Biologically Based Pheromone Production: Synthetic pheromones for disrupting insect mating behavior have been shown to be effective, environmentally benign alternatives to broad spectrum insecticides for controlling insect pests since the 1980s. But pheromones have had limited commercial success due to the high cost of production. Researchers at GENEVA have succeeded in cloning several dozen genes that can be inserted into yeast for biologically-based pheromone production. Scale-up via conventional fermentor-based technology could result in low-cost pheromone synthesis.

Surrogate Insect Nervous System: Entomologists at GENEVA have been issued a patent for a surrogate insect nervous system that could help scientists discover potential new insecticides. Transgenic insect cell lines that contain genetically-engineered house fly sodium channels are the basis of this new high-throughput screening technique. The genetically-engineered channels retain their normal pharmacological properties but are permeable to calcium, thus providing an interface with existing calcium ion fluorescence technologies to detect novel agents that modify sodium channel function. The technology is highly attractive to the agrochemical industry because it is compatible with industry-wide trends toward the automated high-throughput screening of large libraries of novel chemicals.



A New Bacteriocin: Microbiologists at GENEVA have discovered a bacteriocin (protein produced by a bacterium) capable of killing a large majority of *Salmonella*, *Shigella* and *E. coli* O157:H7 bacteria that cause foodborne illnesses. The bacterium that produces this particular protein is harmless and commonly found in the environment. Use of the bacteriocin in food products has the potential to kill pathogenic bacteria and enhance food safety. Medically, the bacterium could be used to fight bacterial infections in hospital or surgery settings. A patent application is in process with the Cornell Research Foundation.

The Salmonella typhimurium *in this petri dish has been killed because of contact with the unique bacteriocin recently discovered by food microbiologist Randy Worobo* [inset] *at* GENEVA. *Use of the bacteriocin could enhance food safety and help fight infection.*

NEW YORK STATE
AGRICULTURAL EXPERIMENT STATION
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NEW YORK STATE AGRICULTURAL EXPERIMENT STATION

A SUNY CAMPUS IN GENEVA, NY

The 1999 Year in Review

From Molecules to Markets . . .

The GENEVA EXPERIMENT STATION
Means Business for New York

CORNELL

From the Director . . .

The GENEVA Experiment Station depends on many financial and human resources to carry out a wide range of research and extension programs that benefit New York, and partners are critical to these efforts. Our partners help meet the high cost of doing research, and recommend priorities for research and extension programs. They also contribute to the critical mass of scientific expertise needed to meet the challenges facing New York's agricultural and food businesses in an age of global competition.

Our partners include the State and Federal government, experiment stations in other states and countries, and scientists employed in private companies. Programs at the Station are enhanced by these partnerships.

Growers and food processors in New York help finance salaries and operations beyond those covered by the 55 percent of the Station's budget derived from the State University of New York. The Station solicits research proposals from the faculty; submits them to representatives of fruit and vegetable organizations for review; arranges annual meetings for faculty to present progress reports orally and in writing; and manages all the financial transactions from sponsors to faculty for support of research projects.

National and international companies also help the Experiment Station by providing faculty with grants, gifts and contracts. In addition, companies provide in-kind donations, including seeds or plants for field trials, products for control of pests in experimental plantings, and food processing equipment for the Station's food processing pilot plant and new vinification and brewing facility.

Together with labs at Highland ■ and Fredonia ●, research at GENEVA ★ serves the entire state.

New York growers and processors also provide in-kind assistance, such as the use of land for research trials with annual crops, and/or vineyards and orchards to test new varieties and production practices. Growers and processors often help evaluate promising breeding lines before new varieties are released by the Station. Representatives of the New York wine industry help GENEVA scientists determine the potential of grape breeding lines to meet the needs of the growing wine industry in New York.

In the last few years, the Station has been involved in an innovative community partnership with the City of Geneva and Ontario County. The focus of this partnership is to develop The Cornell Agricultural and Food Technology Park, a research park that would be located immediately adjacent to the main Station campus. Our goal is to attract companies to the park to conduct research that would foster the development of agriculture, food and biotechnology businesses in New York State.

The park would help ensure the long-term viability of the GENEVA Experiment Station. Scientists working in the park will enhance the brain trust and working environment at GENEVA that attracts and retains world-class scientists. This is a challenging project that requires many partners working closely together.

CONSUMERS, GROWERS, PROCESSORS, commodity groups, agricultural consultants and associations, scientists, and governmental agencies are our essential partners in a common goal: enhancing the viability of New York's agricultural, food processing and biotechnology industries.

As we head into the 21st century, we seek to strengthen these partnerships.

James E. Hunter

Accomplishments with Impact: 1999

Growing Crops Competitively

Seed Evaluation: Operated the state's only official seed testing facility—the New York State Seed Testing Laboratory—

Ellen Chirco, director of the NYS Seed Testing Lab at Geneva, has developed quality tests specifically for New York growers. The lab tests and evaluates all types of seeds

for the 87th consecutive year. The lab provides unbiased seed testing services to residents, seed companies, growers, food processors and government agencies in New York and the Northeast for a fee. Tests are also conducted for the NYS Dept. of Agriculture & Markets to ensure that seed complies with the NYS Seed Law. Planting high quality seeds is the key to successful and profitable crops. Over 7,000 samples were tested in 1999.

Grape Prospecting: Layered digital maps of soil, land use, elevation, and climate maps tailored to grape production to generate new maps to show the optimum sites for vineyard placement in New York. The statewide maps are accurate to one square kilometer, but better resolution has been achieved around the Finger Lakes and Lake Erie. This information will help New York's rapidly expanding grape and wine industry produce premium, hard-to-grow varieties. In 1999, 205,000 tons of grapes were produced in New York, and the farm-gate value approached $60M.

The positive health effects of drinking Concord grape juice has strengthened this segment of the New York market. There were 154,500 tons of Concord grapes processed in New York in 1999—75 percent of the total grapes processed.

Concord Grape Yield: Helped improve production and pest management practices that have increased Concord grape yields in Western New York from a 5-year average of 3.7 tons/acre for 1975-1979, to 6.1 tons/acre for 1995-1999. In that time, yield per acre has increased by 55 percent. In 1999, there was a record yield of 7.9 tons/acre of Concords in New York. The state ranks third in grape production behind California and Washington.

Developing and Selecting New Crop Varieties

New Buckwheat Varieties: Helped develop two new varieties of buckwheat particularly suited to the New York climate. Keukett exhibits early plant growth, increased yield, and uniform seed maturity. Koto shares those traits as well as superior flavor, and is expected to be widely planted in 2001. New York buckwheat is sold for kasha in markets in Eastern U.S. and Europe. Current New York production is about 7 million pounds/year, valued at $1M.

Vegetable IPM Coordinator Curt Petzoldt tested buckwheat as a weed smother crop in sweet corn systems trials.

Growing Healthy Crops and Sustaining the Environment

Evaluation of Cropping Systems: Integrated Pest Management (IPM) staff evaluated the economic cost of growing food in environmentally sensitive ways, in two long-term studies conducted at Geneva—one in strawberries, one in sweet corn—comparing different production systems. Three systems were evaluated: "Conventional IPM," "Future IPM," and "Organic." Cropping studies were compared with profitability. The results help growers learn about IPM approaches that are less costly, more profitable, reduce pesticide use, and of greater marketability to certain consumers.

Natural Genes to Control Plant Diseases: Isolated genes from the *Trichoderma* fungus to control disease-causing fungi. These genes cause *Trichoderma* to produce proteins that degrade the outer walls of other fungi. The genes have been cloned and transferred into plants. The plants then produce the same anti-fungal protein as *Trichoderma* does, which makes plants highly resistant to fungal diseases.

Applying Biotechnology

Matrix Mill: Developed new equipment that reduces the time required for extraction and separation of DNA from plant tissue by a factor of 10. The Matrix Mill makes genetic identification of a desired gene, or trait, a viable option for smaller breeding operations or crops where profit margins are small. To extract DNA from 2000 plants using conventional procedures takes about 10 weeks and costs about $8,000 for extraction only. The Matrix Mill accomplishes the same task in a few days for about $50.

Horticultural scientist Norm Weeden developed the Matrix Mill to speed up DNA extraction. The instrument is patented by Cornell.

Bacterial Toxins to Control Insects: Used the diamondback moth to develop management strategies for growers to delay the development of resistance to *Bacillus thuringiensis* (Bt) toxins. Bt is a microbial insecticide used as a spray to control caterpillars that affect crops. Its use has increased dramatically since the genes for production of Bt toxins were engineered into important crops like corn and cotton. Bt is safe and effective for pest control, but, as with any insecticide, insects may develop resistance to it. Planting Bt crops can dramatically reduce the use of more toxic insecticides.

Managing insect resistance to Bt corn is an issue for entomologists at Geneva because production of Bt corn in the U.S. grew from less than 1 percent in 1996, to 26 percent, or 20.2 million acres in 1999.

Plant pathologists hand-pollinate flowers of Royal Gala apple trees that are genetically enhanced to increase their resistance to fire blight disease, in order to obtain fruit.

Fireblight Resistant Rootstocks: Developed methods for inserting genes into apple varieties and rootstocks that render them more resistant to fire blight. This devastating bacterial disease affects apples and pears in New York and many other fruit growing regions of the world. The bacterium infects flowers and shoots, resulting in crop loss and tree damage. Field trials of genetically enhanced, fire blight resistant trees are carried out at Geneva under a federal permit to develop them for commercial use.

Ensuring a Safer Food Supply

Mammalian Sensitivity to Insecticides: Developed a model system that assesses the sensitivity of insecticide target sites in human cells without using whole humans, and evaluates the fidelity of rodent models used in whole-animal toxicological studies. This is important for assessing whether all pyrethroid insecticides possess a common mechanism of toxicity, and provides important information under the Food Quality Protection Act (FQPA) in assessing chemicals for use in fruit and vegetable production.

Organophosphate Alternatives: Developed several insect management programs for apples that utilize newer, more selective insecticides to replace or eliminate organophosphates. New legislation, called the Food Quality Protection Act (FQPA), is expected to severely restrict the use of organophosphates—the most widely used insecticide in New York orchards for 25 years.

1) Field studies showed that biorational insecticides such as *Bacillus thuringiensis*, Spintor, and Imidacloprid can control orchard insect pests, while enhancing the natural enemies of these key species.
2) The plum curculio pest can be managed by timing sprays according to a new oviposition model based on accumulation of heat units, then applying sprays only to the outer perimeter rows in an orchard.

Eating apples with skins is being marketed as a healthy diet choice by the NY Apple Association because of research by food scientists at Geneva and Ithaca.

Assuring High Quality Foods

Antioxidants in Apples: Identified apples eaten with skins as an inexpensive, year-round source of antioxidants. Northern Spy, Liberty, Crispin, Delicious, and Fuji produced some of the highest levels of antioxidants in apple varieties. Antioxidants can be positive factors in preventing cancers, heart disease, stroke, senility, and other conditions.

Effects of Powdery Mildew on Wine Quality: Discovered that powdery mildew infections too light to be seen with the naked eye make wine grapes more susceptible to other microorganisms that cause wine spoilage. Timing fungicidal sprays to combat powdery mildew substantially improves fruit quality at no additional cost, and helps preserve New York's wine industry, the country's second largest. In 1999, New York's 140 wineries produced over 150 million bottles of wine annually and annual sales exceeded $300 million. Over 1 million tourists visit the wineries annually.

Cornell Cooperative Extension grape specialist Tim Martinson (right) uses data from a weather station to help grape growers time fungicide sprays to optimize wine quality as assessed in Geneva's Wine Analysis Lab.

Hudson Valley entomologist Henry Grimsland checks a pheromone trap to assess the number of adult male corn earworms caught in a sweet corn trial.

Fostering Economic Development

Hudson Valley Growers: Benefitted from more than 75 years of university-industry cooperation. Geneva has scientists and staff permanently located at The Hudson Valley Laboratory, a facility constructed and supported by a grower-owned, non-profit corporation that was established to foster university research and extension programs that benefit stewardship, productivity, and profitability of the Hudson Valley's 16,000 acres of fruit farms and 15,000 acres of vegetable farms. They work on problems unique to the region's climate, soils, and topography.

Empire Apples: Production of Empire apples reached 3.6 million bushels in New York in 1999, 12 percent of the state's total apple production. Empire is the most successful of all the 64 apple varieties developed at Geneva since 1914. The cross is among the top five apples released by Geneva's world-renowned apple breeding program—Cortland, Jonagold, Macoun, and Jonamac. The five accounted for 25 percent of New York's total apple production in 1999. Empire and Jonagold rank in the top 10 among North American retailers.

Stone fruit production in 1999 amounted to $14M/yr for New York growers. Fruit farmers are expanding production of stone fruits.

Reaching Out to Educate

Stone Fruit Association: Hosted Stone Fruit School at Geneva. Researchers and extension educators presented options in peaches, nectarines, and plums to help New York fruit farmers diversify. In 1999, the Northeast Stone Fruit Sponsors (NESFS) was formed to provide information to Northeast growers on profitable production and marketing of stone fruits. The NESFS will provide seed money to fund research projects, set up cooperative university/industry test plots, and schedule tours and meetings for producers.

New Vegetable Production Guidelines: Produced *The 1999 Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production*. The 305-page manual provides growers in the Northeast with research-backed information on what to do when faced with an insect, disease or weed problem in the production of beans, corn, cabbage, broccoli, tomatoes, carrots, pumpkins, and potatoes. The goal is to understand why problems occur, what can be done about them, and how to avoid them. The manual is available on-line at http://www.nysaes.cornell.edu/recommends/

Federal Officials and the FQPA: Participated in a "Beyond the Big Apple" tour that brought officials from the EPA and DEC together with growers and researchers. Federal and state regulators responsible for implementing the Food Quality Protection Act (FQPA) visited farms in eight counties in New York to better understand the impact of their regulatory decisions. Growers provided first-hand knowledge about how pest management decisions are made, what affects food quality, and how vulnerable New York agriculture is to insects, diseases, and weather.

Plant pathologist Helene Dillard (right) shows government officials from the EPA and DEC damage to New York's bean crop during the "Beyond the Big Apple" FQPA tour.

Vegetable Field Day: Demonstrated vegetable breeding techniques and results to industry. Vegetable breeders and representatives from seed companies from New York, Georgia, Florida, California, Brazil, Japan, Canada, and Holland attended as part of a cooperative effort to develop better crops.

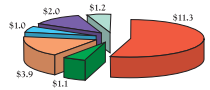
July 1, 1998-June 30, 1999

Expenditures for FY99/00 (Millions)

- Instruction/Department Research
- Research
- Extension (Public Service)
- Academic Support/Library/Scholarships
- Institutional Support Services
- Facility Operation & Maintenance

Total Expenditures = $21.1M

Revenues for FY99/00 (Millions)



- State Appropriations
- Federal Formula
- Federal Grants & Contracts
- State Contracts
- Private Gifts & Contracts
- Investment Income/Other

Total Revenues = $20.5M

Developing Value-Added Products and Processes

Cornell Agricultural and Food Technology Park: In 1999, the City of Geneva, Ontario County, Geneva Growth, the Empire State Development Corporation, the Experiment Station, and the State University Construction Fund completed a Market Study and a Project Business Plan to build a research park on 70 acres of land adjacent to the main campus. The park would attract start-up and established companies to Geneva for collaborative research in agriculture, food, and biotechnology that complements current research and extension programs. State legislation must be approved to use land for development of the park at the Station.

Cornell Vinification and Brewing Lab: In 1999, over $150,000 in state funds and $70,000 in donations from industry were obtained to build a 2,000 sq. ft. pilot plant, designed and specially equipped for enology and brewing studies. The lab is due to open in 2000 and will be the premier site in the Eastern U.S. for collaborative research and development in wine making and brewing arts and science. This university/industry partnership will benefit researchers, industry, students, and suppliers. The goal is business stimulation through innovative science and technology combined with creative applications of technology and training.