



The Louis W. Schatz Center for Tree Molecular Genetics

Research Update

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This a report on the activities of *The Louis W. Schatz Center for Tree Molecular Genetics* over the past six months (January 1 to June 30, 2002). We continue to work diligently to fulfill Dr. Schatz's vision of healthy and productive forests in the future through forward-looking, cutting-edge research today. Over the past four years, we have developed a strong foundation in research technologies, staff, student training programs, and a broad research portfolio that will help to ensure the success and preeminence of *The Schatz Center* when it becomes fully implemented through Dr. Schatz's generous estate gifts.

The estate gift from Dr. Schatz will establish endowments that will provide ongoing support for several features unique to the center at Penn State. This will include a new faculty position in tree genetics at the Mont Alto technical forestry school campus, a post-doctoral fellowship for young scientists to join *The Schatz Center* for two to three year appointments, support for visiting scholars to work with Penn State faculty in *The Schatz Center*, awards for undergraduate students to conduct research in *The Schatz Center*, a biannual colloquium where scientists from around the world can present their latest research findings, and new library collections relevant to forestry and tree genetics. The Schatz Center gifts will also support construction of the new Forest Resources building on the University Park campus. Detailed plans are being developed for the new building, which will include a lab space of over 2,000 square feet plus offices in which *The Schatz Center* will reside. We look forward to Schatz family members attending the opening of the new building in 2005. Until then, the center will continue to enjoy high quality research space within the Biotechnology Institute building (the "Wartik Lab") in the heart of the University Park campus.

Dr. Carlson has recently been appointed as Director of *The Louis W. Schatz Center for Tree Molecular Genetics* by the Research Dean for the College of Agricultural Sciences at Penn State. As Director of the Center, Dr. Carlson will report to the new Director of the School of Forest Resources, Dr. Charles Strauss, and to the university President's office regarding finances and activities in the center. Dr. Carlson and Dr. Strauss will work together to implement the *Schatz Center's* structure and staffing when the endowment funds from Dr. Schatz are established.

Dr. Carlson has received several research grant awards from State and Federal agencies that support projects, staff and students in the *Schatz Center*. Projects currently underway in *The Schatz Center* range from tissue culture to genetic diversity to genomics, including:

- A multidisciplinary study, along with ecologists and plant physiologists, to better understand the role of food-hoarding animals in regeneration of oak forests, funded by the National Science Foundation.
- A project to clone and characterize genes that are responsible for lignin synthesis during the creation of wood in trees, funded by the Department of Energy Biosciences Research Program.
- Experiments to determine if more uniform Christmas tree seedlings can be produced asexually through micropropagation in tissue culture, funded by the PA Department of Agriculture. The photograph on the cover of this report shows a tree with excellent Christmas tree characteristics. Pennsylvania is one of the world's major producers of Christmas trees. Approximately 46 million Christmas trees are currently in production in Pennsylvania, of which 2 million trees are harvested every year. Over 6 million Christmas trees are planted in PA every year. Across the United States there are over 15,000 Christmas tree growers, and app. 100,000 people employed in the industry. There are app. 1 million acres of Christmas trees in production nationwide, from which 34 million Christmas trees are sold each year. Christmas tree farms provide diverse environmental benefits. They replenish the oxygen supply (each tree provides the daily oxygen requirements for 18 people), serve as wildlife habitat, and increase soil stability. Christmas trees are frequently planted on marginal lands where other crops will not grow well such as barren slopes or under power lines. Real trees are also renewable and recyclable, unlike artificial trees which contain non-biodegradable plastics and metals.
- Cytogenetics and genetic mapping are being used to assist the American Chestnut Foundation's blight resistance breeding program to more quickly eliminate unwanted genetic material from Chinese chestnut parent trees from the chromosomes of third and fourth generation seedlings and thus increase the American chestnut genetic contribution.
- Studies are underway ranging from the molecular level to the tree stand level to determine the role of oxidative stress in the toxic response of hardwood trees to Manganese in the soils of Eastern forests, with Dr.

Jonathan Lynch in the Horticulture Department at Penn State. This study is funded by the US Department of Agriculture.

- A new project being conducted with the University of Washington will create the world's largest DNA libraries for plants as a resource for scientists around the world to conduct better molecular genetics research with algae, ferns, and flowering plant species, including trees. This project is funded by the National Science Foundation.
- The "Floral Genome Project" is funded by the National Science Foundation to permit Dr Carlson and colleagues at five universities to discover genes that are responsible for the initiation and development of flowers in trees and other plants. During the first two years of the project, the *Schatz Center* will sequence over 50,000 genes expressed during flower development in a wide variety of plant species. This new data will provide unique insights into flowering in trees, and provide new and new approaches for controlling flowering which is very important to the application of biotechnology to forest tree improvement.

The Louis W. Schatz Endowment for Undergraduate Research

An endowment to support undergraduate research projects was established with \$100,000 of the advance estate gift that Dr. Schatz provided in 1998. This fund provides \$1,000 for travel to a conference and for research expenses for several undergraduate students to conduct research projects in the *Schatz Center* each year. In the 2001 – 2002 school year, four undergraduate students held the award. Two of the Schatz Scholars were Honors College students who successfully submitted the following undergraduate theses to the university in April, 2002:

- ◆ Tanya Breza "Assessing genetic diversity of *Tsuga chinensis* (Chinese Hemlock) using RAPD (DNA) markers".
- ◆ Brandi Stoffregen "Genetic variability in Pennsylvania populations of American Chestnut."

Students in the School of Forest Resources Xi Sigma Pi honor society chapter have volunteered to assist in the American Chestnut research program in *The Schatz Center* by preparing space in the School's research forest for planting new populations of chestnut seedlings in 2003 and 2004. The Xi Sigma Pi students will help with the planting of offspring from new crosses that Dr. Carlson has made this summer between blight sensitive American Chestnut female trees and blight resistant Chinese chestnut male parent trees. Once the new seedlings are established in the research forest we will monitor them for the blight disease and use DNA extracted from the seedlings to create a new genetic linkage map for chestnut.

Some of the students who participate in the chestnut seedling project will be supported by Schatz Center funds to travel to California to meet forestry students and staff at Humboldt State University and hopefully to tour the research forest with Mr. Gordon Schatz. We hope to accomplish the trip(s) in early 2003 and 2004 as funds and weather permit.

Recent publications from the Schatz Center for Tree Molecular Genetics:

- Amarasinghe, V. and Carlson, J. E. "The Development of Microsatellite DNA markers for genetic analysis in Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco)" Canadian Journal of Forest Research, Accepted June 19, 2002.
- Fu, Y. B., Phan, A., Carlson, J.E., and Richards, K.W. "Assessment of bulking strategies for RAPD analyses of flax germplasm." Genetic Resources and Crop Evolution, Accepted May 15, 2002.
- Amarasinghe, V., Brown, G.R. Mank, J.E. and Carlson, J.E. "Microsatellite DNA loci for Western Hemlock (*Tsuga heterophylla* (Raf.) Sarg)." Molecular Ecology Notes, Accepted Jan. 31, 2002.

Recent Presentations on research conducted in the Schatz Center:

- "The Floral Genome Project: A New NSF Plant Genome Project to Uncover the Genetic Basis of The Origin and Diversification of Flower Architecture" at Forest Tree Genome Workshop, Plant and Animal Genome Conference X, San Diego, CA, January 13, 2002.
- "Testing for the effects of animal-mediated dispersal of acorns on the distribution of oak seedlings: surprising initial results" at the annual meeting of the Society for Integrative and Comparative Biology, Anaheim, CA, Jan. 2-6, 2002.