

Plant Biology and Pathology Accountability Report (March 15, 2005)

Chair: Jim White, Professor I

The faculty of the Department consists of approximately 50 members with research and teaching specializations in areas of Molecular Biology, Biotechnology, Natural Products, Horticulture, Plant Breeding and Genetic Improvement, Plant Diversity, Plant Management, Plant Pathology and Horticultural Engineering. Teaching programs important in the department include Biotechnology, Agricultural Science, and Plant Science majors; and the Plant Biology Graduate Program. We also have a strong extension component that seeks to provide service to and impact plant industries locally and globally. Department thrust areas include: 1) health crops research, 2) nursery crops research, 3) turfgrass research, and 4) basic plant biology and pathology research. Over the next five years the department seeks to have major impacts in the NJAES areas of Sustainable Agricultural and Food Systems; and Food, Nutrition, and Health. For this reason we are working to build research, teaching, and outreach programs in *Nursery and Turf*; and *Health-Enhancing Food Crops and Pharmaceutical Bio-discovery*. There is a broad base of consensus that these are industries that are growing in the state, region, country, and world. We believe that the NJAES and Rutgers are poised to assume an international leadership role in these areas.

1. Accomplishments

Research: The Department has many research foci in basic and applied areas of importance to New Jersey and internationally. Overall, faculty research programs were supported with over \$ 10.1 million in grant dollars in the 2004 year and \$ 2.8 million in royalties from plant patents or other intellectual property. In that time faculty published 80 refereed articles, 3 books, 34 book chapters and 44 non-refereed articles, and gave 307 research presentations. Six copyrights were established, some 28 plant variety patents were issued, 28 new plant variety applications were filed, and 43 plant varieties were released.

Teaching: The department's faculty continues to teach in both undergraduate and graduate programs. We taught extensively in approximately 44 different undergraduate and 16 different graduate courses in the Agricultural Science, Plant Science, and Biotechnology undergraduate majors and in the Plant Biology graduate program. We are continuing to modernize our course offerings. We have been actively working to increase the numbers of students enrolled in the Agricultural Science, Biotechnology, and Plant Science curricula. The Ag. Sci. curriculum increased to 25 students this year; and the Biotechnology; and Turf and Horticulture option in Plant Science is continuing to expand in student subscription. Dr. Zane Helsel taught the Modern Crop Production course for the second time this spring. This course has not been offered in over 10 years. Dr. Steve Hart took over major responsibility for and taught the Principles Weed Science course this year. These two courses are important in that they represent major components in the agricultural training for Cook College students. It is also notable that our extension faculty is increasingly providing the leadership in these basic agricultural courses. We are aggressively marketing our majors and graduate program by making outreach and recruitment trips to other institutions. We anticipate that the 3 majors will continue to show growth. To improve the quality of our courses, we have continued peer review of undergraduate and graduate courses. Approximately 75% of our courses have been peer reviewed. The peer review process is supported by the faculty as a means by which course instructors may obtain input of peers in course improvement. We recently completed a self-evaluation of the Plant Biology Graduate Program curriculum. As a result of this evaluation we have restructured the seminar expectations of students. In one of the semesters, the seminars will be arranged in collaboration with instructors of the new graduate seminar course in the graduate

program. It is our expectation that this change will enable us to better train students in critical thinking and contemporary science in their particular track.

Outreach: An important function of the Department of Plant Biology and Pathology is to support the extension program of the NJAES and Rutgers Cooperative Extension. We partner with the Department of Extension Specialists and the Department of Agricultural and Resource Management Agents to deliver extension products to the plant industries of the state. All of the agricultural related programs in the department have faculty with an extension component in their line split. Approximately 16 faculty in the department are also members of Extension Units. Much of the anticipated future growth in agricultural programs in the department will rely on extension members of the department. This strategy enables us to provide the right kind of support to the agricultural industries of the state and our students. This strategy also demands that we partner with RCE to plan and hire new faculty. With the recent development of the Lausten/NJAES Horticultural Program we have enhanced the partnership between extension and disciplinary plant units. The integration of extension, research, and teaching has been a priority in the department and will continue to be important.

2. Plans (Next 5 Years)

Research: The overriding aim of the Department is to have positive transformative impacts locally, nationally, and internationally in areas of Plant Agriculture, Biotechnology, Horticulture, and Plant Biology and Pathology. Impacts that relate to the public University as well as Land Grant College and Experiment Station missions are essential to the continued growth of the Department, College, and Experiment Station. Continued impacts will ensure relevance of the College and Experiment Station for our students and stakeholders long into the future. In the next 5 years growth will continue in the departmental strategic thrust areas, including 1) Health Crops/Natural Products Pharma Research, 2) Nursery Crops Research, 3) Turfgrass Research, and 4) Basic Plant Biology and Pathology Research.

1. In the health crops area we plan to hire a plant genomics faculty member who can collaborate with our food crop breeding programs to help increase the health value of the plant varieties emerging from NJAES breeding programs. This line may also work closely with the faculty currently involved in natural product exploration. We consider this line very important to our development as an international leader in health plant research.
2. In the nursery crops area we will consolidate ornamental nut, holly, and dogwood breeding programs into a single effort. We have hired a young plant breeder (Tom Molnar, Assistant Instructor) to help us in this integration. Because of the importance of nursery crops to New Jersey – we intend to maintain the ornamental breeding program beyond the retirement of Dr. Elwin Orton. This is an extremely important sector of New Jersey agriculture with major economic impacts. NJAES nursery crop products and innovation can have an important influence on this sector of New Jersey agriculture. It is of strategic importance to NJAES that we advance in the area of nursery crops. We hope to add an extension component to this line in the future and increase the responsibilities of the line in some other areas to include oversight of the ornamental nursery crop breeding program.
3. In the turfgrass area we have recently hired an Assistant Professor of turfgrass breeding. Future development in this area of research involves the increasing application of genomics approaches to grass breeding. We have developed a collaborative relationship

with Dr. Jo Messing at the Waksman Institute and collectively Drs. Bonos, Belanger, Meyer, Zilinskas, and Messing have embarked on a major genomics project major focused on grasses. This project also involves collaborations with several other University based research groups in the U.S. We intend to continue exploring genomics applications in turfgrass breeding.

Teaching: We intend to continue to develop the newly approved certificate program in Medicinal and Economic Botany. We are initiating discussions with Dr. T.C. Fleischer (Head Knust Herbal Medicine Program, Kwame Nkrumah University of Science and Technology in Ghana, Africa) to explore development of an international component for the Rutgers training program in Medicinal and Economic Botany. This Herbal Medicine Program in Ghana is unique in its integration of modern scientific rigor and traditional healer knowledge. We envision two aspects of the collaboration, including 1) a student exchange program, and 2) a faculty exchange program. Our teaching program could be greatly enhanced by bringing Health Plant Professors to Rutgers to 1-year visiting appointments to offer International Health Plant courses to our students. Such a program may help us to train students with an international dimension. International Health Crop training will enable Rutgers students in agricultural areas to get the exposure that is needed for them to operate and excel in an international arena.

We see the potential for a new curriculum in Integrative Biology. We believe that the time is right to develop a biology major that is unique to Cook College. This Integrative Biology curriculum would extract courses from multiple Cook majors to produce a more integrated major at Cook College. For example, selected courses from Plant Science and EPIB may permit students to gain training that would better prepare than to deal with a broad array of real world issues. An Integrative Biology curriculum is consistent with the unique approach of Cook College to produce well-rounded students for the dynamic job market of New Jersey. Such a curriculum may also enable the college to attract additional students into the college and develop a biology major that is unique to Cook College.

We are actively developing distance education components to our current courses in Horticulture. In particular we are working to develop the Medicinal and Economic Certificate program so that it will be available as a distance education option for students.

Outreach: We intend to enhance our outreach efforts in the two focus areas of Nursery Crops and Health Crops research. We hope to accomplish this by developing a position in ornamental nursery crop breeding that will interact with the nursery industry to help develop ornamental crops that will find application by New Jersey's Nursery industry. This is part of our increasing partnership with the growing nursery industry of New Jersey. We are also hope to gain partners among current Rutgers Extension Agents to help us with outreach in the Health Crops Research and Teaching. Discussions will be held with extension faculty and administration to evaluate how to increase the partnership in the health crops area.

3. Needs

Faculty: It is extremely important that we are soon able to hire young faculty members in the areas of *Health-Enhancing Food Crops and Pharmaceutical Bio-discovery* and *Nursery Crops*. In the next two years we hope to be able to hire an assistant professor in Plant Nutritional Genomics/Biochemistry to help the current faculty to develop programs in Health and Pharma plants. We are also planning to hire a horticulturist to take over the ornamental crop-breeding

program. It is hoped that this later position will have an extension component in order to increase the impact of the NJAES in the growing Nursery Crop industry of New Jersey.

Equipment: We have been working for several years to obtain a laser scanning confocal microscope for the image analysis facility of Cook College. Such a microscope is indispensable for advanced research in many branches of the biological sciences and does not currently exist at Cook College. A confocal microscope allows for three-dimensional imaging of components within living cells, tissues, or small organisms. Among the major uses for laser scanning confocal microscope are identification and localization of components within cells such as organelles, proteins, and nucleic acids using fluorescent probes or antibodies. Following biological processes in living tissue with green fluorescent protein (GFP) and similar molecules, a technology that was developed in part through research here at Cook College, requires confocal imaging and analysis. Many of the striking, colorful images of cells and tissues seen on the covers of our best journals were made using this technology. A large number of scientists here at Cook College would benefit from such an instrument, including members of the departments of Plant Biology and Pathology, Food Science, Nutrition, Entomology, Ecology and Evolution, Marine and Coastal Sciences, Animal Sciences, and Biochemistry and Microbiology. A laser scanning confocal microscope would cost between \$100,000 and \$250,000, depending on the capabilities of the instrument.

4. Chair Objectives:

In previous years I have sought to encourage a harmonious relationship among faculty and an integration of the major goals of our faculty in diverse areas of biotechnology and agriculture. I believe that this has been reasonably achieved. Faculty now see themselves to be part of a functioning and diverse department. I have also tried to develop a consensus around the vision for increasing our capacities in Horticulture (specifically Nursery Crops) and Health Crops (specifically Plant Genomics/Biochemistry of Health Components of Plants). I believe that we have achieved consensus that these are two important areas to develop. I have tried to partner with faculty and with the Cook College Deans to develop programs that have a broad base of support among the faculty and stakeholders. An example of one such program is the Lausten/NJAES Horticultural Grant and Scholarship Program. This program is funded almost exclusively from royalties and scholarship funds and involves integration of extension and research faculty and stakeholders. This is a program with grass roots appeal to faculty and stakeholders that will cost very little in state funds.

The Department Chair's goals in the 3-5 year term include:

1. Continue help the faculty to develop the use of course peer review as a mechanism for teaching program improvement.
2. Facilitate the development of distance education components in the teaching of plant biology courses.
3. Continue to develop the teaching program in Medicinal and Economic Botany. The certificate in Medicinal and Economic Botany is a program that may have international appeal. An alliance with Kwame Nkrumah University in Ghana to enhance training in this teaching program may help us to improve this program and its utility to further agricultural training at Cook College.
4. Explore development of a certificate program in Turf and Landscape that can be taken by students in any major. The Turf Program has an international appeal and impact. The alliance between Turf and Horticulture enables the college to develop

Nursery and Landscape programs that are well supported by stakeholders and will have a reasonably large student enrollment and impact in New Jersey. Developing a certificate program in Turf and Landscape that will have appeal to students in diverse majors will help us to increase the student base in many of our Turf and Horticulture courses.

5. Explore development of an Integrative Biology Major for Cook College students.
6. Work with Deans and Faculty to hire young faculty in areas of Plant Nutritional Genomics/Biochemistry and Nursery Crops Breeding.
7. Encourage development of research in areas that will enhance sustainability of the NJAES.
8. Continue to encourage faculty to develop experiment station projects to maintain relevance of the NJAES and ensure its long-term development in New Jersey.
9. Partner with Extension faculty and administration to increase the relevance of teaching, research, and outreach programs in the department.