

Request to Plan

Center for Integrated Fungal Research (CIFR)

at

North Carolina State University

Goals and Objectives

A Center for Integrated Fungal Research is proposed for NC State University to provide focus for research and training on the biology, genetics and whole genome analysis of fungi. The Center will exploit the tools of genomic sciences to integrate a broad spectrum of approaches and expertise for investigating and analyzing fungi of agronomic and industrial significance and their interaction with plants. Many of these fungi also have major impacts on medicine and on the environment. In addition to the advancement of basic knowledge of biological processes, the data generated will provide practical applications for improvements in quality of life and the environment. The Center will enhance NCSU's mission to strengthen and expand Genomic Sciences and will take advantage of the University's research leadership in agriculture, forestry and veterinary medicine, as well as newly emerged strengths in Bioinformatics and Functional Genomics. The Center has its roots in the Department of Plant Pathology, a department recognized nationally and internationally for research on the nature of plant diseases, food safety and on improvement of plant health.

The Center has several major goals: discovery and analysis of complete gene sets from major plant pathogenic and industrially important fungal species; creation of affordable, durable genomic resources and their distribution to the fungal research community; the understanding of genome organization, population biology and fungal evolution; whole genome reconstruction; and comparative and global functional analyses to decode the molecular basis of disease caused by fungal pathogens. In addition, the Center will provide training and instruction for graduate students, post doctoral fellows and visiting scientists in fungal biology and genomics.

Organization

The Center for Integrated Fungal Research will receive administrative oversight from the College of Agriculture and Life Sciences. Core faculty will be primarily from the Departments of Plant Pathology and Botany. It is expected that additional faculty from the Departments of Microbiology and Forestry, the Research Center for Bioinformatics, and other departments will be affiliated. The Center will also play a broader role in genomics and will forge partnerships with research activities in the Colleges of Physical and Mathematical Sciences, Engineering, Natural Resources and Veterinary Medicine. A Scientific Advisory Board will be formed composed of 5-7 leading fungal biologists and genomics experts from both industry and academics. Dr. Ralph A. Dean will serve as Center Director. Dr. Dean joined NCSU in 1999 after several years as Associate Director at the Clemson University Genomics Institute. At NCSU, Dr Dean established the Fungal Genomics Laboratory, which is currently supported by over \$3,000,000 from

federal and industry research grants. He has published over 40 peer-reviewed research papers, and is the Director of the International Rice Blast Genome Consortium and is a member of the Phytophthora Genome Initiative, the two leading genomics initiatives focused on fungal pathogens of plants. The Associate Director of the Center will be Dr Gary Payne, Professor of Plant Pathology. Dr. Payne is an internationally recognized expert in food safety and fungal toxins.

Justification for a Center of Integrated Fungal Research

The fungal kingdom represents a diverse group of organisms that have an enormous impact on human-kind. Although originally thought to be related to plants, contemporary molecular systematics has shown them to be the animal kingdom's closest relatives and, consequently, the simplest life forms related to humans. Thus, from a basic research perspective, fungi have been exploited to gain insight into more complex biological processes including the molecular basis of human disease. Fungi provide nourishment, are a rich source of numerous antibiotics and other valuable products, and are used extensively in industrial fermentation processes. Fungi also cause devastating diseases, particularly of plants, and continue to be responsible for enormous human suffering. It is noteworthy that a significant number of plant pathogenic fungi also cause serious human and animal disease, for which there are very few effective therapeutic agents. Further, many fungi elaborate toxins that make food sources unsafe to eat. Over the next 25-30 years, world food production must be doubled. A significant part of this requirement can be met by reducing losses caused by fungi, which are responsible for the vast majority of disease and presently reduce yields by 20-35%. The cost of these losses is estimated at over \$200 billion annually. When losses of natural fibers, building materials and ornamental plants are factored in, financial losses are magnified a further 10 fold. It is widely recognized that fungal pathogens represent a major threat to global food security and are considered potent biological weapons. Genomics is not only revolutionizing biology, but also how we approach science. We are in the era of "Big Science", and now more than ever, research will be large scale, performed through extensive collaboration and teamwork. To most effectively work towards combating the threat of fungal disease and to enhance industrial application of fungi requires a concerted and comprehensive approach to characterize and compare fungal genomes within a formal framework such as the proposed Center for Integrated Fungal Research. Since his arrival at NCSU, Dr. Dean has initiated collaborative projects with faculty at NCSU, as well as with major Agricultural Biotech companies in the Research Triangle Park.

Similar Units

There are no existing units at NCSU or within the UNC system focused on integrating research methodologies including principles of biochemistry, genetics, computer science and genomics for comprehensive analysis of fungal systems. Indeed, there is no Center in the US that focuses on the effects of fungi on food quality and safety. The NCSU Center for Integrated Pest Management focuses on implementation, training and public awareness of agricultural practices for environmental stewardship. The NCSU Center for

Quantitative Genetics focuses on complex traits analysis principally of plants. A Center for the Biology of Nematode Parasitism is in development, and once established, will have research activities complementary to the Center of Integrated Fungal Research. Likewise, the Center for Bioinformatics and the Forest Biotechnology group also have activities related to but not overlapping with the proposed Center for Integrated Fungal Research. It is anticipated that a number of faculty from these centers and programs, which are all in close physical proximity, will be affiliated with the Center.

Support

At least 4 current NCSU faculty would initially make up the central core of the Center. Three faculty are from the Department of Plant Pathology (Dean, Payne and Cubeta) and one from Botany (Daub). All are supported by the College of Agriculture and Life Sciences. The initial group would consist of at least 30 researchers, with more than half being post doctoral associates and graduate students. Administrative support would be provided from a portion of overhead on grants and contracts generated by the Center and returned to the College of Agriculture and Life Sciences. External funding will be sought by individuals associated with the Center and by the faculty as a group. Opportunities exist to seek funding from the National Science Foundation for a Science and Technology Center. The initial core of faculty have funding exceeding \$4,000,000 with more than \$6,000,000 pending. Sources include the National Science Foundation, United States Department of Agriculture-Initiative for Future Agricultural Systems, United States Department of Agriculture-National Research Initiative, United States Department of Agriculture-Agricultural Research Service, Genencor International, Syngenta and Seminis Vegetable Seeds. The Center will be housed in Partners Building II and in the adjacent Toxicology building on Centennial campus. Additional space will be requested from the College of Agriculture and Life Sciences in Partners Building III.