LONG SIGNATURE SHEET

UNCCHARLOTTE *Grad School*
4-7-10 ap

Proposal Number: BINF 3/12/2010

Proposal Title Proposal for New Bioinformatics Applications Graduate Certificate

Originating Department Department of Bioinformatics and Genomics

TYPE OF PROPOSAL: UNDERGRADUATE_____ GRADUATE_✓___ UNDERGRADUATE & GRADUATE____

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
3/5/10	3/5/10	3/5/10	approval	**DEPARTMENT CHAIR**
3/5/10	3/5/10	3/8/10	approval	**COLLEGE CURRICULUM COMMITTEE CHAIR**
.	.			**TEACHER EDUCATION COMMITTEE CHAIR** (Teacher Education Program proposals only)
3/9/10	3/16/10	3/16/10	approved	**COLLEGE FACULTY CHAIR**
3/16/10	3/16/10	3/16/10	approval	**COLLEGE DEAN**
				UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR (for undergraduate courses)
3-17-10	4-6-2010	4-7-10	Approved	**GRADUATE COUNCIL CHAIR** (for graduate courses) Rob Roy McGregor
				FACULTY GOVERNANCE SECRETARY (noting Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

University of North Carolina at Charlotte
New Graduate Certificate Program Proposal
Department of Bioinformatics & Genomics
College of Computing and Informatics

TITLE: Bioinformatics Applications

A. Summary

This proposal is to establish a new graduate certificate program in Bioinformatics Applications. The graduate certificate is designed to train life science students to integrate expertise in established bioinformatics methods into life science research settings. Bioinformatics and Computational Biology provide methods to extract significance from high-throughput experimental results and develop models of complex biological systems. A recent study of the biotechnology community in the Charlotte metro area alone identified 700 companies, nearly one third of which will have need of bioinformatics professionals in the near future. The proposed program is to be added using existing courses only.

B. Catalog Copy

Graduate Certificate Program in Bioinformatics Applications
The purpose of the Graduate Certificate in Bioinformatics Applications is to train individuals in the application of established bioinformatics methods for analysis of biological sequence, structure, and genomic data. The certificate requires twelve (12) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte or as a standalone program.

Admission Requirements
For admission into the certificate program, applicants must meet the following requirements:

1. A bachelor's degree in a life science discipline, that includes advanced coursework in molecular biology and genetics.
2. Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

Program Requirements
Students will take four courses that introduce core methods for analysis of molecular biological data:

BINF - 6200 Statistics for Bioinformatics (3)

And three courses chosen from the following list of electives:

BINF - 6201 Molecular Sequence Analysis (3)
BINF - 6202 Computational Structural Biology (3)
BINF - 6203 Genomics (3)
BINF - 6211 Design and Implementation of Bioinformatics Databases (3)
BINF - 6350 Genomic Biotechnology (3)

If a student wishes to enter the program having completed coursework that is equivalent to one or more of the core requirements, the requirements may be waived at the discretion of the certificate coordinator. In this case, the required 12 credit hours may be selected from other advanced graduate courses offered by the Department of Bioinformatics and Genomics.

Transfer credit may not be applied toward this certificate.

It is suggested that students in the Graduate Certificate Program arrange formal co-mentorship by a Department of Bioinformatics and Genomics faculty member, if the student is concurrently enrolled in another thesis-based degree program on campus and intends to extend or enable their thesis research through the application of bioinformatic methods.

C. Justification

Justification: Bioinformatics is a newly evolving discipline that provides methods for the analysis of very large-scale biological data, and for modeling complex biological systems. While training students in the skills required to participate in method development in bioinformatics is addressed in degree programs, there is also a market for training graduates who are essentially "clients" of bioinformatics – those who will use bioinformatics methods in research, and need to use them well, but whose primary focus will be on the biological and medical challenges and not on programming or method development.

Providing training in Bioinformatics Applications for life scientists will:

- Make routine bioinformatics tasks accessible and understandable to this audience;
- Prevent errors of data interpretation that arise when widely-available bioinformatics tools are used without understanding;
- Develop a population of bioinformatics-literate biologists who will find it easier to bridge the divide between computing and biology to develop collaborations;
- Enhance the skill base of the local workforce for the benefit of local molecular biology and biotechnology employers.

Genomic biology and genomic medicine, which generate vast quantities of molecular sequence, molecular structure, gene expression and other data, have become a national priority. With President Obama's appointment of Francis Collins, the former head of the

Human Genome Project, as NIH Director, it has become clear that the emphasis on genomic biology will continue during this administration[1]. And while bioinformatics specialists are in high demand to develop analytical methods, models, and databases to handle all of this data, the need for bioinformatics skills has also "trickled down" to the average biologist or medical researcher.

Every molecular biology laboratory relies on routine sequence analysis operations to design probes and constructs or to predict the function of a novel sequence using homology information. It is even becoming common for molecular biology investigators to initiate the creation of massive data sets, such as the gigabytes or terabytes of data generated by a gene expression experiment, without prior knowledge of how the data can be analyzed. Availability of bioinformatics-literate graduates at the Masters level will satisfy a growing demand for laboratory workers who are also able to perform routine bioinformatics and data analysis tasks.

As reported recently in the Chronicle of Higher Education[2]. President Obama has continued to increase research funding for NIH, NSF and other federal agencies:

> "In all, the president proposed $66-billion for nondefense research and development projects for the 2011 fiscal year, and a 4-percent increase in basic research funds. That included an increase of $1-billion for the National Institutes of Health, which would receive a total of $32.2-billion. That 3.2-percent increase would be the largest for the NIH in eight years, other than the infusion of money the agency received in last year's stimulus legislation.
>
> The president's budget also includes an 8-percent increase for the National Science Foundation."

Genomic biology and genomic medicine are to remain a top research priority:

> "Among the president's priorities for distributing research money through the NIH are the study of genomes and the application of that research to medicine"

The Graduate Certificate in Bioinformatics Applications will prepare students to intelligently use the computational tools for analysis of genomic sequence and associated data that have been developed during the last 20 years, and will provide them with a sufficient base of general bioinformatics knowledge to be intelligent early adopters of new bioinformatics methods as they continue to evolve.

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1 Nathan, D and Orkin, S. Musings on genome medicine: the Obama effect redux. Genome Medicine, September 11, 2009.

[2] Nelson, L. *Despite Spending Freeze, Obama Proposes More Money for Research in His 2011 Budget.* The Chronicle of Higher Education. February 1, 2010.

This training program will be structured to provide students with the skills and knowledge to evaluate and deploy bioinformatics applications and to train others in their use. There is a growing demand for professionals with these skills. In Charlotte alone, a recent survey by the Chamber of Commerce identified 700 biotechnology employers, at least a third of which have identified a prospective need for employees with some level of bioinformatics knowledge. The proposed certificate will serve as an important qualification for individuals that will seek employment in North Carolina's biotechnology sector. In addition, the program will provide an excellent foundation for further graduate study in the life sciences, bioinformatics, genomic medicine, and other health disciplines.

Impact: The Graduate Certificate in Bioinformatics Applications will complement programs in Biology (CLAS) and Kinesiology (CHHS) in which students are developing and using molecular biology laboratory skills. The Graduate Certificate in Bioinformatics Applications will serve a different audience than the proposed Graduate Certificate in Bioinformatics Technology, which will focus primarily on developing graduates with computer programming skills. The program will utilize existing courses offered by the Department of Bioinformatics and Genomics to provide training in core Bioinformatics analysis skills that complement laboratory molecular biology training. An interdisciplinary faculty will offer a unique opportunity for students to enhance their life science skill set with computational methods, to prepare for employment in North Carolina's growing biotechnology sector.

D. Letters of Support and Consultation

Biology
Kinesiology