

# LONG SIGNATURE SHEET



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**UNC CHARLOTTE**

Proposal Number: BINF 3/11/2010

Proposal Title Proposal for New Bioinformatics Technology 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	approved	<u>DEPARTMENT CHAIR</u> 
3/5/10	3/5/10	3/8/10	<del>approved</del> approved	<u>COLLEGE CURRICULUM COMMITTEE CHAIR</u> 
<del>3/9/10</del>	<del>3/16/10</del>			<u>TEACHER EDUCATION COMMITTEE CHAIR</u> (Teacher Education Program proposals only)
3/9/10	3/16/10	3/16/10	approved	<u>COLLEGE FACULTY CHAIR</u> 
3/16/10	3/16/10	3/16/10	approved	<u>COLLEGE DEAN</u> 
				<u>UNDERGRADUATE COURSE &amp; CURRICULUM COMMITTEE CHAIR</u> (for undergraduate courses)
3-17-10	4-6-2010	4-7-10	Approved	<u>GRADUATE COUNCIL CHAIR</u> (for graduate courses) 
				<u>FACULTY GOVERNANCE SECRETARY</u> (noting Faculty Council approval on Consent Calendar)
				<u>FACULTY EXECUTIVE COMMITTEE</u> (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 Technology**

### **A. Summary**

This proposal is to establish a new graduate certificate program in Bioinformatics Technology. The graduate certificate is designed to train graduates who will bring interdisciplinary expertise in biological sciences and computing to bear on large-scale analysis problems in genomic biology. The fields of 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 Certificate program in Bioinformatics Technology will provide a means to cross-train students in the fundamentals of biology, statistical analysis and programming, with a focus on preparing them to develop software and databases for the execution of bioinformatics tasks. The proposed program is to be added using existing courses only.

### **B. Catalog Copy**

#### **Graduate Certificate Program in Bioinformatics Technology**

The purpose of the Graduate Certificate in Bioinformatics Technology is to train individuals in method development for analysis of large-scale biological data and modeling of complex biological systems, with a focus on acquiring complementary skill sets in life sciences and in programming, statistical analysis, and database development. The certificate requires fifteen (15) credit hours of coursework. The certificate may be pursued concurrently with a related graduate degree program at UNC Charlotte.

#### **Admission Requirements**

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

1. A bachelor's degree in related field, including, but not limited to, a life science, physical science, mathematics, or computing discipline.
2. Practical experience and confidence with computers, for instance use of common web browsers, word processing, plotting, and spreadsheet applications.

#### **Program Requirements**

Students will follow one of two pathways through the program, depending on their bachelor's degree field and previous experience. The following courses make up the required core:

If the bachelor's degree is in life sciences:

- BINF - 6200 Statistics for Bioinformatics (3)
- BINF - 6110 Bioinformatics Programming I (3)
- BINF - 6111 Bioinformatics Programming II (3)

If the bachelor's degree is in computing or mathematics:

- BINF - 6200 Statistics for Bioinformatics (3)
- BINF - 6100 Biological Basis of Bioinformatics (3)
- BINF - 6101 Energy and Information in Biological Modeling (3)

One advanced bioinformatics technology course from the following list of electives is required:

- BINF - 6211 Design and Implementation of Bioinformatics Databases (3)
- BINF - 6310 Advanced Statistics for Bioinformatics (3)
- BINF - 6380 Bioinformatics Programming III (3)

One bioinformatics applications course from the following list of electives is required:

- BINF 6201 - Molecular Sequence Analysis (3)
- BINF 6202 - Computational Structural Biology (3)
- BINF 6203 - Genomics (3)

If a student wishes to enter the program having completed coursework that is equivalent to the core course requirements, the core requirements may be waived at the discretion of the certificate coordinator. In this case, the required 15 coursework hours may be selected from the electives listed above, or 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 rapidly evolving discipline that provides methods for the analysis of very large-scale biological data, and for modeling complex biological

systems. The Graduate Certificate in Bioinformatics Technology will develop a population of trained graduates with a useful combination of skills in computational methods and life sciences. The admission requirements of the program specify that students entering the program should have one of these skill sets in place upon entering the program, and/or being provided by concurrent enrollment in a degree program at UNC Charlotte. The Graduate Certificate in Bioinformatics Technology offers accelerated cross-training in programming, aimed at biologists entering the program, and in molecular biology and biophysics, aimed at computer scientists.

Providing training in Bioinformatics Technology will:

- Develop a population of graduates with a sound foundation of bioinformatics skills having three main components – an understanding of important principles of molecular biology, training in applied statistical analysis for analysis of large datasets, and fundamental programming skills;
- Train students from diverse disciplines through a common experience that integrates their skills and identifies them as bioinformaticians;
- 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<sup>1</sup>. And while bioinformatics specialists are in high demand to develop analytical methods, models, and databases to handle all of this data, there is a growing need for bioinformatics "technicians" who have a broad base of skills and are flexible enough to work in many different bioinformatics settings.

It is 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 life science workers who are also able to perform routine bioinformatics tasks and develop databases and software to solve routine problems.

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

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

<sup>2</sup> Nelson, L. Despite Spending Freeze, Obama Proposes More Money for Research in His 2011 Budget. The Chronicle of Higher Education. February 1, 2010.

“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 Technology will prepare students for data analysis, database management, and programming roles in industry settings, such as molecular diagnostics and molecular medicine, where bioinformatic methods are commonly used.

This training program will be structured to provide students with the skills and knowledge to design and program bioinformatics applications and to interpret the results of bioinformatic analysis. 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, Mathematics (CLAS), Computer Science and Software and Information Systems (CHHS) that form part of the foundational disciplinary knowledge of bioinformatics. The Graduate Certificate in Bioinformatics Technology will serve a different audience than the proposed Graduate Certificate in Bioinformatics Applications, which will focus primarily on developing graduates who are trained users of established bioinformatics methods. The program will utilize existing courses offered by the Department of Bioinformatics and Genomics to provide training in core Bioinformatics skills. An interdisciplinary faculty will offer a unique opportunity for students to enhance their life science or quantitative skill set with computational methods, to prepare for employment in North Carolina's growing biotechnology sector.

#### **D. Letters of Support and Consultation**

Biology

Computer Science  
Software and Information Systems  
Mathematics and Statistics

**Subject: Re: Consultation**

**Date:** Monday, April 5, 2010 12:13 PM

**From:** ALAN DOW <adow@uncc.edu>

**To:** Lawrence Mays <lemays@uncc.edu>

Dear Larry,

Thanks for the consultation with the Department of Mathematics and Statistics. The proposal for the Bioinf Tech Graduate Certificate Program has my support.

In fact, I would like to inquire of either you or the Grad Committee if such a Certificate can be earned (without extra charge) by a student seeking a graduate degree in another department. This certificate would fit very well in our Applied Mathematics PhD program in which each student is required to earn an Applied Minor by taking courses outside our department.

regards,  
Alan

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