Curriculum in Bioinformatics and Computational Biology (GRAD)

Modern biology, in this postgenome age, is being greatly enriched by an infusion of ideas from a variety of computational fields, including computer science, information science, mathematics, operations research, and statistics. In turn, biological problems are motivating innovations in these computational sciences. There is a high demand for scientists who can bridge these disciplines. The goal of the Curriculum in Bioinformatics and Computational Biology (BCB) is to train such scientists through a rigorous and balanced curriculum that transcends traditional departmental boundaries.

Incoming students are expected to matriculate from a broad range of disciplines; thus, it is important to ensure that all students have a common foundation on which to build their BCB training. The first year is dedicated to establishing this foundation and training all students with a common set of core BCB courses. BCB students will also participate in three laboratory research rotations their first year and ultimately join a laboratory at the end of those rotations. Research work is done in the laboratory facilities of the individual faculty member and is supported primarily by faculty research grants.

Curriculum faculty have appointments in 18 departments in the School of Medicine, School of Dentistry, Gillings School of Global Public Health, Eshelman School of Pharmacy, School of Information and Library Science, and the College of Arts and Sciences. This level of diversity allows students a broad range of research opportunities.

Requirements for Admission for Graduate Work

Ideal BCB candidates should have an undergraduate degree in a biological, physical, mathematical, or computational science. They must apply to the program through a unified application program known as the Biological and Biomedical Sciences Program (BBSP). Students apply for graduate study in the biological or biomedical sciences at UNC—Chapel Hill. Students interested in any of the BBSP research areas apply to BBSP and those whose application portfolio places them highest on the admission list are asked to visit Chapel Hill for interviews. Students who are ultimately admitted to UNC—Chapel Hill make no formal commitment to a Ph.D. program. After completing their first year of study leave BBSP join a thesis laboratory, and matriculate into one of 14 participating Ph.D. programs. During their first year BBSP students are part of small, interest-based groups led by several faculty members. These groups meet frequently and provide a research community for students until they join a degree-granting program. Students are encouraged to apply as early as possible, preferably before December 1. (Applicants seeking a master's degree are not considered for admission.)

Financial Aid

Stipends for predoctoral students are available from an NIH predoctoral training grant and from the University. Tuition, student fees, and graduate student health insurance are also covered by the training grant and the University.

In addition to the dissertation requirements of The Graduate School (four full semesters of credit including at least six hours of doctoral dissertation, a written preliminary examination, an oral examination and a dissertation), students in the Curriculum in Bioinformatics and Computational Biology must meet the following requirements:

- complete all five of the BCB core courses (BCB 715, 716, 717, 720, and 722)
- complete twelve hours of elective courses (as determined by student and thesis advisor); at least 9 hours must be computational
- participate in the BCB Colloquium as attendees during the first and second years
- act as teaching assistant for one of the BCB modules in Year 2
- attend BCB Student Seminars in Years 2 and 3; present in BCB Student Seminars beginning in Year 3 until graduation
- participate in BCB Grant Writing course in Year 2
- attend BCB sponsored special seminars and new student symposium
- attend the BCB annual retreat; present posters or talks

Students are required to rotate through at least three laboratories before choosing a thesis advisor. The advisor or co-advisor must be from BCB Core Faculty list. It is strongly recommended that students attend national meetings in order to better understand how their research fits with progress in their field.

Professors

Shawn Ahmed, Genetics and Biology
Jin Bear, Cell Biology and Physiology
Kerry Bloom, Biology
Charles Carter, Biochemistry and Biophysics
Jeff Daniil, Biology
Ian Davis, Genetics and Pediatrics
Henrik Dohlman, Pharmacology
Timothy Elston, Pharmacology and Computational Medicine
Gregory Forest, Math
Plavio Frohlich, Psychiatry
Cell Biology and Physiology
Biomedical Engineering
Neurology
Terry Furey, Genetics and Biology
Amy Gladfelter, Biology
Shawn Gomez, Biomedical Engineering
Boyce Griffith, Mathematics
Biomedical Engineering
Klaus Hahn, Pharmacology and Medicinal Chemistry
Corbin Jones, Biology and Genetics
Brian Kuhlman, Biochemistry and Biophysics
Alain Laederach, Biology
Sam Lai, School of Pharmacy
Yun Li, Genetics and Biostatistics
Yufang Liu, Statistics & Operations Research
Biostatistics, and Genetics
Amy Shaub Maddox, Biology
Terry Magnuson, Genetics
Steve Marron, Statistics and Operations Research
William Marzluff, Biochemistry and Biophysics
Karen Mohlke, Genetics
Fernando Paro-Manuel de Villena, Genetics
Charles Perou, Genetics and Pathology and Laboratory Medicine
Computational Medicine
Jan Prins, Computer Science
Jack Snoeijink, Computer Science
John Sondak, Pharmacology, and Biochemistry and Biophysics
Brian Strahl, Biochemistry and Biophysics
Alex Tropsha, Chemical Biology and Medicinal Chemistry
William Valdar, Genetics
Kevin Weeks, Chemistry
Mark Zylka, Neuroscience Center
Cell Biology and Physiology

Associate Professors

J. Mauro Calabrese, Pharmacology
Lineberger Comprehensive Cancer Center
Jill Down, Biochemistry and Biophysics; Biology
Marty Ferris, Genetics
Erin Heinzen, School of Pharmacy and Genetics
Bradley Humminger, School of Information and Library Science
Samir Kelada, Genetics
Daphne Klotsas, Applied Physical Sciences
Karin Leiderman, Mathematics
Mike Love, Biostatistics and Genetics
Paul Maddox, Biology
Adrian Marchetti, Marine Sciences
Dan McKay, Biology and Genetics
Leonard McMullin, Computer Science
Both deterministic and stochastic models are discussed. Techniques used to develop and analyze models of biochemical networks. The course provides an introduction to the basic mathematical and computational approaches.
BCB 725. Introduction to Statistical Genetics. 3 Credits.
Covers statistical methods for the analysis of family and population-based genetic data. Topics include classical linkage analysis, population-based and family-based association analysis, haplotype analysis, genome-wide association studies, basic principles in population genetics, imputation-based analysis, pathway-based analysis, admixture mapping, analysis of copy number variations, and analysis of massively parallel sequencing data.

Rules & Requirements
Grading Status: Letter grade.

Same as: BIOS 785.

BCB 784. Introduction to Computational Biology. 3 Credits.
Molecular biology, sequence alignment, sequence motifs identification by Monte Carlo Bayesian approaches, dynamic programming, hidden Markov models, computational algorithms, statistical software, high-throughput sequencing data and its application in computational biology.

Rules & Requirements
Requisites: Prerequisites, BIOS 661 and 663; Permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: BIOS 784.

BCB 785. Statistical Methods for Gene Expression Analysis. 3 Credits.
Clustering algorithms, classification techniques, statistical techniques for analyzing multivariate data, analysis of high dimensional data, parametric and semiparametric models for DNA microarray data, measurement error models, Bayesian methods, statistical software, sample size determination in microarray studies, applications to cancer.

Rules & Requirements
Requisites: Prerequisites, BIOS 661 or 673, and 663; Permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

Same as: BIOS 785.

BCB 888. Responsible Conduct of Research. 1 Credits.
Classroom-based graduate level course covering critical topics for ethical and responsible conduct of experimental research. There are both classroom lecture, workshop-type discussion components, in addition to assigned outside of class readings. Case studies and hypothetical situations involving the most likely scenarios confronting graduate students will be covered, these topics include: mentor and mentee relationships, publication authorship, collaboration, peer review, conflicts of interest, intellectual property, plagiarism, data acquisition and data processing. Restricted to students in good standing as a graduate student at UNC; In the unlikely event that classroom space is limited, preference will be given to graduate students who have previously received external federal funding sources and may require a refresher course in RCR.

Rules & Requirements
Repeat Rules: May be repeated for credit. 2 total credits. 1 total completions.
Grading Status: Letter grade.
Same as: BIOL 888.

BCB 891. Special Topics. 1-3 Credits.
Advance topics in current research in statistics and operations research.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics.
Grading Status: Letter grade.
Same as: MATH 891, GNET 891.
BCB 899. Special Topics in Bioinformatics and Computational Biology. 1-6 Credits.
Special topics course in the Bioinformatics and Computational Biology Curriculum. Topics will vary.

Rules & Requirements
Repeat Rules: May be repeated for credit. 9 total credits. 9 total completions.
Grading Status: Letter grade.

BCB 905. Research in Bioinformatics and Computational Biology. 1-8 Credits.
Credit awarded to students for research in bioinformatics and computational biology.

Rules & Requirements
Repeat Rules: May be repeated for credit.
Grading Status: Letter grade.

BCB 993. Master's Research and Thesis. 3 Credits.
Students are not accepted for master's program.

Rules & Requirements
Repeat Rules: May be repeated for credit.

BCB 994. Doctoral Research and Dissertation. 3 Credits.
Credit for work done towards doctorate.

Rules & Requirements
Repeat Rules: May be repeated for credit.

Contact Information
Curriculum in Bioinformatics and Computational Biology
Visit Program Website (http://bcb.unc.edu)

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