

Computational Biology Prelim

The purpose of the *Computational Biology Preliminary Examination* is to give students an opportunity to demonstrate their ability to analyze, evaluate, and present a pre-existing body of *specific* research in the area of computational biology. Examples of areas of research applications that fall within this field include, but are not limited to, the following topics: molecular evolution, biological networks, biological data representation, expression analysis, biomolecule structure, biomedical NLP, genomics, ecological analyses, etc. Areas of computer science that may be applied to a biological application include, but are not limited to: algorithms, databases, high-performance computing (HPC), human computer interaction (HCI), image processing, machine learning (ML), nonlinear dynamics, optimization, and parallel computation

The prelim consists of the following components:

- Review Paper - A 15-20 page paper reviewing a coherent selection of papers from the published research literature in the chosen area.
- Formal Presentation - A 20-minute presentation, followed by questioning by the Computational Biology Prelim committee.

Successful completion of this examination satisfies the Area Exam portion of the Computer Science department's Preliminary Examination requirement.

The review paper should summarize a *minimum* of 3 key papers in the chosen area, but more typically will address 5-8 papers. Part of the challenge of the prelim is to pick a set of papers that are interrelated and form a coherent selection, and which can be sensibly compared and contrasted. For example, the topic of predicting backbone flexibility in protein structures might present, discuss and compare current computational techniques such as molecular dynamics, normal mode analysis, graph-theory algorithms, and sequence-based methods, and contrast the predictions provided by the computational methods with information such as B-factors and order parameters computed directly from the crystallography or NMR experimental process.

The review paper should be double spaced with reasonable margins (e.g., 1" on every edge) and fonts (e. g., 10-12 point type).

Preparation

Typical preparation for the Computational Biology Prelim consists of **CSCI 5314 (Algorithms for Molecular Biology)**, **CSCI 5317 (Genome Databases: Mining and Management)**, or the CSCI cross-listing of **MCDB 5520 (Bioinformatics and Genomics)**. Other courses such as BIOI 7711/7712 are or may be acceptable based on future course offerings and individual student and faculty concerns.

Note that while these courses are strongly recommended as preparation for the Computational Biology Prelim, students with transfer courses, or other kinds of preparation, may well be ready to take the prelim without taking these specific courses.

Logistics

Students will first identify a potential topic area, as well as a Computer Science faculty member who must agree to review and approve the topic.

Proposal: The student is responsible for writing a brief (< 1 page) proposal that:

- describes the topic area,
- specifies the approving faculty member (advisor), and
- proposes a minimal list of at least 3 technical papers to be comprehensively reviewed. (We expect that the student will incorporate additional papers as the review paper is fleshed out.)

The approving faculty member will be available for consultation and consideration of papers, but it is the responsibility of the student to perform the background research necessary to delineate the topic and to identify the key papers in the area.

The brief proposal is submitted to the Computational Biology Prelim Chair for approval no later than March 1 of the spring semester.

Review Paper: Once the Chair has approved both the topic area and the selected papers, the student has no more than 21 calendar days to prepare the review of the selected papers. The student may consult relevant faculty members with specific questions concerning the content of the individual papers, but cannot solicit or receive assistance of any kind on the overall analysis of the papers.

Each Computational Biology Prelim will be evaluated by a committee comprised of three faculty members. These will be selected by the student and approved by the Computational Biology Prelim Chair. The Prelim Chair need not be on every committee.

Copies of the completed review will then be delivered via *both* hard-copy for the Graduate Advisor's records and pdf to the department Graduate Advisor on or before the end of the 21 day period. Students may not submit preliminary drafts to any member of the committee for review. The student is responsible for submitting a paper that has no grammatical or spelling errors. Foreign students may ask a native English speaker to review the paper for grammatical corrections, but not for feedback on the content or presentation style.

Presentation: The formal presentation will be held within four weeks of the submission of the paper. Given that three faculty schedules need to be coordinated, arrangements to schedule the date of the oral exam should begin as early in the semester as possible. Scheduling the presentation is the student's responsibility.

At the formal presentation students are expected to present the content of their review as they would at a technical conference. The committee's evaluation is based on the technical content, presentation style, and command of the area. Although fluency in English is not a requirement, students must be capable of clearly conveying the material orally. The presentation should be no more than 20 minutes in length. Students are strongly encouraged to make practice runs of their presentation to their peers, research associates, and faculty members who are not participating in the Computational Biology Prelim.

Miscellaneous

The subject area of the review paper may well correspond closely to a student's current area of research and planned thesis work. As such, it may overlap with a planned, or in progress, literature review section of a thesis proposal. This is explicitly permitted.

Prior papers written by the student—including conference papers, journal articles, masters theses, and class projects—cannot be submitted verbatim as a substitute for the Computational Biology Prelim paper. However, portions of such prior written work on which the student is the sole author may be re-used as the basis for part of the Computational Biology paper. Use of material where the student is one of several authors must be negotiated between the student and the Computational Biology faculty sponsor prior to the examination.

Computational Biology Faculty

At the current time, the core CS faculty members in the area of computational biology are: Aaron Clauset, Robin Dowell, Debra Goldberg, Larry Hunter, and Rob Knight. Other faculty members have research interests that overlap with this area and in consultation with the Computational Biology Prelim Chair can approve Computational Biology prelim topics.