Bachelor of Science Degree in Computer Science and Molecular Biology awarded jointly by EECS and Biology

6-7 Information Session

April 1, 2011
Rate of New DNA Sequence Production (Broad Institute)

Sequence Production Gb/yr

Moore’s Law
Human Genome Equivalent

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April 1, 2011
Motivation for the Joint Program

New opportunities in emerging field of computational/molecular bio

- emerging research directions
  - one of fastest growing areas of faculty interest
- new career opportunities
  - one of fastest growing areas in bio-tech area

→ goal is to make these opportunities available to undergraduates
Motivation for the Joint Program

New opportunities for students

- **early exposure** to all aspects of this emerging area
  - *transcends traditional department boundaries*
- **strong foundations** in both biology and computer science
  - *retains strengths of traditional departments*
- access to **innovative, integrative, capstone electives**
  - *typically restricted to graduate level*
- access to new **career opportunities**
  - *previously requiring higher degrees*
- increased **leadership potential**
  - *expertise across traditional disciplinary boundaries*
Curriculum Design for the Joint Program

Features of the joint program

- fits within four-year undergraduate program
- provides depth in appropriate areas of CS and biology
- prepares students for graduate study in biology, in CS, and in emerging programs at the interface
- prepares students for careers that leverage computational biology, e.g., pharmaceuticals, bioinformatics, medicine, ...
Requirements

Structured as a traditional Bachelor’s Degree Program

- **General Institute Requirements (GIRs)** (17 subjects)
- **Mathematics and Introductory Subjects** (3 subjects)
  - (18.03 or 18.06) and 6.01 and Math for Computer Science
- **Chemistry** (2 subjects)
  - Organic Chemistry (5.12) and Thermodynamics (7.10 or ...)
- **Introductory Laboratory**, CI-M#1 (1.5-eq. subjects)
  - Introduction to Experimental Biology (7.02)
- **Foundational Computer Science** (3 subjects)
  - Software Engineering and Introductory and Advanced Algorithms
- **Foundational Biological Science** (3 subjects)
  - Genetics (7.03) and Biochemistry (7.05..) and Cell Biology (7.06)
- **Restricted Elective in Computational Biology** (1 subject)
- **Restricted Elective in Biology** (1 subject)
- **Advanced Undergraduate Project**, CI-M#2 (1-eq. subject)

186 units (15.5 subjects) beyond GIRs (3 subjects overlapping GIRs)
Structured as a traditional Bachelor’s Degree Program

senior project: 1/2+1/2
 restricted elective: 1
 computational biology
 restricted elective: 1
 biology
 foundational cs/bio: 6
 intro/lab: 2.5
 math/chemistry: 4
 GIRs/programming: 17

General Institute Requirements
 Programming (high school or IAP)
Advantages of the Joint Program

The joint program offers advantages over alternative structures.

- single, conventional bachelor’s degree
- curriculum designed
  - by faculty
  - to build new opportunities
  - to retain traditional strengths
- students are first-class citizens in two departments, two schools
  - two academic advisors, one from each department
- member of community of students in this area
Sample roadmaps

Technical subjects ≤ 36 units per term.

<table>
<thead>
<tr>
<th></th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Year 1</td>
<td>18.01 8.01 5.11</td>
<td>18.02 8.02 7.01</td>
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<tr>
<td>Year 2</td>
<td>18.03 5.12 6.01</td>
<td>7.02 6.042</td>
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<td>Year 3</td>
<td>7.03 6.006</td>
<td>7.05 6.005</td>
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<tr>
<td>Year 4</td>
<td>7.06 6.046 7.10</td>
<td>7.28 6.581 6.UAP/6.UAT</td>
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Late-entry roadmap: Assuming GIRs + 5.12 during first two years → one term with 48 units.

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### Overlap of Joint Program with EECS

<table>
<thead>
<tr>
<th>CS (6-3)</th>
<th>Overlap: ( \frac{8}{14} = 57% )</th>
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<tbody>
<tr>
<td>18.03</td>
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<td>6.034</td>
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<td>6.046</td>
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<tr>
<td>CS lab</td>
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<tr>
<td>AUS#1</td>
<td>restricted elective (e.g., 6.047)</td>
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<tr>
<td>AUS#2</td>
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<td>UAP/UAT</td>
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## Overlap of Joint Program with Biology

<table>
<thead>
<tr>
<th>Biology (7)</th>
<th>Overlap: $7.5/12 = 62%$</th>
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<tbody>
<tr>
<td>5.12</td>
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<td>5.60</td>
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<td>7.02 (1.5)</td>
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<tr>
<td>restricted elec. (3)</td>
<td>restricted elec. (1)</td>
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<td>30-unit lab (2.5)</td>
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Requirements

Structured as a traditional Bachelor’s Degree Program

senior project: 1/2+1/2
restricted elective: 1
computational biology
restricted elective: 1
biology
foundational cs/bio: 6
intro/lab: 2.5
math/chemistry: 4
GIRs/programming: 17

General Institute Requirements
Programming (high school or IAP)
Interaction with Existing Programs

Students who major in the new joint program
- may not also minor in Biology or BioMedical Engineering
- may not double major with EECS (6-2), CS (6-3),
  Math with CS (18C), Biology (7 or 7A), or BE (20)
- may switch to a double major in EECS and Biology