

CSE 427 Introduction to Computational Biology: Generic Syllabus  
Department of Computer Science & Engineering

This generic syllabus describes CSE427 as approved and initially taught in 2006-7. Subsequent offerings will differ in detail, while retaining the same focus on the mathematical and computational principles underlying this interdisciplinary field.

Topics:

1. Basics of Molecular Biology
2. Pairwise sequence alignment
3. The algorithms and statistics of BLAST
4. Amino acid substitution matrices
5. Multiple sequence alignment
  - o Definition, NP-completeness, progressive alignment, whole-genome multiple alignment
  - o Comparative sequence analysis and the UCSC Human Genome Browser
6. Inference of phylogenetic trees
7. Markov chains and hidden Markov models
8. Challenges in Computational Molecular Biology

Reading list:

1. [Basics of Molecular Biology](#) (class handout)
2. [Molecular Biology for Computer Scientists](#), a primer by Lawrence Hunter
3. Pairwise sequence alignment: Lectures 3-5 from [CSE 527](#)
4. Altschul, Gish, Miller, Myers & Lipman. "[Basic local alignment search tool](#)". Journal of Molecular Biology 215:403-410 (1990).
5. BLAST statistics: [Stephen Altschul's primer](#).
6. Multiple Sequence Alignment: Sections 6.1-6.4 from [CSE 527](#)
7. Blanchette, Kent, Riemer, Elnitski, Smit, Roskin, Baertsch, Rosenbloom, Clawson, Green, Haussler, and Miller "Aligning Multiple Genomic Sequences With the Threaded Blockset Aligner". Genome Res. 14: 708 – 715 (2004).
8. Section on phylogenetic trees in [Lecture 4](#) from [Michael Brudno's lecture notes](#)

Programming projects (for more details, see:

<http://www.cs.washington.edu/education/courses/cse490c/07wi/homework.html>)

- Week 1: Prokaryotic gene prediction
- Week 3: Protein similarity search via dynamic programming
- Week 5: BLAST similarity search versus a sequence database
- Week 7: Sequence conservation via multiple sequence alignment
- Week 9: Hidden Markov models

Grading criteria: 18% per project plus 10% based on participation in class discussion.