

Math 578b: Computational Molecular Biology

Lectures: 11:00-12:20 AM TuTh, Room: RRI 301

Instructors

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Course Description

Applications of the mathematical and statistics to data from molecular biology. Statistics for genomic sequence data: DNA sequence assembly, significance of alignment scores, hidden Markov models, models of sequence evolution, genetic mapping, and microarray analysis.

Textbook

M.S. Waterman (1995) *Introduction to Computational Biology*. Chapman Hall-CRC Press.
Warren J. Ewens and Gregory Grant (2005) *Statistical Methods in Bioinformatics: An Introduction*. Springer

Optional Textbooks

T. Koski (2002) *Hidden Markov Models for Bioinformatics*. Kluwer Academic Publishers.

R. Durbin et al. (1998) *Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids*. Cambridge University Press.

Grading

Homework 40%, Exam I 30%, Exam II 30%.

Homework Assignments and Exams

You are encouraged to seek help from others including your fellow classmates and the instructor for homework assignments. However, the final work must be done by yourself.

The exams will be on the honor system. You can use textbooks, lecture notes, and computers. *However, you are not allowed to seek help from others.* The submitted work must be done by yourself. If there are some evidences of violating USC scientific integrity rules, both the help provider and the recipient will receive zero credits for the relevant exams.

Assignment Submission

You will be using Blackboard to turn in your assignments/exams. For every homework, a *turnitin* link will be made available. Please make sure you check the due dates for each assignment/exam. You can

either do your homework on pen and paper and then upload its scanned version or if you have access to an iPad or a Microsoft Surface or anything equivalent, you can use any supported writing application to write your homework on the device and then upload the PDF. The below sections provide instructions for both the modes.

Option 1: Scanning your homework using your Phone device

If you prefer doing your homework using a pen/pencil and paper, you can use your phone as the scanning device to convert it into a digital format that can be uploaded via *turnitin*. We recommend the 'Adobe scan' app for scanning your homeworks :

- Apple: <https://apps.apple.com/us/app/adobe-scan-digital-pdf-scanner/id1199564834>
- Android: https://play.google.com/store/apps/details?id=com.adobe.scan.android&hl=en_US

Please note that this app can be used free of cost. Once you install the app, the rest of the steps are straightforward. You should be able to take pictures of your homework page by page and then create one PDF out of it. You can read detailed instructions here: <https://www.adobe.com/devnet-docs/adobescan/android/en/scan.html#scanning-quick-steps>

Option 2: Using iPad/Surface/Writing device

If you are using an iPad or Microsoft surface or any other writing device (with a stylus or equivalent) you can use any of the following apps:

iPad:

- Apple Notes: <https://apps.apple.com/us/app/notes/id1110145109#?platform=ipad>
- One Note: <https://apps.apple.com/us/app/microsoft-onenote/id410395246>
- PDF Viewer: <https://apps.apple.com/us/app/pdf-viewer-annotation-expert/id1120099014>

Microsoft Surface:

- One Note (inbuilt): <https://www.onenote.com/>
- Bamboo Paper: <https://www.microsoft.com/en-us/p/bamboo-paper/9wzdncrfj1bh>

You should be able to export a PDF from these writing apps once you finish writing your homework. The PDF can then be uploaded on *turnitin*.

All the apps mentioned above available for free.

USC Technology Support Links

[Zoom information for students](#)

[Blackboard help for students](#)

[Software available to USC Campus](#)

Sharing of course materials outside of the learning environment is prohibited

USC has a policy that prohibits sharing of any synchronous and asynchronous course content outside of the learning environment.

SCampus Section 11.12(B)

Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (See Section C.1 Class Notes Policy).

Course evaluation

Course evaluation occurs at the end of the semester university-wide. It is an important review of students' experience in the class. The process and intent of the end-of-semester evaluation should be provided.

Math 578b Computational Molecular Biology			
	Lecture	Topic	Lecturer
Wk. 1	8/24	Introduction; Markov Chains I	FS
	8/26	Markov Chains II	FS
Wk. 2	8/31	Word Counts I	FS
	9/02	Word Counts II	FS
Wk. 3	9/07	EM algorithm	FS
	9/09	Monte Carlo Markov Chain (MCMC)	FS
Wk. 4	9/14	Sequencing Accuracy	FS
	9/16	Motif finding	FS
Wk. 5	9/21	Sequencing Progress I (Lander-Waterman Model)	FS
	9/23	Sequence Progress II (Next Generation Sequencing: Chip-Seq)	FS
Wk. 6	9/28	Global Alignment Statistics	FS
	9/30	Local Alignment Statistics I	FS
Wk. 7	10/05	Local Alignment Statistics II	FS
	10/07	Exam I	FS
Wk. 8	10/12	Evolution Models I	LC
	10/14	Fall recess	LC

Wk. 9	10/19	Evolution Models II	LC
	10/21	Evolution Models III	LC
Wk. 10	10/26	HMM I	LC
	10/28	HMM II	LC
Wk. 11	11/02	HMM III	LC
	11/04	Statistical Genetics I	LC
Wk. 12	11/09	Statistical Genetics II	LC
	11/11	Statistical Genetics III	LC
Wk. 13	11/16	Multiple Testing and FDR	LC
	11/18	Next Generation Sequencing I	LC
Wk. 14	11/23	Next Generation Sequencing II	LC
	11/25	THANKSGIVING	
Wk. 15	11/30	Next Generation Sequencing III	LC
	12/02	Exam II	LC

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu

Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.