# Fundamentals of bioinformatics

Welcome to Fundamentals of bioinformatics! We’re going to have a great time this semester exploring bioinformatics together. The course will be TA'd by Sai Kota.

**Dr. Katz:** I am a seasoned bioinformatician working at CDC, and I have had my footprint in *Neisseria*, *Vibrio*, *Listeria*, *Escherichia*, *Salmonella*, influenza, SARS-CoV-2, and many other pathogens. Working at CDC is my full time job, and it is my honor to work with you after hours in this course. I am excited to introduce you to the marvelous world of bioinformatics and infectious diseases. The statements expressed in this course do not necessarily reflect those of CDC.

# Course outcomes

Bioinformatics is an intersection between statistics, molecular biology, and computer science. Learning bioinformatics will have different meanings depending on your background. Advancing yourself in all three of these fields will aid in your success. However, many other skills will help you here, and so success can also come in the forms of learning other related skills.

In addition to bioinformatics, this course will also touch on how bioinformatics can aid in the study of infectious diseases. This will help give real life meaning to these academic exercises and will help you get real career skills in bioinformatics.

# Email

Please use your student emails to contact me at lkatz@gsu.edu. This will help me understand who is contacting me and that it pertains to the course. I am not at my email at all times of the day and so please allow me 24 hours to respond. However, I will do my best to answer as soon as possible.

# Additional Resources

Bioinformatics is a cutting edge field and accordingly, it is difficult to find a centralize resource or book. Therefore, we elect to provide you with a few different optional resources for your readings. Other readings may be provided week by week.

* Books: Students may purchase the hard copy version or secure the book in other formats.
  + Christensen, “Introduction to Bioinformatics in Microbiology,” 2023 (second edition)
* Rob Edward’s Computational Genomics Manual https://linsalrob.github.io/ComputationalGenomicsManual/
  + Rob Edward’s YouTube playlist https://www.youtube.com/playlist?list=PLpPXw4zFa0uLMHwSZ7DMeLGjIUgo1IBbn
* Many more resources for the curious:
  + https://github.com/lskatz/awesome-bioinformatics-education

# Computing environment

**This class requires the Linux command line.**

You will be required to install the Linux command line. There are a few ways you can do this:

* MacOS already has the command line.
* Ubuntu Linux already has the command line.
* Windows: [WSL2](https://apps.microsoft.com/store/detail/windows-subsystem-for-linux/9P9TQF7MRM4R) from the Microsoft app store

Additionally, you might find it helpful to install a proper text editor. I recommend that you use the program VSCode.

# Class policies

**Learning management:** Course materials will all be found on iCollege. I may communicate with individual students via e-mail, but class-wide announcements and documents will all be shared via iCollege.

**Attendance policy:** This is an asynchronous class and therefore attendance will not be taken. However, being present might fundamentally help you learn the lessons in real time. Because this is an asynchronous course, instead of a requirement of in-person learning, you will be required to watch the weekly recordings either synchronously or asynchronously.

**Activities**: Activities may be assigned every week or every other week. They will be listed on iCollege. They are due Friday at 11:59pm after being assigned.

**Make up work**: Late assignment submission will receive a late penalty of **20% per day**. If a student has a documented, excused absence on the due date for an assignment, they must contact the instructor via e-mail as soon as possible to provide this documentation and remove the penalty for the day(s) that are excused.

**Intellectual property:** Materials produced by the instructor for this course remain the intellectual property of the instructor and may not be distributed without express authorization from the instructor. This includes uploading content to online repositories as well as sharing course materials with students not enrolled in the class.To determine whether sharing instructor materials is allowed, please discuss explicitly with the instructor.

**Grade Disputes:** If you receive a grade that you believe is in error, you may challenge the grade in writing. I will only consider written requests. I will only accept grade disputes for one week after the assignments are returned. You must provide supporting evidence for your dispute, either from the notes, the textbook, or some other concrete source. Incomplete grade disputes will not be considered.

# Grading

Grades will be determined by asynchronous or synchronous attendance, success in the activities, and success in the final exam.

* Attendance (50%): You will be asked to answer basic questions about the lecture.
* Activities (40%): Activities will be held for approximately half of our sessions. The results of your workshops will be graded. The TA may also take part in grading.
* Final exam (10%): A final exam will be given and will be open book, open Internet. You may discuss with your classmates.

Final grades will be assigned according to the scale below:  
A+ 96.5-100%  
A 90.5-96.49%  
A- 89.0-90.49%  
B+ 86.5-88.99%  
B 80.5-86.49%  
B- 79.0 – 80.49%  
C+ 76.5 – 78.99%  
C 70.5-76.49%  
C- 69.0 – 70.49%  
D 60-68.99%  
F below 60%

Do not ask us to give you extra credit or drop assignments. The grade you receive will be based on your performance on all assignments over the course of the semester.

# Class honesty policy

In this class I will adhere to the University Academic Honesty Policy with the additions below. You will need to copy and paste this link in your web browser to view it https://deanofstudents.gsu.edu/faculty-staff-resources/academic-honesty/

Graded Assessments: The student will receive a zero (0) grade on any quiz or test where there is reasonable evidence for cheating. In addition, a report of academic dishonesty will be submitted to the dean’s office.

Critical Thinking Homework Assignments: The student will receive a zero (0) grade on the project if there is evidence of plagiarism, or other violation of the university academic honesty policy (see website above). In addition, a report of academic dishonesty will be submitted to the dean’s office.

Plagiarism consists of: using another person’s words/statements/ideas without quoting, referencing or citing; submitting work done by another person; copy/pasting words/sentences/statements from the internet without quoting/referencing/citing. For more information about what plagiarism is and how to avoid it, please visit: www.plagiarism.org or https://owl.purdue.edu/owl/avoiding\_plagiarism/index.html

Even the most well-intentioned student can plagiarize because of an incomplete understanding of how to quote or cite/reference. Educate yourself and avoid this!

Unauthorized Collaboration: Each student is to turn in their own original work. If it is determined that the submission was written wholly, or in part, by someone other than the student, it will be given a 0 grade and reported to the dean’s office. However, collaboration is allowed in all assignments in this class unless otherwise stated in writing.

Multiple Submission: Each submission in this class is to be a new work. The student may not submit the same work in multiple classes (unless given explicit permission by the instructor).

# Generative AI tools

Generative AI tools, such as ChatGPT, are designed to assist in creating and analyzing text, code, video, audio, and other multimedia. Use of these resources in your coursework comes with benefits and risks. In this course, the rules for AI usage are as follows: You may use a generative AI tool like ChatGPT only when it is specifically permitted as part of an assignment. Any unapproved use within the course might be considered a breach of academic honesty. While exercising responsible and ethical engagement with AI is a skill you may hone over time, your unique human insights, critical thinking, and creative contributions remain pivotal to your learning experiences and success.

# Student evaluations

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take time to fill out the online course evaluation.

# Students with Disabilities

Students who wish to request accommodation for a disability may do so by registering with the Office of Disability Services. Students may only be accommodated upon issuance by the Office of Disability Services of a signed Accommodation Plan and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought.

# Week by week

Please note that this conveys a plan for the semester. Some deviations may be necessary as the semester progresses. These are the dates that lectures will be made available online. If it is an asynchronous date, the recording will be made available on that date; otherwise there will be a live recording and the recording will be made available as late as the next day. For example, if the Jan 10 lecture is scheduled to be a live recording, and the actual recording might be made available on either Jan 10 or Jan 11.

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| **WEEK** | **Date** | **Topic** | **Readings** |
| Week 1 | January 15 | Intro to this course | Chapter 1, section 1 |
| Week 2 | January 22 | Worldwide databases | Chapter 3 |
| Week 3 | January 29 **guest lecturer Dr. Joe Wirth** | Intro to Linux commands | Chapter 1, sections 3 through 5  http://korflab.ucdavis.edu/bootcamp.html |
| Week 4 | February 5 | Sequencing formats | Chapter 2, section 4 |
| Week 5 | February 12 | Installation of software | https://astrobiomike.github.io/unix/conda-intro |
| Week 6 | February 19 | Sequencing instruments | Chapter 2 |
| Week 7 | February 26 | Assembly | Chapter 2, sections 2-3 |
| Week 8 | March 5 | gene prediction and Annotation | Chapter 2, section 5 |
| Week 9 | March 12 | Sequence querying | Chapter 4 |
|  | March 19 | Spring break |  |
| Week 10 | March 26 | Alignment | Chapter 6 |
| Week 11 | April 2 **guest lecturer Dr. Joe Wirth** | Phylogeny | Chapter 4 |
| Week 12 | April 9 - prerecorded | Genomic epidemiology | Chapter 11  Eric Stevens, et al; Use of Whole Genome Sequencing by the Federal Interagency Collaboration for Genomics for Food and Feed Safety in the United States. *J Food Prot* 1 May 2022; 85 (5): 755–772. doi: <https://doi.org/10.4315/JFP-21-437> |
| Week 13 | April 16 **guest lecturer Dr. Jo Williams** | Metagenomics | Chapter 9 |
| Week 14 | April 23 | Bonus topic |  |
| Week 15 | April 28-May 2 | Final exam | open book, open Internet |