Statistical Methods in Bioinformatics
The University of Toledo
Bioinformatics, Proteomics and Genomics, COMLS
BIPG 5200 (45720)

Instructor:	Sadik A. Khuder. Ph.D.	**Term**:	Fall 2021
Email:	sadik.khuder@utoledo.edu	**Class Location**:	127 HEB
Office Hours:	By arrangement	**Class Day/Time**:	
Office Location:	Room 12 RHC	**Lab Location**:	127 HEB
Office Phone:	(419) 383-4089	**Lab Day/Time**:	
		Credit Hours:	3

<div style="text-align:center">**SPECIAL COURSE EXPECTATIONS DURING COVID-19**</div>

Maintaining a safe campus during the ongoing COVID-19 pandemic remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

ATTENDANCE

The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Before coming to campus each day, students should take their temperature and complete a self-assessment for symptoms of COVID-19, such as cough, chills, fatigue or shortness of breath. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 should not come to campus and contact their primary care physician or the University Health Center at 419.530.5549. For more information on the symptoms of COVID-19, please go to https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

COVID-19 testing for sick students is available on both Main Campus and Health Science Campus. Call 419.383.4545 for an appointment. Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on Navigating COVID-Related Course Concerns.

In the event that you have tested positive for COVID-19 or have been diagnosed as a probable case, please review the CDC guidance on self-isolation and symptom monitoring, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need to know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life, and/or the Office of Accessibility and Disability Resources to coordinate supportive measures and meet contact tracing requirements.

FACE COVERINGS

Face coverings are required while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason preventing you from wearing a face covering due to a health condition

deemed high-risk by the CDC, submit an [online application](#) to request an accommodation through the Office of Accessibility and Disability Resources. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. Students already affiliated with the Office of Accessibility and Disability Resources who would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs. You may connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

VACCINATION

Doctors and other health care professionals agree that the best way to protect ourselves and each other is to get vaccinated. Case data clearly show that vaccines remain highly effective at preventing serious illness from COVID, including the highly contagious delta variant. If you have not yet received your COVID vaccine, the University encourages you do so as soon as possible. No appointment is needed to get the shot at the UTMC Outpatient Pharmacy, University Health Clinic or Main Campus Pharmacy. Once you receive the COVID vaccination, please register on the COVID Vaccine Registry site at: https://utvaccinereg.utoledo.edu/.

SPECIAL NOTES

It's important to note, that based on the unpredictability of the COVID-19 virus, things can change at any time. So please be patient and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

COURSE/CATALOG DESCRIPTION

This course introduces students to statistical methods commonly used in bioinformatics. Students will learn to use statistical programs and related bioinformatics resources locally and on the Internet. Lectures and lab discussion will emphasize on the statistical models and methods underlying the computational tools. The course briefly reviews basic statistical methods and methods more specific to bioinformatics research, including Markov chains, hidden Markov models, Bayesian statistics, and Bayesian networks. Students will learn the principles behind these statistical methods and how they can be applied to analyze throughput data.

COURSE OVERVIEW

Survey of statistical methods commonly used in bioinformatics. This course is the first in a two semester sequence examining topics in biostatistics for graduate students in bioinformatics or related fields.

STUDENT LEARNING OUTCOMES

After completion of the course, students should be able to:

1. State the fundamental concepts of statistics in bioinformatics.
2. Describe the formulation of stochastic models for high throughput data
3. Apply statistical techniques to solve bioinformatics problems
4. Interpret the results of the analysis of high throughput data

5. Apply Markov chains and Hidden Markov Models to solve bioinformatics problems.
6. Use statistical tests commonly employed in bioinformatics.
7. Recognize modern statistical methods and software to solve problems in bioinformatics.
8. Interpret the statistical results as reported in the bioinformatics literature.

TEACHING STRATEGIES
A variety of teaching methods will be used, including in class lectures, exercises, quizzes, project, and online instructional lectures and videos.

PREREQUISITES AND COREQUISITES
None

REQUIRED TEXTS AND ANCILLARY MATERIALS
There is no required text. All the required materials will be available on Blackboard. Readings will consist of original literature, review articles, and R based books.

TECHNOLOGY REQUIREMENTS
None

UNIVERSITY POLICIES
Statement on Non-Discrimination on the basis of Disability (ADA)

The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.)

Academic Accommodations
The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.)

GRADING
Assignments   30%

There are 11 assignments in this course. These assignments are intended to improve skills in bioinformatics and statistical analysis of high throughput data. The lowest assignment score will be dropped from the calculation of your final grade.
Students registering for BIPG 720 are required to do an additional assignment.

Quizzes   15%

There are 5 quizzes in this course. Each quiz will cover the material presented in that particular week. Few questions from previous quizzes may also be included. Further instructions will be supplied for each particular quiz.

Project   20%

A project will explore a topic of the course in greater depth. A written report, along with a power point presentation, is required. A project that addresses a question through data analysis with a written report and summary of conclusions would be sufficient. More detailed descriptions of the project along with suggested topics will be posted to the course webpage at the appropriate times during the term. The due date for project submission is last week of the course.

COURSE SCHEDULE

Module	Date	Topic	Assignments	Quiz
1	8/31	Introduction to statistical methods in molecular biology		1
2	9/07	Introduction to R and Bioconductor	1	
3	9/14	Modeling DNA	2	
4	9/21	Markov Chains	3	2
5	9/28	Hidden Markov model	4	
6	10/05	Evolutionary models Phylogenetic tree estimation	5	
7	10/12	Statistical hypothesis testing	6	
8	10/19	Linear models	7	
9	10/26	Bayesian models		3
10	11/02	Analysis of frequency data	8	
11	11/09	Survival analysis	9	
12	11/16	Experimental design	10	4
13	11/23	Multivariate analysis I	11	
14	11/30	Multivariate analysis II		5
15	12/07	Applied Bioinformatics	Final Exam	