

TRANSLATIONAL BIOINFORMATICS

GMS 6804- Spring 2022- 3 CREDIT HOURS

LOCATION: Communicore CG-056

MEETING TIMES: Tuesday 11:45-2:45 pm

INSTRUCTOR: *Dominick Lemas, PhD*

Office: 2234 Clinical and Translational Research Building

Email: dilemas@ufl.edu

Phone: (352) 294-5971

OFFICE HOURS: By appointment

COURSE COMMUNICATION: Students may email the instructor with questions, but are encouraged to consider whether their questions are of general interest to the entire class. Dedicated class time will be devoted to discussing and answering general questions about either course content or course mechanics that are relevant to all students.

MAIN TEXT (required)

1. Kann M, Lewitter F, eds. Translational Bioinformatics (TBI). Open Access, and available online at <http://collections.plos.org/translational-bioinformatics>.

ADDITIONAL REFERENCES

1. Bessant C, Oakley D, Shadforth I. Building Bioinformatics Solutions with Perl, R and SQL, 2nd ed. April 2014. ISBN-13: 978-0199658565
2. Jones NC, Pevzner PA. An Introduction to Bioinformatics Algorithms (Computational Molecular Biology). August 2004. ISBN-13: 978-0262101066
3. Durbin R, Eddy SR, Krogh A, Mitchison G. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. May 1998. ISBN-13: 978-0521629713
4. Foulkes AS. Applied Statistical Genetics with R: For Population-based Association Studies (Use R!) April 2009. ISBN-13: 978-0387895536
5. Ziegler A, Konig IR. A Statistical Approach to Genetic Epidemiology: Concepts and Applications, 2nd ed. June 2010. ISBN-13: 978-3527324538
6. Jain KK. Textbook of Personalized Medicine. 2009. ISBN- 978-1-4419-0769-1
7. Mikail CN. Public Health Genomics. 2008. ISBN-13: 978-0787986841
8. Garcia-Sancho M. Biology, Computing, and the History of Molecular Sequencing. 2012. ISBN-13: 978-0230250321
9. Singh V, Kumar A. Advances in Bioinformatics, 1st ed. Aug 2021. ISBN-13: 978-9813361904
10. Sharma N et al. Chemoinformatics and Bioinformatics in Pharmaceutical Sciences, 1st ed. June 2021. ISBN-13: 978-0128217481
11. Raza K, Dey N. Translational Bioinformatics in Healthcare and Medicine, 1st ed. May 2021. ISBN-13: 978-0323898249
12. Compeau P, Pevzner. Bioinformatics Algorithms. Jan 2018. ISBN-13: 978-0990374633
13. Additional papers provided in class.

COURSE DESCRIPTION: This course covers the fundamental concepts of translational bioinformatics and how bioinformatics methods are applied to clinically relevant problems. The course is organized in 4 parts: informatics tools and resources, biomolecules and data, multi-omics analysis, and reproducible workflows.

PURPOSE OF THE COURSE: The purpose of this course is to give students a broad overview of the field of bioinformatics, and the tools commonly used in bioinformatics, as well as their applications to practical biomedical issues, diseases, population health, drug discovery, etc. The students will also be exposed to a variety of open-source programs for sequence alignment, SNPs discovery, and on how to access and analyze data from large biological databases, for translational and clinical research.

COURSE OBJECTIVES: The objective of this course is to present the students with the fundamentals ideas of bioinformatics and how they related to translational and clinical questions. Since the discovery of the double helix structure of DNA by Watson and Crick in 1953, the advances made in molecular biology have been gigantic. However, it became clear very soon that biologists, mathematicians, computer scientists, informaticians (but also chemists, biochemists etc.) should interact together to advance the state of the art further. The development of computational tools in the last couple of decades has been one of the main factors for the birth of bioinformatics, and the use of advanced computational tools and techniques in Biology. By the end of the course, students will be able to:

1. Describe the current trends and problems of bioinformatics and how they relate to clinical issues, population health and public health.
2. Apply open-source tools to retrieve, store, and analyze high dimensional data of translational and clinical importance.
3. Write competitive grant proposals that includes investigator biosketches, specific aims, research approach, research environment, career development plan, data sharing and implementation and other attachments as applicable.

COURSE POLICIES

ATTENDANCE POLICY: Class attendance and participation is mandatory. Student will lead at least one class discussion. Excused absences follow the criteria of the UF Graduate Catalogue (e.g., illness, serious family emergency, military obligations, religious holidays), and should be communicated to the instructor prior to the missed class day when possible. UF rules require attendance during the first two course sessions. Missing more than three scheduled sessions will result in a failure. Regardless of attendance, students are responsible for all material presented in class and deadlines for class assignments. Students are required to complete the assigned readings prior to the class meetings, and be prepared to discuss the material for each session. Students that are not actively participating in class discussions and/or come to class without completing reading assignments will lose participation points for the week.

ASSIGNMENT POLICY: Unless otherwise stipulated, all assignments are individual assignments. Students are forbidden to collaborate or consult with one another on such assignments. Students must of course follow the University Policy on Academic Misconduct, which includes but is not limited to prohibition of plagiarism. All assignments are due by Friday at midnight via email the same week they are assigned. All assignments have to be turned in to pass the class. NO exception. Programming demonstrations will include a 10-15 minute tutorial related to the course objectives that must be reproducible and include data analysis. Reaction paper assignments are 1-page narratives that include reactions, thoughts, analysis, and questions about the presentation, field trip or lecture topic. There will be one take-home final written examination that will require students to critically evaluate key issues related to translational bioinformatics.

MAKE-UP POLICY: Students are allowed to make up work only as the result of illness or other unanticipated circumstances. In the event of such emergency, documentation will be required in conformance with University policy. Work missed for any other reason will earn a grade of zero.

TERM PROJECT POLICY: The final assignment for this course is a group project, which includes a presentation and a research proposal to address a research question related to translational bioinformatics. There will be class time devoted to general formatting, refining the research question, developing the study design, outlining mentoring/training plan and identifying key measures/outcomes. Each group will present its proposal to the rest of the class, followed by class discussion and peer-review. As such, this is a collaborative project. Students are expected to work on this project in a professional manner, and are expected to clearly delineate roles and responsibilities.

Note: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <http://gradcatalog.ufl.edu/content.php?catoid=5&navoid=1054>.

UF POLICIES

UNIVERSITY POLICY ON ACCOMMODATION STUDENTS WITH DISABILITIES: Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

UNIVERSITY POLICY ON ACADEMIC MISCONDUCT: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <http://www.dso.ufl.edu/students.php>. You are expected and required to comply with the University's academic honesty policy (University of Florida Rules 6C1-4.017 Student Affairs: Academic Honesty Guidelines, available at <http://regulations.ufl.edu/chapter4/4017.pdf>). Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. Note that misrepresentation of the truth for academic gain (e.g., misrepresenting your personal circumstances to get special consideration) constitutes cheating under the University of Florida Academic Honesty Guidelines

NETIQUETTE – COMMUNICATION COURTESY: All members of the class are expected to follow rules of common courtesy in all email messages, social media posts, threaded discussions, and chats. The first instance of clearly rude and/or inappropriate behavior will result in a warning. The second instance will result in a deduction of five percentage points (20 points) from your overall grade. The third instance will result in a drop of a letter grade (A to B, A- to B-, and so on).

GETTING HELP

For issues with technical difficulties for E-learning in Sakai, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

Any requests for make-ups due to technical issues **MUST** be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You **MUST** e-mail your instructor within 24 hours of the technical difficulty if you wish to request a make-up. Other resources are available at <http://www.distance.ufl.edu/getting-help> for: • Counseling and Wellness resources • Disability resources • Resources for handling student concerns and complaints • Library Help Desk support Should you have any complaints with your experience in this course please visit <http://www.distance.ufl.edu/student-complaints> to submit a complaint.

GRADING POLICIES

Your semester grade will be based on a combination of participation, homework assignments, individual and group projects as well as a final exam.

1. Participation: 15%
2. Homework: 20%
3. Tutorial/Demo: 10%
4. Group Project: 35%
5. Reaction Papers: 10%
6. Final Exam: 10%

Notes: Homework assignments will lead to class discussion each week. Participation each week includes: actively participating in group and class discussions, leading discussion of assigned reading and individual and group presentations. Instructions for each assignment, the final exams and individual and group projects will be carefully described when assigned.

SCALING

Letter grade	Grade points	Grade Percentage
A	4.0	95-100
A-	3.67	90-94
B+	3.33	87-89
B	3.0	83-86
B-	2.67	80-82
C+	2.33	77-79
C	2.0	73-76
C-	1.67	70-72
D+	1.33	67-69
D	1.0	63-66
D-	0.67	60-62
F	0	<60

COURSE SCHEDULE (TENTATIVE)

Week	Dates	Topic	Programming	Assignments
Wk 1	01/11	Introductions, overview and course objectives	Github Rstudio Docker Twitter	survey quiz-01 job description
*Wk 2	01/18	Translational Bioinformatics: Past, Present, and Future	Docker Asciinema	quiz-02 personal statement
*Wk 3	01/25	Biomolecules, Data and Diseases	Docker Asciinema	quiz-03 SciENCv
*Wk 4	02/01	Bioinformatic Tools, Databases & Studies Dr. Aida Miro-Herrans	Rstudio Bioconductor	quiz-04 group topic bingo
Wk 5	02/8	Collaboration & Reproducibility	Github Learning Lab	proposal outline personal statement-v2
Wk 6	02/15	Sequencing, Assembly, Interpretation	Rstudio Bioconductor	tutorial/demo quiz-05
*Wk 7	02/22	Gene-Environment Interactions	Rstudio Bioconductor	tutorial/demo quiz-06
Wk 8	03/01	Interdisciplinary Center for Biotechnology Research (ICBR) Tour		reaction paper #1
Wk 9	03/08	NO CLASS/ SPRING BREAK		
Wk 10	03/15	Microbiome	Demo: TBD	specific aims quiz-07
Wk 11	03/22	Metabolomics	Demo: TBD	research plan quiz-08
Wk 12	03/29	Research Computing Center (RCC) Field Trip		reaction paper #2
Wk 13	04/05	Late Breaking Topics	Demo: TBD	peer-review
Wk 14	04/12	Innovation Hub & Technology Transfer Tour		reaction paper #3
Wk 15	04/19	Group Project Presentations		full proposal
Wk 16	04/26	NO CLASS		final exam

*Class meetings will be in Communicore CG-22

TBI= Translational Bioinformatics (<http://collections.plos.org/translational-bioinformatics>)