



# Fundamentals of Bioinformatics & Proteomics/Genomics

The University of Toledo

BRIM Program in Bioinformatics & Proteomics/Genomics

BIPG5100 Fundamentals in BPG, Section 001, CRN #45060

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|--------------------------|----------------------------|------------------------|----------------------------------|
| <b>Instructor:</b>       | Robert Trumbly, PhD        | <b>Course Website:</b> | <a href="#">Blackboard Learn</a> |
| <b>Email:</b>            | Robert.Trumbly@utoledo.edu | <b>Class Location:</b> | Online lectures                  |
| <b>Office Hours:</b>     | by arrangement             | <b>Class Day/Time:</b> | Online lectures                  |
| <b>Office Location:</b>  | CCE 3105F                  | <b>Lab Location:</b>   | 127 HEB                          |
| <b>Instructor Phone:</b> | 419-383-4347               | <b>Lab Day/Time:</b>   | TBA                              |
| <b>Offered:</b>          | Fall 2020                  | <b>Credit Hours:</b>   | 3 cr                             |

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## CATALOG/COURSE DESCRIPTION

Introduction to bioinformatics and computational biology. Both theory and practical methods for evaluating and managing biomedical data will be covered. Topics range from sequence analysis to structure prediction. Includes computer laboratory sessions. May be taken concurrently with BIPG5200/7200.

## COURSE OVERVIEW

Bioinformatics is now central to understanding the tsunami of biological and medical data coming from genome sequencing and various systems biology approaches. This course provides an overview of bioinformatic methods, though in enough depth to understand the strengths and limitations of the various methods. It is team-taught by lecturers from the faculty at the University of Toledo and Bowling Green State University. All lectures are posted online or emailed directly to students.

## STUDENT LEARNING OUTCOMES

The successful student will be able to:

- L1. Describe mammalian and nonmammalian genome structure and function, including (for example) repeat element distribution in chromosomes, and transcription factor binding sites.
- L2. Discuss the processes of genome evolution, including (for example) phylogenetics.
- L3. Describe and use analytic tools associated with systems/bioinformatic approaches, including (for example) transcriptomics, proteomic mass spectroscopic methods, and determining statistical significance in large bioinformatic datasets.
- L4. Execute appropriate statistical analysis of sequence information, including (for example) probabilistic methods, deterministic methods, and cluster analysis.
- L5. Use existing bioinformatic and statistical software, including (for example) sequence alignments and their interpretation, phylogenetic analyses, prediction of genes and transcription factor binding sites, and display, prediction, and analysis of 3D biomolecule structures.
- L6. Assess evidence linking specific genotypes to given human diseases.
- L7. Communicate bioinformatic information in an accurate and comprehensible manner.

## PREREQUISITES AND COREQUISITES

BMSP6340/8340 Current Problems & Research Approaches in Genes and Genomics (2.5cr) is recommended, and



can be taken concurrently. However, this should not be necessary for students who have had upper-level courses in biology or biochemistry.

### **TEXTS AND ANCILLARY MATERIALS**

BOOK ISBN: 978-1-118-58178-0 Jonathan Pevsner, Bioinformatics and Functional Genomics, third edition, Wiley Blackwell, copyright 2015 The second edition of Pevsner, copyright 2009 may also be used.

### **TECHNOLOGY REQUIREMENTS**

Computer with internet connection, current browser, Microsoft Office (or other software that can save documents in .docx, .xlsx, and .pptx formats).

### **ACADEMIC POLICIES**

[Graduate Policies: http://www.utoledo.edu/policies/academic/graduate/](http://www.utoledo.edu/policies/academic/graduate/)

### **COURSE EXPECTATIONS**

The weekly homework assignments must be completed in a timely manner to receive full credit.

### **OVERVIEW OF COURSE GRADE ASSIGNMENT**

Most of the course grade will be determined by the weekly homework assignments. The term project will represent 30% of the course grade. As the 11 homework assignments make up 70% of the grade, each homework assignment is worth ~6.4% (70/11) of the final grade.

#### **Final Grading**

Grading scale: 90 and above: A, 80-89: B, 70-79: C, 60-69: D, below 60: F. Students who complete all assignments should obtain an A or B in the course.

### **UNIVERSITY POLICIES**

#### **Policy 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.](#)

Students can find this policy along with other university policies listed by audience on the [University Policy webpage](http://www.utoledo.edu/policies/audience.html/#students) (<http://www.utoledo.edu/policies/audience.html/#students>).

<https://www.utoledo.edu/title-ix/policies.html>

[https://www.utoledo.edu/policies/administration/diversity/pdfs/3364\\_50\\_01.pdf](https://www.utoledo.edu/policies/administration/diversity/pdfs/3364_50_01.pdf)

[https://www.utoledo.edu/policies/main\\_campus/student\\_life/pdfs/3364\\_30\\_04\\_Student\\_code\\_of\\_conduct.pdf](https://www.utoledo.edu/policies/main_campus/student_life/pdfs/3364_30_04_Student_code_of_conduct.pdf)

#### **Academic Accommodations**

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](#) (<http://www.utoledo.edu/offices/student-disability-services/>) by calling 419.530.4981 or sending an email to [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).



## ACADEMIC AND SUPPORT SERVICES

Please follow this link to view a comprehensive list of [Student Academic and Support Services](http://www.utoledo.edu/studentaffairs/departments.html) (http://www.utoledo.edu/studentaffairs/departments.html) available to you as a student.

## SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

## COURSE SCHEDULE

| WEEK | DATES (WK)         | TOPIC  | LEARNING OUTCOME(S)  | ASSIGNMENTS DUE |
|------|--------------------|--|----------------------|-----------------|
| 1    | Aug 24-28          | Introduction, 1<br>Databases, 2                  | L3                   |                 |
| 2    | Aug 31 -<br>Sep 04 | Pairwise alignments, 3<br>Database searching, 5  | L3, L4, L5<br>L3, L5 | #1              |
| 3    | Sep 7-11           | Multiple alignments, 6<br>TCGA/CBio databases    | L3, L4 L5<br>L3, L6  | #2              |
| 4    | Sep 14-18          | Proteomics/MassSpec, 12<br>Protein structure, 13 | L3<br>L5             | #3              |
| 5    | Sep 21-25          | Phylogenetic analysis, 7                         | L2, L4               | #4              |
| 6    | Sep 28 -<br>Oct 02 | RNA structure pred'n, 10                         | L5                   | #5              |
| 7    | Oct 05-09          | RNA structure pred'n, 10<br>Microarrays, 11      | L5<br>L4, L5         | #6              |
| 8    | Oct 12-16          | NextGen sequencing,<br>RNAseq                    | L3<br>L4, L5         | #7              |
| 9    | Oct 19-23          | Microbial genomes,16-18<br>Metagenomics, 17      | L1, L2<br>L4         | #8              |
| 10   | Oct 26-30          | Genome annotation, 8<br>Genome comparison, 8     | L2<br>L1, L2         | #9              |
| 11   | Nov 02-06          | Transcription factors,ChIP<br>ENCODE database, 8 | L1<br>L3, L6         | #10             |
| 12   | Nov 09-13          | Gene ontology, 12<br>Networks & pathways         | L2<br>L3, L6         | #11             |
| 13   | Nov 16-20          | Human genome, HiC 20<br>Cancer genomics, 21      | L1, L6<br>L6         |                 |
| 14   | Nov 23-27          | Map other diseases, 21                           | L6                   |                 |
| 15   | Nov 30 -<br>Dec 04 | Work on term projects                            | L7                   |                 |
| 16   | Dec 7-11           | Disc. term projects                              |                      | Term project    |

**Note:** Numbers under "Topic" refer to chapters in the Pevsner text. There are two lectures per week, and where only one topic is listed, it will use both slots.