

## **Applications of Bioinformatics and Genomics/Proteomics. BIPG 6400/8400**

**Summary:** In this final course of the BPG program, students will be familiarized with the most advanced computational techniques, programs and databases used at the frontiers of biomedical sciences. Advanced applications will be covered in four broad areas: new bioinformatics tools, genomics, proteomics, and RNomics.

**Instruction:** The course is team-taught by faculty from The University of Toledo and Bowling Green State University.

**Course director:** Dr. Alexei Fedorov, Dept. of Medicine, Vice Director BPG Program, Director of Bioinformatics Lab, (419) 383-5270, alexei.fedorov@utoledo.edu.

**Format:** Conventional lecture in classroom will be recorded with Echo360 and uploaded on the Internet the same day; Location: HEB Rm 127; every Wednesday and Friday; Time 10am -12pm.

**Office hours:** Every Wednesday and Friday from 9 AM to 10 AM in the office of Dr. Fedorov (Room 308 at Health Science building, HSC; tel: 419-383-5270). Also, students may contact remotely via Skype (Afedorov\_lab) every Wednesday and Friday from 9 am to 10 am.

**Homework time policy:** Each homework assignment must be returned in ten days by noon. (For example, for a Wednesday class this homework must be returned via e-mail next Saturday by noon) Absolutely NO excuse for a late homework return (automatic 0 points). Several EXTRA assignments will be available through the course. They are designed to improve grades. Special assignments must be returned in two weeks.

### **Grading principles:**

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|------------------|-----|
| • Homework       | 55% |
| • LABs+ activity | 10% |
| • Mid-term Exam  | 15% |
| • Final Exam     | 20% |
- Extra points for outstanding homework and SPECIAL ASSIGNMENTS are possible!
  - Students receive a waiver to change one homework grade to the A-grade.

### **Topics covered in each video lecture/lab**

1. INTRODUCTION TO GENOMICS: 1000 GENOMES **1h14m** (Alexei Fedorov) **1/11/2017**

2-3. Single-Nucleotide Polymorphism (SNP) **1h38m** and **1h36m** (John Gray) **1/13/2017**  
**and 1/18/2017**

4. How to work with Human Exome part 1 (FASTQ, SAM, BAM, VCF, BET files and IGV program). 1h20m (Alexei Fedorov) 1/20/2017
5. How to work with Human Exome part 2. LAB from FastQ to VCF files 1h00m (Alexei Fedorov) 1/25/2017
6. How to work with Human Exome part 3. IGV-program 1h13m (Alexei Fedorov) 1/27/2017
7. Organization and structure of the Human genome. DNA repeats. RepeatMasker program. 1h34m (Alexei Fedorov) 2/01/2017
8. GENOMIC MRI. 1h05m (Alexei Fedorov) 2/3/2017
9. INTRONS: structure, function, and evolution. Introduction to computational algorithms for gene prediction. 1h31m (Alexei Fedorov) 2/8/2017
10. Computational approaches for gene predictions. 1h (Alexei Fedorov) 2/10/2017
11. Advanced gene predictions. Basics on Support Vector Machines 1h (Alexei Fedorov) 2/15/2017
12. Artificial Intelligent Approach. Machine Learning. WEKA. 1h32m (Gursel Serpen) 2/17/2017.
- 13-14. Long non-coding RNA. 1h32m 1h55m (Neocles Leontis) 2/22/2017 and 2/24/2017
15. Bacterial Genomics 1h28m (Robert Blumenthal) 3/1/2017
16. Take-home exam (Exome Project 40m explanations) 3/3/2017

### SPRING BREAK

17. GALAXY web tools 1h39m (Robert Trumbly) 3/15/2017
18. DNA structure. Z-DNA, H-DNA. Genome is not an instruction but rather is unsupervised operating system. 1h23m (Alexei Fedorov) 3/17/2017
19. Data Mining in Bioinformatics 1h20m (Sadik Khuder) 3/22/2017
20. Cluster Analysis in Bioinformatics 1h20m (Sadik Khuder) 3/24/2017
21. Pattern Recognition in Bioinformatics 1h20m (Sadik Khuder) 3/29/2017

22. Gene Regulatory Network **1h20m** (Sadik Khuder) 3/31/2017
23. Population Genetics **1h10m** (Alexei Fedorov) 4/5/2017
24. Profound differences between DNA and RNA molecules. Introduction to RNA World. **1h12m** (Alexei Fedorov) 4/7/2017
25. Small non-coding RNA. Part 1: snoRNA **1h07m** (Alexei Fedorov) 4/12/2017
26. Small non-coding RNA. Part 2: microRNA, siRNA, piRNA **1h17m** (Alexei Fedorov) 4/14/2017
27. Advanced Molecular Phylogenetics, Part 1 **1h20m** (Scott Rogers) 4/19/2017
28. Advanced Molecular Phylogenetics Part 2 **1h20m** (Scott Rogers) 4/21/2017
29. Cellular Automata and Bioinformatics **0h46m** (Alexei Fedorov) 4/25/2017
30. **Final exam** 4/28/2017