Applications of Bioinformatics & Proteomics/Genomics
The University of Toledo
BRIM Program in Bioinformatics & Proteomics/Genomics
BRIM6400/8400 Applications of BPG, Section 001, CRN #26313

Instructor: Alexei Fedorov, PhD
Email: Alexei.Fedorov@utoledo.edu
Office Hours: 10:00-5:00pm, Mon.-Fri., by appt.
Office Location: 3105F CCE Building
Office Phone: 419-383-5270
Term: Spring 2016

Class Location: Online Lectures
Class Day/Time: TBA
Lab Location: 127 HEB
Lab Day/Time: TBA
Credit Hours: 3cr hr

COURSE/CATALOG DESCRIPTION
Lectures and hands-on activities that demonstrate the application of bioinformatics, proteomic and genomics techniques to solve research problems being studied by selected faculty from UT, BGSU or another institution.

COURSE OVERVIEW
The course is team-taught by instructors from The University of Toledo and Bowling Green State University. Students will be familiarized with the most advanced computational techniques, programs and databases used at the frontiers of biomedical sciences. Several computer laboratory explorations have been developed so students can join the presenter in analyzing relevant experimental data.

STUDENT LEARNING OUTCOMES
This course presents current uses of bioinformatics in ongoing research, meaning that specific content is likely to change from year to year. Nevertheless, in general, successful students WILL BE ABLE TO DESCRIBE the application of current bioinformatic tools to research on mammalian genome structure and function, the processes of genome evolution, and related topics. Advanced applications will be covered in four broad areas: new bioinformatics tools, genomics, proteomics, and RNomics.

TEACHING STRATEGIES
The course is team-taught by faculty from The University of Toledo and Bowling Green State University. Students will be familiarized with the most advanced computational techniques, programs and databases used at the frontiers of biomedical sciences.

PREREQUISITES AND COREQUISITES
There are no prerequisites. However, previous completion of BIPGS100 (Fundamentals of BPG) is recommended.

REQUIRED TEXTS AND ANCILLARY MATERIALS
No textbooks are required. Students will work with the information/instructions provided online.

TECHNOLOGY REQUIREMENTS
Blackboard access

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.
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.

ACADEMIC POLICIES
This course follows the main UT policies.

COURSE EXPECTATIONS
Homework time policy: Each homework assignment must be returned within ten calendar days by noon. (For example, for a Tuesday class this homework must be returned via email the following Friday by 12 pm.) Absolutely NO excuses accepted for late homework return. A majority of lectures/labs will be available on the web in advance by at least one day. Several extra-credit assignments will be made available through the course, intended to help improve understanding and grades. Special assignments must be returned within two weeks.

GRADING
The course is team-taught by faculty from The University of Toledo and Bowling Green State University. The grade will be determined entirely by performance on projects assigned and graded by each instructor.

Grading principles:

- Homework 40%
- LABs+ activity 10%
- Mid-term Exam 20%
- Final Exam 30%

- Extra points for outstanding homework and SPECIAL ASSIGNMENTS are available!
- The lowest single homework grade will be changed to A automatically (this is in support of the policy of accepting no late homework for any reason).

COMMUNICATION GUIDELINES
E-mail, Skype, office hours

STUDENT SUPPORT SERVICES
Student Support Services can help students succeed in this course by providing academic services when needed in the areas of, advising, tutoring, financial resources, self-directed learning, and by directing students to other specific resources, as needed. Students can access these services by calling Student Services at, 419-383-6286.

COURSE SCHEDULE
Note: This changes annually to represent the latest research, but the following (from a previous syllabus) illustrates the type and range of topics covered.

1. Introduction To Genomics: Genome is not an instruction text but an unsupervised operating system. (Alexei Fedorov)
2. Genome as an advanced Cellular Automaton. (Alexei Fedorov)
3. Organization and structure of the Human genome. (Alexei Fedorov)
4. Complex hierarchy of non-randomness in the human genome. (Alexei Fedorov)
5. Codon bias puzzle. What forces have created unequal codon frequencies? (Alexei Fedorov)
6. INTRONS: structure, function, and evolution. (Alexei Fedorov)
7-8. Single-Nucleotide Polymorphisms (SNPs) (John Gray)
9. Introduction to computational algorithms for gene prediction. (Alexei Fedorov)
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<thead>
<tr>
<th>Lecture</th>
<th>Topic</th>
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<tbody>
<tr>
<td>10-11.</td>
<td>Advanced gene predictions. Basics on Support Vector Machines (Graduate Students)</td>
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<td>12.</td>
<td>Bacterial Genomics (Robert Blumenthal)</td>
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<td>13.</td>
<td>Transcription factor binding sites (Robert Trumbly)</td>
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<td>15.</td>
<td>Recombination and large rearrangements in the human genome. (Alexei Fedorov) Feb 28th</td>
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<td>Take-home exam</td>
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<td>SPRING BREAK</td>
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<td>16.</td>
<td>Gene arrays (Douglas Leaman)</td>
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<td>17.</td>
<td>Data Mining in Bioinformatics (Sadik Khuder)</td>
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<td>18.</td>
<td>Cluster Analysis in Bioinformatics (Sadik Khuder)</td>
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<td>19.</td>
<td>Pattern Recognition in Bioinformatics (Sadik Khuder)</td>
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<td>20.</td>
<td>Gene Regulatory Network (Sadik Khuder)</td>
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<td>21.</td>
<td>Profound differences between DNA and RNA molecules. Introduction to RNA World. (Alexei Fedorov)</td>
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<td>22.</td>
<td>Small non-coding RNA. Part 1: snoRNA (Alexei Fedorov)</td>
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<td>23.</td>
<td>Small non-coding RNA. Part 2: microRNA, siRNA, piRNA (Alexei Fedorov)</td>
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<td>24.</td>
<td>Long non-coding RNA (Alexei Fedorov)</td>
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<td>25.</td>
<td>Advanced Proteomics. LAB</td>
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<td>26.</td>
<td>Glycan Analysis, Imaging, and Biomarker Discovery by MALDI-MS (Dragan Isailovic)</td>
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<td>27-28.</td>
<td>Advanced Molecular Phylogenetics (Scott Rogers)</td>
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<td>Final exam</td>
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