



## BCB 5250 Introduction to BIOINFORMATICS II

### Instructors:

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Assistant Professor

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*Office Hour:* Mon 11am – 12:30pm,  
Tue 10am – 11:30am, or by appointment

### Class Meeting Time/Location:

**Time:** TR 2:15 pm – 3:30 pm

**Location:** 115 Ritter Hall

### Credits/Pre-requisites:

3 Credits

BCB 5200 (Into to Bioinformatics I) and undergraduate level genomics are required.

### Course Description:

Introduction to Bioinformatics I and II are designed to introduce senior/graduate students to the fundamental concepts, methods, and research topics in Bioinformatics for analyzing biological and health data. Introduction to Bioinformatics I course will cover introduction of Bioinformatics, introduction of computer skills for Bioinformatics, Bioinformatics database, sequence alignment, phylogenetic analysis, gene expression analysis, protein analysis, modeling and simulation of biological pathways, and systems biology. Introduction to Bioinformatics II will intensely cover omics (genomics, transcriptomics, and metagenomics) research topics especially including genome assembly, RNA-Seq analysis, and genome identification and annotation of metagenomic samples. In the Introduction to Bioinformatics II course, students will be divided into groups and work on their selected projects. Exciting cutting-edge research topics in Bioinformatics will be proposed to students.

### Topical Outline:

- Introduce sequencing techniques
- String match and suffix tree algorithms
- Genome assembly
- Genome annotation and gene prediction
- Variant calling
- Metagenomics analysis
- Transcriptomics analysis
- Literature review presentation
- Term project and presentation

### Learning Objectives: At the completion of this course, students will be able to:

- Know fundamental concepts of bioinformatics
- Understand underlying basic bioinformatics algorithms



- Use bioinformatics applications and tools to study omics data
- Recognize how to apply different bioinformatics tools
- Write scripts to automate existing applications
- Understand cutting edge bioinformatics research topics
- Ability to propose new algorithms and implement software tools for them

**Course Textbook/Reading Materials (optional):**

No textbook is required for this course. Assigned materials will be posted on class website.

Optional reference books are as below:

- R Cookbook by Paul Teetor (O’Reilly Cookbooks)
- Bioinformatics Programming Using Python: Practical Programming for Biological Data (O’Reilly)
- Bioinformatics Data Skills: Reproducible and Robust Research with Open Source Tools 1st Edition by Vince Buffalo (O’Reilly)
- An Introduction to Bioinformatics Algorithms (Computational Molecular Biology) 1st Edition by Neil C. Jones (Cambridge, Mass. : MIT Press, c2004)
- Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology 1st Edition by Dan Gusfield (Univ. of Cambridge)
- Bioinformatics and Functional Genomics 2nd or 3rd Edition by Jonathan Pevsner (Hoboken, N.J. : Wiley-Blackwell, c2009)

**Assignment and Grades:**

**Assignments:** There will be multiple assignments in a variety of format such as (but not exclusively) in-class assignments, online assignments, and take home assignments. If you miss an assignment of any kind (in class or online), there is NO make-up. You will not receive any credit for assignments turned in late. If you receive a 0 for an assignment due to an academic integrity violation, that 0 will count toward your final grade and may not be dropped.

**Exams:** There will be no exams. Instead of exams, literature review presentation will be held before/during midterm exam period and term project presentation will be held before the final exam period.

**Grading Scheme**

| Course Item                          | Percent of Final Grade |
|--------------------------------------|------------------------|
| Homework Assignments                 | 40%                    |
| Literature Review Presentation       | 20%                    |
| Project and Presentations            | 40%                    |
| <b>Total</b>                         | <b>100%</b>            |
| Miss class without in advance notice | -1%                    |

Final grades for the course will be based on the following scale. The instructor reserve the right to make adjustments to grades based on overall performance in the course. There will be no opportunity for “extra credit” to improve grades that have already been earned. Bargaining for grades will not be tolerated.



| Letter Grade | F   | D          | C-         | C          | C+         | B-          | B          | B+         | A-         | A   |
|--------------|-----|------------|------------|------------|------------|-------------|------------|------------|------------|-----|
| %            | <60 | ≥60<br><70 | ≥70<br><73 | ≥73<br><77 | ≥77<br><80 | ≥80-<br><83 | ≥83<br><87 | ≥87<br><90 | ≥90<br><93 | ≥93 |

**Attendance policy:**

You are expected to attend every lecture and take notes. There is no makeup for exams unless you demonstrate in advance (and agreed by the instructor) that a significant life-event prevents you from attending class or if you have a documented emergency. If you schedule something else during a class when you take an exam, you will get a zero for that grade.

**ACADEMIC INTEGRITY AND HONESTY**

Students are expected to be honest in their academic work. The University reserves the right to penalize any student whose academic conduct at any time is, in its judgment, detrimental to the University. Such conduct shall include cases of plagiarism, collusion, cheating, giving or receiving or offering or soliciting information in examinations, or the use of previously prepared material in examinations or quizzes. Violations should be reported to your course instructor, who will investigate and adjudicate them according to the policy on academic honesty of the College of Arts and Sciences. If the charges are found to be true, the student may be liable for academic or disciplinary probation, suspension, or expulsion by the University. Students should review the College of Arts and Sciences policy on Academic Honesty (<http://www.slu.edu/x16363.xml>).

**STUDENTS WITH SPECIAL NEEDS-DISABILITY SERVICES**

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Student Success Center (BSC 331) or by going to [www.slu.edu/success](http://www.slu.edu/success).

Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at 314-977-8885 or visit the Student Success Center. Confidentiality will be observed in all inquiries.

Course instructors support student accommodation requests when an approved letter from Disability Services has been received and when students discuss these accommodations with the instructor after receipt of the approved letter.

**COURSE CONTENT DISCLAIMER**

In this course, students may be required to read text or view materials that they may consider offensive. The ideas expressed in any given text do not necessarily reflect the views of the instructor, the English Department, the Writing Program, or Saint Louis University. Course materials are selected for their historical and/or cultural relevance, or as an example of stylistic and/or rhetorical strategies and techniques. They are meant to be examined in the context of intellectual inquiry of the sort encountered at the university level.

**WRITING CENTER**



I encourage you to take advantage of the writing services in the Student Success Center; getting feedback benefits writers at all skill levels. Trained writing consultants can help with any writing, multimedia project, or oral presentation. During the one-on-one consultations, you can work on everything from brainstorming and developing ideas to crafting strong sentences and documenting sources. These services do fill up, so please make an appointment! For more information, or to make, change, or cancel an appointment, call 977-3484 or visit <http://www.slu.edu/writingservices.xml>.

### Tentative schedules

| Week                  | Dates      | Topic  | Lecturer  |
|-----------------------|------------|--|-----------|
| 1                     | 01/17/2017 | Introduce Sequencing Techniques  | Lin       |
|                       | 01/19/2017 | String Match   | Ahn       |
| 2                     | 01/24/2017 | Suffix Tree  | Ahn       |
|                       | 01/26/2017 | Genome Assembly  | Ahn       |
| 3                     | 01/31/2017 | Genome Assembly  | Ahn       |
|                       | 02/02/2017 | Genome Assembly  | Ahn       |
| 4                     | 02/07/2017 | Gene Prediction and Genome Annotation  | Ahn       |
|                       | 02/09/2017 | Gene Prediction and Genome Annotation  | Ahn       |
| 5                     | 02/14/2017 | Variant Calling  | Ahn       |
|                       | 02/16/2017 | Variant Calling  | Ahn       |
| 6                     | 02/21/2017 | Metagenomics   | Ahn       |
|                       | 02/23/2017 | Metagenomics   | Ahn       |
| 7                     | 02/28/2017 | Metagenomics   | Ahn       |
|                       | 03/02/2017 | Literature Review (Genome Assembly, Gene Prediction Variant Calling, Metagenomics) | Lin & Ahn |
| 8                     | 03/07/2017 | Project Proposal Presentation  | Lin & Ahn |
|                       | 03/09/2017 | Project Proposal Presentation  | Lin & Ahn |
| 9                     | 03/14/2017 | Spring Break (No Class)  |           |
|                       | 03/16/2017 | Spring Break (No Class)  |           |
| 10                    | 03/21/2017 | Transcriptomics analysis-overview  | Lin       |
|                       | 03/23/2017 | Analysis pipeline and Tuxedo tools   | Lin       |
| 11                    | 03/28/2017 | Fastq Data Retrieval and Quality Control   | Lin       |
|                       | 03/30/2017 | Read mapping   | Lin       |
| 12                    | 04/04/2017 | Post-alignment QC  | Lin       |
|                       | 04/06/2017 | Transcriptome reconstruction by Cufflinks  | Lin       |
| 13                    | 04/11/2017 | Expression quantification: read count  | Lin       |
|                       | 04/13/2017 | Differential Expression and Visualization  | Lin       |
| 14                    | 04/18/2017 | Differential Expression and Visualization  | Lin       |
|                       | 04/20/2017 | Gene functional annotation and pathway analyses                                    | Lin       |
| 15                    | 04/25/2017 | De novo assembly   | Lin       |
|                       | 04/27/2017 | Literature Review (Transcriptomics)  | Lin & Ahn |
| 16                    | 05/02/2017 | Project Final Presentation   | Lin & Ahn |
|                       | 05/04/2017 | Project Final Presentation   | Lin & Ahn |
| Final (No Final Exam) |            |  |           |

Literature review presentation requires students to ask questions!