Advanced Techniques in Systems Biology and OMICS Research

BIOL 5005.003 - **SPRING SEMESTER, 2013**
TIME: TR 9:30 am – 10:50 am
LOCATION: Curry 211

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Instructors: Dr. Ron Mittler (ron.mittler@unt.edu) LSC-B 422
and Dr. Vladimir Shulaev (shulaev@unt.edu), LSC-B 420
Phones: RM (940) 565-3590; VS (940) 369 5368
Office Hours: TR 11:00 am —12:00 pm BY APPOINTMENT
Prerequisite: Biochemistry, Molecular Biology, Genetics or Equivalent,
please consult the instructors before registering)

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Catalog Course Description: BIOL 5005.003. This course is designed to teach the basic principles and techniques of OMICS (transcriptomics, proteomics, metabolomics, and bioinformatics) research, system biology, and functional genetics, as well as grant writing. Subjects covered will include different microarray and GeneChip platforms, proteomics, metabolomics (LC- and GC-MS), transcriptomics (RNAseq), NextGen whole genome shotgun sequencing, mutant analysis, bioinformatics and systems biology. In addition to the lectures, each student (or a team of 2-4 students, depending on class size) will be required to present a talk about a selected project and write a grant proposal on that subject. For this purpose the student(s) will choose a subject and upon approval by the instructors will present the subject to the class. The subject will then be discussed by the entire class with respect to its importance, the validity of the scientific questions presented, the best experimental design(s) to be used, and the strategy of writing the grant. The student(s) will then write and submit the grant (15 pages minimum; NSF style) and will be graded on its quality. There will be no written exam. A pre-proposal is due by spring break for the instructor's approval.

Required Text: There is no required textbook for this course. Each week the students will be given one or more research papers to read. PDF of these, as well as PowerPoint and PDF files of the lectures, will be available on the Ecampus WebCT course website.

Course Objectives and Goals for BIOL 5005.003: The goal of this course is to prepare the student for the advanced and complex landscape of today's cutting edge research in biology. Understanding the principles, methods and uses of the newest OMICS techniques and systems biology will contribute greatly to the student's future in academy and industry.

Tentative Lecture Schedule and Course Requirements: The **tentative** lecture schedule is given below. If and when there are changes, announcements will be made in class. Attendance is necessary to gain the understanding and knowledge to do well on the course assignment. Students should read the appropriate material provided on line **BEFORE** the lecture.

Grading: Grading in the course will be based on the final version of the grant written by the student(s). The student(s) are encouraged to consult the instructors at different stages of the grant writing process. The deadline for submitting the grant is May 2 (please see schedule below). A pre-proposal is due by March 21 and will include: abstract, objectives, research strategy, rational, and expected outcome.

Notes: Students interrupting class by talking, being disruptive or using cell phones or ipods will be asked to leave the classroom. Students are responsible for knowing **all** drop dates and withdrawal dates. It is the responsibility of the student to be familiar with the university policy on cheating, plagiarism, and student code of conduct found at the web site www.unt.edu/csrr/categories_of_misconduct.

Disabilities Accommodation: "The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability

Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with an accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323."

Attendance: Students **must** attend all classes. Classes can **only** be missed with **prior approval** or **documented** emergency/illness (Doctor or ER note).

Tentative lecture schedule:

Date		Chapter/Topic
Jan 15	Lecture 1	Introduction to Systems Biology
Jan 17	Lecture 2	Grant writing
Jan 22	Lecture 3	Grant writing
Jan 24	Lecture 4	Functional genomics
Jan 29	Lecture 5	Genetics approaches
Jan 31	Lecture 6	Reverse and forward genetics
Feb 5	Lecture 7	Structural genomics
Feb 7	**STUDENT PRESENTATION**	
Feb 12	Lecture 8	Whole genome sequencing
Feb 14	Lecture 9	Transcriptomics – Custom microarrays
Feb 19	Lecture 10	Transcriptomics – Affy microarrays
Feb 21	Lecture 11	NexGen sequencing technologies
Feb 26	Lecture 12	RNA sequencing
Feb 28	Lecture 13	Bioinformatics for genomics
Mar 5	**STUDENT PRESENTATION**	
Mar 7	Lecture 14	Bioinformatics for transcriptomics
Mar 19	Lecture 15	OMICS data validation
Mar 21	Lecture 16	Metabolomics
Mar 11-17	*Spring break no classes*	
Mar 26	Lecture 17	Analytical techniques for metabolomics
Mar 28	Lecture 18	Mass Spectrometry techniques
Apr 2	Lecture 19	Metabolomics data analysis
Apr 4	Lecture 20	Data analysis - non-supervised methods
Apr 9	Lecture 21	Data analysis - supervised methods
Apr 11	**STUDENT PRESENTATION**	
Apr 16	Lecture 22	Metabolic pathway analysis
Apr 18	Lecture 23	Metabolomics data analysis – case studies
Apr 23	Lecture 24	Proteomics
Apr 25	Lecture 25	OMICS data integration and network modeling.
Apr 30	**STUDENT PRESENTATION**	
May 2	**GRANT PROPSAL SUBMISSION**	