Genomic Science

GEN 626; CHEM 626 (2 credits)
Spring 2019
Tuesday & Thursday 2:25-3:15 p.m.
Room 1408 Genetics/Biotechnology Center
Instructor: Professor David C. Schwartz, dcschwartz@wisc.edu

Jan. 22	Introduction
Jan. 24	Genomes: content and information
Jan. 29	Physical and genetic mapping
Jan. 31	Basic mammalian genomics
Feb. 5	Genomic screening approaches; high throughput cell biology
Feb. 7	Methods to detect specific DNAs: amplification of DNA, hybridization
Feb. 12	Microfluidics and nanofabrication in the genomic sciences
Feb. 14	Use of single molecule/single cell devices and platforms in genomic analysis
Feb. 19	NextGeneration DNA sequencing platforms
Feb. 21	NextGeneration DNA sequencing platforms (cont.)
Feb. 26	Synthetic biology: genome design and fabrication I
Feb. 28	Synthetic biology: genome design and fabrication II
March 5	CRISPRs: genome engineering
March 7	Student Report and Topics
March 12, 14	Student Report and Topics
March 19, 21	*Spring Break, no class*
March 26, 28	Student Report and Topics
April 2, 4	Student Report and Topics
April 9	No class (NHGRI meeting at St. Louis, MO)
April 11	Student Report and Topics
April 16, 18	Student Report and Topics
April 23, 24	Student Report and Topics
Apr 30, May 2	Student Report and Topics

Description and Course-Learning Outcomes:

Genomic science is radically altering the way we investigate biological systems. Next generation sequencing, and other new approaches are radically changing the way we study biological systems. Advances in single molecule systems, mass spectrometry, micro/nanofabrication, and surface science have converged with computer science to completely alter the experimental landscape. This convergence is paving the way for new ways of understanding and controlling biological systems.

This special topics course is designed to bring cutting-edge topics in the genomic sciences into the reach of traditionally "pure" chemistry, biology, engineering, computer science, & statistics students. It is also designed for enabling biologically-oriented students to deal with the advances in analytical science so that they may incorporate new genomic science concepts into their own scientific repertoires.

The course is divided into three parts:

1- There will be lectures on the basics of genomic science to bring the class to the level of constitutive comprehension of the field. Basics will be covered in both the physical and biological sciences. Topics include: next-generation sequencing, single molecule / single cell systems, chip technologies, basic microbiology, basic mammalian genomics, mapping (physical and genetic), flow-cytometry, basic proteomics, fluidic screening systems, simple robotics and automation, microfluidics, micro- nanofabrication, synthetic biology (CRISPR inspired genome design and fabrication), and “interactome” systems. The scope and depth of these lectures will depend on the background of the class.

2- Outside speakers will provide talks on specialized topics on genomic science.

3- Students will present an original, independent research proposal on a topic related to the course content. The idea here will be to try to combine your current research focus with significant extensions in the genomic sciences. Prof. Schwartz will work closely with each student through loops of assigned reading (individualized to a given student’s presentation topic) and one-to-one interactions for fostering familiarity with new concepts. In past years, some of these class presentations favorably altered and strengthened the research path that graduate students took within their own research groups. Student proposals will be presented within the environment of an informal group meeting with encouraging feedback.

Who should apply: Any graduate student who wants to learn how the tools of genomic science can potentiate their current research aims. Undergraduates must obtain the instructor’s permission.

Reading Assignments:

Prof. David C. Schwartz will assign readings from scientific journals based on the lecture topics.

Evaluation of students:

Students will be evaluated based on their participation in discussion in the class, and on their original research proposal and presentation. Students are expected to work closely with Prof. Schwartz in developing their research proposal, and to actively participate in class discussions.

Participation in discussions in the class: 30%

Research project and presentation: 70%

Projects will be evaluated using these criteria: originality, significance, synthesis of ideas and facts, and attention to sufficient, correct and clear experimental/analytical detail; each student's presentation quality will be judged by its clarity to a broad range of students mediated by appropriate graphics and oral delivery. Lastly, the ability of a student to confidently field questions will also factor in to the final evaluation.

Grading policy:

A = 93 – 100%

AB = 88 – 92%

B = 83 – 87%

BC = 78 – 82%

C = 70 – 77%

D = 60 – 69%

F = below 60%

Credits for this course:
2 credits

Meeting of the credit hour policy standards:
This course includes 30 hours of in-class lectures as well as student reports and topics presentations. In addition, there are four hours per week of out-of-class student work. This work includes studying reading materials assigned for each of the lectures and presentations as well as extensive preparation time for the student report and topic presentations.