

Syllabus for 2023 Biology GU4777

“From curiosity to cure – case studies in cool biochemistry”

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Department of Biological Science

Columbia University

Class sessions twice weekly from 9:25 to 11:25 AM on M/W in 601 Fairchild Center

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Course overview: The goal of this course is to engage upper-level undergraduates and beginning graduate students in an immersive intellectual experience at the intersection of rigorous scientific inquiry and the history of innovation in molecular biology. The central theme will be curiosity and critical thinking as the twin drivers of both technological innovation and scientific discovery. The course will be divided into a series of modules focused on analysis and presentation of original research papers related to one important breakthrough in molecular biology that occurred during the past century. A prominent theme of the course will be the persistently unpredictable trajectory linking technical research and methodological developments to breakthrough science. Approximately eight-to-twelve original research papers will be covered in each module, spanning topics from the development of the methods that made the breakthrough possible through practical application of the resulting knowledge.

Three or four of the following breakthroughs will be covered in the 27 class sessions this term:

- Development of the Trikafta triple drug treatment for cystic fibrosis.
- Development of “next-generation” nucleic acid sequencing method.
- Development of CRISPR for human genetic engineering.
- Discovery and clinical application of insulin by Banting & Best.
- Genetics and pharmacological treatment of human hyperlipidemia.
- Development of the Gleevec tyrosine kinase inhibitor to cure Ph^+

Class sessions: There will be two 2-hour discussion sessions each week. The first four sessions of the semester will include detailed tutorials on (i) how to properly “speed read” a scientific research paper to extract essential content, (ii) how to effectively cut through the fog of jargon typical of the scientific literature, (iii) how to decide which methods and topics in a paper merit more careful analysis, and (iv) how to distill the extensive and sometime dense content in a research paper into a concise summary for a professional scientific audience. In subsequent classes, teams of two-to-four students

will present individual research papers and answer related questions from their peers and the instructors. Two papers will be presented during most class sessions. Every team will be responsible for a presentation approximately once every two weeks.

Module reports: Each student will write a maximally 500-word essay summarizing what they found most interesting in each module. There will be three or four such reports during the term depending on how many modules end up being covered. These essays will go through two rounds of peer review prior to final submission (*i.e.*, students will read each other's papers and provide brief feedback on clarity).

Final project: Each team will select a molecular-biology-related breakthrough not covered in the syllabus and prepare a final project in which they dissect its history based on analysis of four original research papers in related areas. Each team will jointly summarize their studies in a verbal presentation to the class, and every student will independently write-up an ~1,200 word "news-and-views" style summary of the breakthrough studied by their team.

Assessments: Paper presentations in class will count for 60% of the grade, while module essays will count for 10%. The verbal presentation and written report for the final project will count for 10% and 15%, respectively. The final 5% of the grade will be based on contributions to class discussions.

Prerequisites: One year of college coursework in biology covering introductory molecular/cellular biology and biochemistry at the level of Biology C2005-2006 at Columbia. No prior coursework in biochemistry is required.

Academic integrity: All participating faculty and students will be expected to adhere to the highest standards of academic integrity, as outlined in the policy statement posted on the Columbia University website (<http://www.college.columbia.edu/academics/integrity-statement>). Students are encouraged to collaborate with one another on classroom presentations but are expected to write-up their "new-and-views" paper completely independently. Students will be clearly informed at the time of distribution of each assessment whether collaboration with other students is allowed. Students who fail to adhere to these principles or to properly cite sources used for their written work will be referred to University officials for disciplinary action (hopefully for summary academic execution in the case of outright cheating).

Disability accommodation: The instructors will grant all reasonable requests for accommodation of disabilities and special circumstances, subject to the caveat that standards of academic integrity and intellectual rigor will not be compromised. The instructors will honor all accommodations recommended in official correspondence from the Columbia University Office of Disability Services, and they will respect the confidentiality of any related information conveyed in such correspondence or in personal communications with students.

Course Summary:

Date	Details	Due
Mon Jan 23, 2023	Assignment Riordan1989Science Presentations	due by 11:59pm
Wed Feb 1, 2023	Assignment Group Presentation #1	due by 11:30am
Wed Feb 15, 2023	Assignment Group Presentation #2	due by 11:30am
Wed Mar 1, 2023	Assignment Group Presentation #3	due by 11:30am
Wed Mar 22, 2023	Assignment Group Presentation #4	due by 11:30am
Fri Mar 31, 2023	Assignment hCFTR Module Essay	due by 11:59pm
Wed Apr 5, 2023	Assignment Group Presentation #5	due by 11:30am
Wed Apr 19, 2023	Assignment Group Presentation #6	due by 11:30am
Sun Apr 30, 2023	Assignment NGS Module Essay	due by 11:59pm
Fri May 5, 2023	Assignment Module 3 Essay	due by 11:59pm
Wed May 10, 2023	Assignment Final Project Presentation	due by 11:59pm
Fri May 12, 2023	Assignment Final Project Paper	due by 11:59pm

