Genetics of Compulsive Behavior – 3 Credits
01:447:460:01 and 01:447:460:02

Spring Semester 2027

Course Instructor and Contact Information:

Dr. Lei Yu, Distinguished Professor
Office: Life Sciences Building LSB-126
Phone: 848-445-0794
Email: yu@dls.rutgers.edu

Course Meeting Days, Times, Location, Modality:

- Course is offered as an in-person course. Attendance is mandatory. Tardiness and absence will result in grade reduction.
- Class meets twice a week, each for 2 periods (80 min).
- Date/time/location to be announced following university's computer-generated assignment for class date/time/location.
- Course Canvas site: to be announced, following university's computer-generated assignment for class.

Office Hours / Student Support Hours:

- Office hours format: in-person or online
- Location for in-person office hours: by arrangement between the instructor and student
- Office hours times: open to meeting during regular class hours or at alternate times, by arrangement between the instructor and student

Course Description:

Compulsive urge can be channeled toward productive endeavors such as a strong drive to succeed in competitions, schooling, and career. On the other hand, improper handling of compulsive urge may lead to problematic behaviors such as alcoholism, drug use, gambling, and other undesirable behaviors. There are also conditions that are medically defined as disorders, with certain types of compulsive behaviors as part of the diagnostic symptoms, such as OCD, ADHD, and eating disorders. There is evidence that genetics contribute to compulsive behavior in humans, and research in animal models has begun to uncover the molecular factors that underlie the genetic basis of compulsive behavior.

Primary research literature will be used as the main material for this course, selected to cover the study of a range of compulsive behavior genetics. The course will involve extensive reading and in-class discussion, and will examine scientific literature relating to the genetics of compulsive behavior. Each cycle will begin with assigned primary literature on the genetic research of a specific compulsive behavior, with assigned student oral presentations and in-class discussion. Each student will then independently write an essay, summarizing the salient features of the research paper, and presenting her/his own analysis and critique. A peer-review component is incorporated, with randomized roster assignment to peer-review classmates' writings, assigned in a two-way anonymous fashion (neither the peer reviewers nor the reviewees know each other's names), to promote objective peer reviewing. In addition, peer reviews will be subjected to peer evaluation, also assigned in a two-way anonymous fashion. Typically four to six rounds of literature review and essay writing will be conducted during the course, covering scientific research on some of the major types of compulsive behavior. The course focus will be on developing skills in critical thinking and effective writing, as well as critical evaluation of written materials.

Prerequisites: Genetics 01:447:380 or Genetic Analysis I 01:447:384, and General Biology Lab 01:119:117 or 01:119:102

Required Texts and Course Materials:

- Course Materials: Research literature and journal articles are assigned by the course instructor.
- No textbooks are required.

Technical / Technology Requirements:

- Access to the use of a word processing software and email is needed, to receive email notices, communicate with the course instructor, and complete/submit assignments
- If you do not have the appropriate technology for financial reasons, please email the Dean of Students at deanofstudents@echo.rutgers.edu for assistance. If you are facing other financial hardships, please contact the Office of Financial Aid.

Course Learning Goals:

By fully participating in this course, students will be able to develop scientific writing skills listed below:

- Communicate complex ideas effectively, in standard written English, to a general audience.

- Communicate effectively in modes appropriate to genetics as a discipline: in-class presentation, questions and answers with course instructor and fellow students in the course.
- Evaluate and critically assess sources and use the conventions of attribution and citation correctly: written summary of assigned reading as part of the written essays.
- Analyze and synthesize information and ideas from multiple sources to generate new insights: written essays based on assigned reading, with emphasis on generating one's own synthesis of the research topics.
- Improve writing skills through multiple rounds of essay writing, by responding effectively to editorial feedback from the instructor and peers.

Departmental Learning Goals – URL:
https://genetics.rutgers.edu/academics/undergraduate/learning-goals

Departmental Learning Goals – Fulfilled by This Course:
- Knowledge specific goals: Know the terms, concepts and theories in genetics.
- Integrate the material from multiple sources and research. That is, to think holistically and to see the whole as well as the parts.
- Use genetic information and ideas to critically analyze published research articles in genetics.

SAS Core Curriculum Goal:
WCD – Student is able to communicate effectively in modes appropriate to a discipline or area of inquiry; evaluate and critically assess sources and use the conventions of attribution and citation correctly; and analyze and synthesize information and ideas from multiple sources to generate new insights.

Exams, Assignments, and Grading Scale:
- There are no quizzes or exams for this course.
- Research literature will be assigned for reading and essay writing.
- During the class, most time will be devoted to discussion of assigned reading and evaluation of student's writing.
- Grade weighting of assessments: Because there are no quizzes or exams for this course, the course grade is based on written essay assignments, with all assignments contributing equally toward the course grade. Each assigned assessment score: the sum of written essay scores, peer review scores, and review evaluation scores, all with on-time submissions. Submission lateness penalties are subtracted in calculating the total score of each assessment.
- Attendance and class participation: Because this is a discussion-based course, full in-person class attendance and active participation of in-class discussions are

required, in order to earn the full essay-based course grade. Tardiness (arriving late by 5 minutes or more) will result in a 0.1% deduction per instance, and absence will result in a 0.25% deduction per instance, with attendance-related deductions capped at 5% total. Students are also expected to actively participate in class discussions; lack of participation may result in additional deductions of up to 5% total. Taken together, attendance and participation deductions may reduce the final course grade by up to 10%.

- Rutgers undergraduate grade system: letter grades, with no minus grades. See the table below for letter grade scale:

Letter Grade	From	To
A	90	100
B+	85	89.99
B	80	84.99
C+	75	79.99
C	70	74.99
D	60	69.99
F	0	59.99

- Rounding when tabulating course grade: the third decimal point will be rounded (example: 89.994 = B+, 89.995 = A).

Disability Accommodations:

- Students in need of disability accommodations should register for accommodations and consult the policies and procedures of the Office of Disability Services.
- In order to receive consideration for reasonable accommodations, a student with a disability must contact Office of Disability Services, participate in an intake interview, and provide documentation.

Academic Integrity Policy:

Rutgers University takes academic integrity very seriously. By enrolling in this course, you assume full responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- *Cheating*
- *Plagiarism*
- *Aiding others in committing a violation or allowing others to use your work*
- *Failure to cite sources correctly*
- *Fabrication*
- *Using another person's ideas or words without attribution, including re-using a previous assignment*

- *Unauthorized collaboration*
- *Sabotaging another student's work*

If you are ever in doubt, consult your instructor.

Please review the Academic Integrity Policy at:
https://nbprovost.rutgers.edu/academic-integrity-students

Use of AI Tools in This Course:

Because this is a writing-intensive course focused on critical analysis of primary scientific literature, the use of AI tools, including large language models such as ChatGPT, is intentionally and strictly limited. Students are expected to independently compose and write all assigned essays, including the analysis, interpretation, and critique of the assigned research journal articles. AI tools may be used only for basic proofreading purposes, such as spell-checking and suggesting grammatical or stylistic corrections, but not for generating ideas, summaries, or analyses.

Improper or indiscriminate use of AI tools will be treated as a potential violation of the university's academic integrity policy and may result in grade penalties up to and including a failing grade, consistent with institutional guidelines.

The purpose of this policy is to encourage students to develop the foundational skills that this course is designed to cultivate. Effective scientific writing requires the ability to read complex literature critically, evaluate experimental evidence, construct logical arguments, and communicate one's ideas clearly and persuasively. These skills can only be developed through sustained, independent practice.

While AI-assisted writing tools are likely to be used in students' future professional settings, their responsible and effective use depends on a user's ability to judge the quality, accuracy, and limitations of the output. By independently completing the written assignments in this course, students will establish a strong grounding in scientific reasoning and writing, and develop the ability to recognize flawed logic, misinterpretation of data, or overgeneralization of results – issues that are particularly consequential in scientific and biomedical research. This course therefore emphasizes learning how to think and write like a scientist, so that students are well-equipped in the future to critically assess both human- and AI-generated scientific text.

By independently completing the written assignments in this course, students will strengthen their ability to evaluate evidence, articulate original perspectives, and engage in reasoned scientific arguments – skills that are valuable for future advanced studies, research, and professional careers in science and medicine. Therefore, this policy is to ensure that each student gains the full educational benefit of this course.

Student Support and Mental Wellness:

- Student Success Essentials: https://success.rutgers.edu
- Student Support Services: https://www.rutgers.edu/academics/student-support

- The Learning Centers: https://rlc.rutgers.edu/
- Rutgers Libraries: https://www.libraries.rutgers.edu/
- Bias Incident Reporting: https://studentaffairs.rutgers.edu/bias-incident-reporting
- Dean of Students – Student Support Office: https://success.rutgers.edu/resource/dean-students-student-support-office
- Office of Veteran and Military Programs and Services: https://veterans.rutgers.edu
- Student Health Services: http://health.rutgers.edu/
- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): http://health.rutgers.edu/medical-counseling-services/counseling/
- UWill: free immediate access to teletherapy; you can choose a therapist based on your preferences including issue, gender, language, ethnicity. http://health.rutgers.edu/uwill/
- Office for Violence Prevention and Victim Assistance: www.vpva.rutgers.edu/
- Office of Disability Services: https://ods.rutgers.edu/
- Basic Needs Assistance (food, housing, and other essentials): https://ruoffcampus.rutgers.edu/basic-needs
- Rutgers Student Food Pantry: https://ruoffcampus.rutgers.edu/food-pantry

Course Closed?

There is no wait list for this course, as Department of Genetics no longer issues Special Permission Numbers. Please continue to monitor Web-Reg for openings.

Genetics of Compulsive Behavior - Content Areas

1) Overview: Compulsive Behaviors
   a) What are compulsive behaviors
   b) The good, the bad, and the ugly
   c) How research on compulsive behaviors has evolved
2) Classification of Compulsive Behaviors
   a) The impulsivity – compulsivity continuum: impulse control disorders
   b) Movement-related
      i) ADHD / ADD
      ii) Tourette's syndrome
      iii) Motor control disinhibition
      iv) Intolerance to delayed gratification / sensitive to reward
   c) Eating-related
      i) Anorexia nervosa
      ii) Bulimia nervosa (& orthorexia nervosa)
      iii) Food addiction: binge eating & compulsive over-eating
   d) Drug-related
      i) Alcohol dependence and alcoholism
      ii) Psychostimulants: cocaine, amphetamine, methamphetamine
      iii) Opioids: morphine, heroin, prescription pain medicine addiction
      iv) Hallucinogens
      v) Barbiturates
      vi) Nicotine & smoking
   e) Non-drug addictions
      i) Pathological gambling
      ii) Trichotillomania
      iii) Kleptomania, pyromania
      iv) Compulsive shopping
      v) Compulsive hoarding
      vi) Sex addiction
      vii) Video game/internet addiction
   f) Behavioral stereotypy
      i) Motor stereotypy
      ii) Inappropriate persistence, persistent responding
   g) Overlap with other psychiatric disorders
      i) Autism
      ii) Comorbidity with psychiatric disorders
3) Neurobiological Basis of Compulsive Behaviors
   a) Focus on the brain

i) Neuroanatomical sites involved in compulsivity
ii) Neurotransmitter systems involved in reward
iii) Brain lesion studies: human clinical cases and animal models

b) Distinction of cognitive functions involved in compulsivity
i) Psychological tests to quantify behavioral compulsiveness
ii) Neurophysiological measurements for physiological responses during psychological tests
iii) Human brain imaging studies: with and without drugs
iv) Voluntary vs. involuntary
v) Craving vs. intension

4) Genetics of Compulsive Behaviors
a) General approaches to study genetics of compulsive behaviors
i) Genetic studies in human populations: “guilt by association”
ii) Gene-based studies in animal models: cause-effect analysis

b) Animal models for compulsive behaviors
i) Validity vs. inadequacy of animal models
ii) Spontaneous animal models: “OCD” mice as an example
iii) “Designer mouse” type of models: targeted gene editing

c) Neurochemical systems and genes involved in compulsive behaviors
i) Norepinephrine (NE): arousal/excitation control
ii) Serotonin (5-HT): behavior initiation/cessation control, mood regulation
iii) Dopamine (DA): reward, reinforcement control
iv) Opioids: pleasure/sense of doom control

d) Genes for neurotransmitter/neuropeptide synthesis and metabolism
e) Genes for neurotransmitter/neuropeptide receptors

5) Gene vs. Behavior
a) Nature vs. nurture: innate or acquired? Born to be or environmental?
b) Trait vs. state: key issue in genetic research

Science Writing: Focusing on Discipline-Appropriate Writing

Overview of Course Structure:

- This course focuses on discipline-appropriate primary research literature reading and essay writing, using published journal articles assigned by the instructor as the major source of material.
- The emphasis is on developing skills in critical thinking and effective writing, as well as critical evaluation of written materials in the form of peer review.
- Various topics on the genetics of compulsive behavior serve as discipline-specific subject areas, with source materials consisting of a primary research publication as each essay's focus, and a number of review articles for topic-specific background information.
- Each essay-writing cycle lasts about two weeks (possibly longer for the first essay) in the beginning of the semester, and may become shorter as the semester progresses and the students become more familiar with the writing process. Typically, the course consists of a total of four to six essay-writing cycles, depending on the varying time it takes to understand the technical complexity of the primary research articles.
- Learning about science writing is integral to the course, front and center to each essay-writing cycle. Writing topics (listed below) are discussed throughout the course, in the form of in-class discussions, using issues gleaned from student writing as examples.

Writing Topics:

- Using AI tools to assist in polishing written materials for proofreading purposes, such as spell-checking and suggesting grammatical or stylistic corrections
- Re-reading of research paper to develop central ideas
- Prewriting planning: outline and structure
- Purpose and audience for essay writing
- Evidence-based reasoning
- Relevant vs. trivial details: what to cite in supporting one's argument
- Proper quotation/citation in science writing vs. plagiarism
- Passive vs. active voice in science writing
- Writing an introductory paragraph of the essay
- Writing the conclusion
- Writing a rough draft for an essay
- Revising
- Complete sentences vs. fragments
- Run-on sentences
- Paragraph structure
- Closing sentences and clinchers
- Word choice and diversity
- Variety of sentences
- Capitalization, punctuation, spelling
- Peer-review feedback writing & evaluation of peer-review feedback