Syllabus

Neuroscience of Consciousness

NEUR 592 | BIOL 691

Fall Semester 2024

Course Organization

Weekly schedule: Each week runs from Monday (12:01 am) to Sunday (11:59 pm) starting August 26, 2024

Instructor: Frank Krueger, Ph.D.

Department: School of Systems Biology

Phone: 703-993-4358

E-mail: fkrueger@gmu.edu (preferred)

Office Hours: By appointment (via Zoom)

Course Description

This course introduces you to the neuroscience of consciousness —a phenomenon that is so fundamental to our lives. You receive a neuroscience overview into the realms of consciousness and unconsciousness, including the hard problem of consciousness; mental processes and disorders of consciousness; consciousness in sleep, dreaming, and psychedelics; neural basis of consciousness, and neuroscientific theories of consciousness. You also learn about the neuroscience methods applied to unravel the neural signatures of consciousness. The course is designed for everyone who has ever wondered why we are conscious and how our brains create such unique subjective experiences.

Learning outcomes

By the end of this course, students will be able to:

1. Understand the hard problems of consciousness, neuropsychological processes and disorders of consciousness, consciousness in sleep, dreaming, and psychedelics, the neural mechanism of consciousness, and major neuroscientific theories of consciousness.
2. Evaluate the advantages and disadvantages of neurophysiological, pharmacological, endocrinological, and neurocomputational methods in studying consciousness.

Prerequisite

Prerequisites are the completion or concurrent enrollment in all other required general education courses or permission of the instructor. This course is essential for anyone interested in the rapidly developing field of neuroscience of consciousness. Reading, research and construction projects, and collaboration with the class are major components of the course.

Textbook & Course Materials

Required Text, Recommended Texts, and Other Readings

Other readings will be made available on Canvas (See Learning Modules).

- Laureys S, Gosseries O, & Tononi G (eds.) (2015). *The Neurology of Consciousness: Cognitive Neuroscience and Neuropathology*. Elsevier Science Publishing (2nd edition).
- Dehaene S. (2014). *Consciousness and the Brain: Deciphering How the Brain Codes our Thoughts*. Penguin Books.
- Koch C. (2020). *The Feeling of Life Itself. Why Consciousness is Widespread but Can't Be Computed*. MIT Press.
- Seth A. (2021). *Being You: A New Science of Consciousness*. Faber & Faber.

Course Logistics

This course will use a distance learning format; the primary meeting space will be on Canvas 9.1; and we will use other means of keeping in touch such as e-mail, telephone, and Zoom. This is a rigorous course: you will accomplish the following activities in a typical week:

- reading about 35-50 pages, reflecting the content, and discussing the material with your classmates,
- completing online activities and responding to weekly requirements, and
- working on assignments completed in Canvas according to the assignment schedule.

Though the delivery method is different, it should take you the same amount of time as a typical full-semester course. You should **expect to spend approximately 9 hours on coursework each week** (including the time you would have spent in a classroom). It is critical to keep up with weekly requirements. Each week, I will provide announcements via e-mail and a module in our Canvas course to specify required activities and assignments (available by clicking on 'Weekly Modules' on the course menu in Canvas).

Canvas (Available on August 26, 2024)

We will use Canvas for the course. Additional guidance on individual assignments and discussion questions will be posted there. All assignments will be submitted through Canvas for grading. Please visit our Canvas site regularly.

Access Canvas by following these steps:

1. Go to http://mymason.gmu.edu.
2. Login using your NETID and password.
3. Click on the 'Dashboard' tab.
4. Click on 'Fall 2024 Special Topics in Neuroscience (NEUR-592-DL1, BIOL-691-DL2)' (Consciousness).

Instructor-Student Communication

I will respond to your e-mails from Monday (9 am) through Friday (6 pm) within 24 hours. If I am away from e-mail for more than two days, I will send an announcement to the class.

Before sending an e-mail with questions, please check the following (available on your Canvas course menu) **unless the e-mail is of a personal nature**:

1. Syllabus.
2. Ask the Professor (Feel free to respond to other students in the Help forum if you know the answer.).
3. Canvas Tutorials on how to use Canvas features.
4. Canvas Q&A (resources specific to Mason).
5. Technology Requirements.

Mason E-MAIL

- Mason requires that Mason e-mail be used for all courses. I will be sending messages to your Mason e-mail, and you are responsible for ensuring you have access to these messages.
- You may forward your Mason e-mail to other accounts but always use your Mason e-mail when communicating with me to verify your identity.
- You must regularly check your Mason e-mail account and keep your mailbox maintained so that messages are not rejected for being over quota.
- When you e-mail me, you can expect a response within 24 hours (*Monday through Friday*). If I am going to be away from e-mail for more than two days, I will send an announcement to the class.
- When you e-mail me, be sure to include '**Neuroscience of Consciousness'** at the beginning of the subject heading to alert me that I have received a message from one of my online students.

Participation

Netiquette For Online Discussions

Our discussion should be collaborative, not combative; you create a learning environment, share information, and learn from one another. Respectful communication is essential to your success in this course and as a professional. Please re-read your responses carefully before you post them so

others will not take them out of context or as personal attacks. Be positive to others and diplomatic with your words, and I will try my best to do the same. Be careful when using sarcasm and humor. Without face-to-face communication, your joke may be viewed as criticism. Experience shows that even an innocent remark in the online environment can be easily misconstrued.

Netiquette prepared by Charlene Douglas, Associate Professor, College of Health & Human Services, GMU.

Technology Requirements

Technology requirements for the course are:

- Internet connection (DSL, LAN, or cable connection desirable).
- Supported Web browser (e.g., Internet Explorer, Chrome, Safari) to use Adobe Connect for Live Class Sessions.
- MS Office 365 ProPlus is provided at no cost via the Microsoft Student Advantage Program (Access is tied to your @gmu.edu e-mail address).

Student Responsibilities

Mason E-mail

Students are responsible for the content of university communications sent to their George Mason University e-mail account and are required to activate their account and check it regularly. For accessibility and privacy, the university, school, and program will send communications to students solely through their Mason e-mail account —students should respond accordingly.

Patriot Pass

Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Canvas, University Libraries, Mason E-Mail, myMason, Patriot Web, Virtual Computing Lab, and WEMS. (https://password.gmu.edu/index.jsp).

Students with Disabilities

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester (Office of Disability Services).

Academic Integrity

Students must be responsible for their work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be the foundation of our university culture (https://oai.gmu.edu/).

Honor Code and Virtual Classroom Conduct

Students must adhere to the guidelines of the George Mason University Honor Code (See Honor Code).

We value critical thinking, and therefore, students must read the assigned material (e.g., books, articles) before the class with a critical eye. Your guiding principles should be active thought, quality of inputs, and a conflict resolution attitude.

The principle of academic integrity is taken very seriously, and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form.

Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification.

Plagiarism is the equivalent of intellectual robbery and cannot be tolerated academically. If you have any doubts about what constitutes plagiarism, please contact me.

University Policies

Students must follow university policies (University Policies).

Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing (http://universitypolicy.gmu.edu/policies/responsible-use-of-computing).

University Calendar

Details regarding the current Academic Calendar (https://registrar.gmu.edu/calendars/).

University Catalog

The current university catalog (University Catalog).

Student Services

Writing Center

The George Mason University Writing Center staff provides various resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing (Writing Center). ESL Help: The program was designed specifically for students whose first language is not English who feel they might benefit from additional, targeted support throughout an entire semester (Writing Center).

University Libraries

University Libraries provide resources for distance students. (http://library.gmu.edu/for/online).

Counseling and Psychological Services

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops, and outreach programs) to enhance students' personal experience and academic performance (http://caps.gmu.edu).

Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the 'Buckley Amendment,' is a federal law protecting student educational records and providing students with certain rights. (http://registrar.gmu.edu/privacy).

Weekly Schedule

Distance learning courses are dynamic—to ensure we achieve our learning outcomes— we may need to negotiate weekly schedule changes. We will focus on learning, fairness, and reason for any approved changes. Each week's activities —reading assignments about topics, watching videos, and reflecting about neuroscience methods (via a blog), defining key concepts (via a glossary), testing your knowledge about brain anatomy (via a quiz), and sharing and discussing your knowledge with classmates (via discussion forum)— **require approximately 9 hours.**

Note that there is no final exam in this course but students write a research grant proposal during the exam week of the course. The table below lists the weekly schedule, significant activities, significant assignments, points, and due dates for this course. Final grades will be based on the total number of points earned in the class.

Weeks	**Major Topics and Method**	**Assignments (graded)**	**Points**	**Due Dates (11.59 pm, EST)**
Week 1 Monday, August 26 - Sunday, September 1	I. INTRODUCTION TO CONSCIOUSNESS Topic: Definition of Consciousness and the Mind-Body Problem Method: Single-Unit Recording	Orientation Quiz Discussion Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 5 5 10	Sunday, 8/31 Thursday, 8/29 Sunday, 9/1

Week 2 Monday, September 2 - Sunday, September 8	II. NEUROPSYCHOLOGICAL SIGNATURES OF CONSCIOUSNESS Topic: Neuronal Oscillations, Coherence, and Correlates of Visual Consciousness Method: Electroencephalography (EEG)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 9/5 Sunday, 9/8
Week 3 Monday, September 9 - Sunday, September 15	II. NEUROPSYCHOLOGICAL SIGNATURES OF CONSCIOUSNESS Topic: Top-down/ Bottom-up Attention and Signatures of Consciousness Method: Event-Related Potential (ERP)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 9/12 Sunday, 9/15
Week 4 Monday, September 16 - Sunday, September 22	II. NEUROPSYCHOLOGICAL SIGNATURES OF CONSCIOUSNESS Topic: Consciousness and the Self: Controlled Hallucination, Bayesian'srule, the Self and the Beast Machine Method: Magnetoencephalography (MEG)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 9/19 Sunday, 9/22
Week 5 Monday, September 23 - Sunday, September 29	III. LEVEL AND MEASUREMENT OF CONSCIOUSNESS Topic: Consciousness and the Waking Intrinsic Brain Activity: The Footprints of Consciousness and the Brain at Rest Method: Positron Emission Tomography (PET)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 9/26 Sunday, 9/29
Week 6 Monday, September 30 - Sunday, October 6	III. LEVEL AND MEASUREMENT OF CONSCIOUSNESS Topic: Consciousness, Sleep, and Dreaming Method: Magnetic Resonance Imaging (MRI)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 10/3 Sunday, 10/6
Week 7 Monday, October 7 - Sunday, October 13	III. LEVEL AND MEASUREMENT OF CONSCIOUSNESS Topic: Consciousness, Anesthesia, and Psychedelics Method: Functional Magnetic Resonance Imaging (fMRI)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 10/10 Sunday, 10/13
Week 8 Monday, October 14 - Sunday, October 20	IV. SEVERE BRAIN INJURY AND RELATED CONDITIONS Topic: Consciousness and Vegetative State Method: Resting-State fMRI (RS-fMRI)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 10/17 Sunday, 10/20

Week 9 Monday, October 21 - Sunday, October 27	IV. SEVERE BRAIN INJURY AND RELATED CONDITIONS Topic: Minimally Conscious State and Locked-in Syndrome Method: Functional Near-Infrared Spectroscopy (fNIRS)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 10/24 Sunday, 10/27
Week 10 Monday, October 28 - Sunday, November 3	IV. SEVERE BRAIN INJURY AND RELATED CONDITIONS Topic: Consciousness and Dementia: How the Brain Loses Itself Method: Transcranial Magnetic Stimulation (TMS)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 10/31 Sunday, 11/3
Week 11 Monday, November 4 - Sunday, November 10	V. SEIZURES, SPLITS, NEGLECTS, AND ASSORTED DISORDERS Topic: Consciousness, Epilepsy, and Brain-Computer Interface Method: Transcranial Direct Current Stimulation (tDCS)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 11/7 Sunday, 11/10
Week 12 Monday, November 11 - Sunday, November 17	V. SEIZURES, SPLITS, NEGLECTS, AND ASSORTED DISORDERS Topic: Split-Brains and Split-Minds Method: Transcranial Focused-Ultrasound Stimulation (tFUS)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 11/14 Sunday, 11/17
Week 13 Monday, November 18 - Sunday, November 24	V. SEIZURES, SPLITS, NEGLECTS, AND ASSORTED DISORDERS Topic: Out-of-Body and Near-Death Experiences Method: Invasive Stimulation Method in Animals (Optogenetics)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection	5 5 5 5 10	Thursday, 11/21 Sunday, 11/24
Monday, November 25 Sunday, December 1	Thanksgiving Break			
Week 14 Monday, December 2 - Sunday, December 8	VI. THEORIES OF CONSCIOUSNESS Topic: Summary and the Future of Consciousness Method: Lesion Studies (Humans)	Topic: Discussion (Part 1) Topic: Glossary Brain: Quiz Topic: Discussion (Part 2) Method: Reflection Course Evaluation	5 5 5 5 10 10	Thursday, 12/5 Sunday, 12/8

Exam Week Monday, December 9 - Sunday, December 15	Research Grant Proposal	Submission: Proposal	160	Sunday, 12/15
			Total 600	

Grading Scale (points)

Final grades assigned for this course will be based on the percentage of total points earned and are set as follows:

Letter Grade	Percentage	Points	Performance
A^+	98-100%	588-600	Superb Work
A	93-97%	558-582	Excellent Work
A^-	90-92%	540-552	Nearly Excellent Work
B^+	87-89%	522-534	Very Good Work
B	83-86%	498-516	Good Work
B^-	80-82%	480-492	Mostly Good Work
N/A	<80%	<480	Failing Work