

## **GESM141: Aging and the Human Brain**

### **Seminar in the Life Sciences**

**Fall 2024**

**Monday and Wednesday**

**2:00-3:50 PM, GER room 230**

#### **INSTRUCTOR**

Marc Vermulst, PhD

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Office Hours: Monday 12-2PM or by appointment

#### **COURSE OVERVIEW**

Every day we grow a little bit older, and with each passing day we become a little more susceptible to disease. Why does aging predispose us to diseases? And what molecules control the rate at which we age? Can we manipulate these molecules to extend our lifespan? Or is our lifespan set from the day we were born? Over the past 40 years, scientific research has provided unprecedented insight into the molecular mechanisms that precipitate human aging and linked these mechanisms to various human diseases, including Alzheimer's and Parkinson's disease. A major goal of this course will be to provide an up to date overview of the molecular processes that constrict human lifespan, with a comprehensive focus on the human brain. Accordingly, this course will also provide a broad overview of the anatomy of the brain in the context of both normal and pathological aging.

#### **COURSE OBJECTIVES**

Upon completion of this course, students are expected to:

- (1)** Achieve a general understanding of the basic biological mechanisms that cause human aging
- (2)** Achieve a general understanding of the research tools and model organisms used in aging research
- (3)** Acquire general knowledge of functional and structural anatomy of the brain
- (4)** Acquire general knowledge of the physiology of neurons and glial cells
- (5)** Understand the biological basis of major age-related neurodegenerative disorders.
- (6)** Understand the basics of aging research and the logic behind scientific aging experiments.

This course is designed to provide students with the support and guidance needed to achieve the objectives noted above.

### **COURSE WEBSITE**

Course readings, announcements and information/resources will be posted to the course website.

### **POTENTIAL READING MATERIAL**

Garrett, B. (2015). Brain and Behavior: An Introduction to Biological Psychology, 4th Edition. SAGE

### **POLICIES**

Assignments turned in late for any reason will incur a deduction of 10% of the total point value for the assignment for each day past the due date. Completion of all course readings and assignments and active participation is expected of all students.

### **COURSE ASSIGNMENTS AND ACTIVITIES**

An important aspect of the learning process is the knowledge and insight that is gained from active participation and from sharing your own perspective on a given topic as well as listening to the thoughts of others in the course. Interaction with fellow course participants will primarily occur via oral and written communication opportunities that arise throughout the semester. Interaction with fellow classmates is required during discussion segments. There will be 3 quizzes.

### **GRADING**

The final grade will be based on:

Participation: 15%

Daily questions: 10%

Midterms (2): 25% each

Final: 25%

### **STATEMENT FOR STUDENTS WITH DISABILITIES**

Requests for academic accommodations based on a disability are approved by the Disability Services and Programs (DSP). Requests must be approved each semester and should be submitted to the course instructor and TA early in the semester to ensure time for any necessary accommodations. DSP location: STU 301; phone number: (213) 740-0776, email: [ability@usc.edu](mailto:ability@usc.edu); web address: [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html).

### **ACADEMIC INTEGRITY**

As a member of the USC community and this course you are expected to adhere to the principles of academic integrity outlined in the Student Conduct Code described in SCampus. These principles include avoiding plagiarism in its many forms, unauthorized collaboration on course assignments, and not cheating. Please see the helpful Academic Integrity guide (<http://www.usc.edu/student-affairs/SJACS/forms/AcademicIntegrityOverview.pdf>) for an overview and links to additional

## **SESSION TOPICS**

**Aug. 26:** Course overview, aging as a problem and a possibility to change medicine

**Aug. 28:** Basic biology, genetics and telomeres

**Sept. 2:** Labor day, no class DNA damage, cancer

**Sept. 4:** DNA damage, cancer

**Sept. 9:** Mitochondria

**Sept. 11:** Stem cells

**Sept. 16:** Epigenetics

**Sep. 18:** Cellular senescence

**Sep. 23:** Proteostasis

**Sep. 25:** Mechanisms to delay aging (1)

**Sep. 30:** Mechanisms to delay aging (2)

**Oct 2:** Recap

**Oct. 7:** Study day

**Oct. 9: midterm 1**

**Oct. 14:** Introduction to brain biology

**Oct. 16:** Neural connections

**Oct. 21:** Neural physiology, Action potentials

**Oct. 23:** Synapses, LTP

**Oct. 28:** Glial cells

**Oct. 30:** Day to work on midterm 2.

**Nov. 4: Midterm 2 presentations**

**Nov. 6:** Natural brain aging

**Nov. 11:** Natural brain aging (2) and Dementias

**Nov. 13:** Alzheimer's disease (1)

**Nov. 18:** Alzheimer's disease (2)

**Nov. 20:** Parkinson's disease (1)

**Nov. 25:** Parkinson's disease (2)

**Nov. 27:** Brain aging recap

**Dec 2:** Study day for finals

**Dec 4:** Finals