

GERO 510: Physiology of Development and Aging Spring 2021

Time: Tuesdays 9:00 am - 1150 am - This is an Online Blackboard/Zoom Course

Course Instructor

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*Email is the best way to get a hold of me.

Textbook

This course is not accompanied by a textbook. All materials will be provided as ppt slides.

Course Description

Aging is an inevitable process that affects everyone. With the recent increase in lifespan, it is important to understand the 'what, why, who, where, when, and how' of aging to be well prepared and lead a healthy/productive life. This course will provide opportunities to learn about several aspects of biological aging at the theoretical, molecular, cellular, and whole-body level. There will be discussions on cutting-edge research and the latest discoveries to provide a contemporary and up-to-date knowledge base.

Prerequisite

It is desirable but not mandatory for students to have had an undergraduate course in biology.

Course objectives

By the conclusion of the course, students are expected to be able to:

- 1) Provide an informed opinion on key issues in biological gerontology relevant to health care providers, social service professionals, educators, administrators and policy analysts.
- 2) Discuss the nature of aging at the theoretical, molecular, cellular, and whole-body level.
- 3) Clearly distinguish between normal aging processes and age-associated diseases.
- 4) Understand/analyze the latest research on biogerontology and continue to stay updated.

Class Schedule

Jan. 19 – Orientation and Introduction to Aging Biology - Class 1

- *Class Structure and Evaluation*
- *Why the Study of Aging is Important*
- *The Significance and Impact of Gerontology*
- *Major Theories of Aging*
- *Demography of Aging*
- *Normal Aging and Diseases*
- *Models for Biologic Aging*
- *Geroscience*
- *The dissemination of scientific research*

Jan. 26 – Molecules, Cells, and Aging - Class 2

- *Basic Organization of Cells, Tissues, and Organs*
- *The Genomes*
- *Mitochondria*
- *Cellular Metabolism*
- *Signal Transduction*
- *Oxidative Stress and Cellular Aging*
- *Stem Cells*
- *Cancer Cells and Dysregulation*

Feb. 2 – Nutrition, Metabolism, and Aging - Class 3

- *Nutrient Signaling Pathways and Aging*
- *Mitochondria and Aging*
- *Vitamins and Minerals*
- *Guidelines for Healthy Eating*
- *Current Research on Nutrition in the Elderly*

Feb. 9 – The Digestive System - Class 4

- *Oral Region - Components, Functions, and Age Changes*
- *The Esophagus: Common Issues in the Elderly*
- *The Stomach and Small Intestine: Motility and Absorption Problems in the Elderly*
- *The Colon: Functional and Anatomic Problems in the Elderly*
- *The Microbiome and Aging*

Feb. 16 – The Endocrine System - Class 5

- *The Endocrine Glands in Youth and Aging*
- *Diabetes and the Metabolic Syndrome*
- *Hormones and Healthy Lifespan*
- *Endocrine Aging*

Feb. 23 – The Skeletomuscular System - Class 6

- *Anatomy of Bone*
- *Physiology of Bone Growth and Renewal*
- *Anatomy of Muscles*
- *Physiology of Contraction and Movement*

Mar. 2 – Aging of Bone & Muscle, Arthritis, and Osteoporosis - Class 7 - *First Exam Given Out*

- *Age Related Changes in Muscles, Activity and Physical Performance*
- *Common Muscle Issues in the Elderly*
- *Age Related Changes in Bone in Males and Females*
- *Bone Problems in the Elderly (Osteoporosis, Fractures, etc)*

Mar. 9 – The Sensory System - Class 8 - *First Exam Due*

- *The Visual System and the Effects of Age*
- *The Auditory System and the Effects of Age*
- *The Olfactory System and the Effects of Age*
- *Touch and Balance*

Mar. 16 – The Nervous System - Class 9

- *Basic Anatomy of the Nervous System*
- *The Synapse: Target of Drug Therapy and of Drug Abuse*
- *How Neurons Communicate*
- *Normal Age-Related Changes in the Central and Peripheral Nervous Systems*
- *Dementias, Alzheimer's Disease, and Parkinson's Disease*

Mar. 23 – NO CLASS - Spring 2021 Wellness Day

Mar. 30 – The Respiratory System - Class 10

- *Anatomy and Physiology of the Respiratory System*
- *Age-Related Changes in Function*
- *Age-Related Disorders of the Respiratory System*
- *Respiratory Infection in the Elderly*

Apr. 6 - The Immune System - Class 11

- *Basic Components of the Immune System*
- *Age Related Changes in the Immune System*
- *Self-Recognition in the Immune System (Autoimmunity)*
- *Infectious Diseases in the Elderly (Shingles, Pneumonia, Candida, etc)*
- *The Role of Immunity in Aging*

Apr. 13 – The Urinary and Reproductive System - Class 12

- *Anatomy and Physiology of the Urinary Tracts and Changes with Age*
- *Incontinence in Males and Females*
- *Other Age-Related Changes in the Urinary System*
- *Anatomy and Physiology of the Reproductive Systems and Changes with Age*
- *Diseases of the Reproductive System*

Apr. 20 – The Cardiovascular System - Class 13

- *Anatomy and Physiology of the Cardiovascular System*
- *Atherosclerosis*
- *Stroke*
- *Other Common Cardiovascular Diseases Related to Age*

Apr 27 – The Integumentary System – Class 14 - *Second Exam Given Out*

- *Main Functions for Homeostasis*
- *The Aging Epidermis*
- *The Aging Dermis*
- *The Boundary Between Dermis and Epidermis, and Subcutaneous Tissue*
- *Vitamin D Production and Its Ramifications*
- *Skin Diseases Seen in Aging*

May 5 – *Term Paper Due*

May 11 – *Second Exam Due*

Student Evaluation

- **Grades** are based on performances on two exams (35% each), a term paper (25%), and mandatory attendance (5%).
- **Exams:** There will be two take-home exams, a midterm given out on **March 2** (due on **March 9**), and a final given on **April 27** (due on **May 11**). There will be a single question on each lecture, of which 4 of the 7 should be answered in a short essay (one-page answer maximum per question).
- **The exams are not cumulative.** The format for all exams and the term paper is single-spaced, Arial 12pt, and 1" margins. References and figures are NOT included in page counts.
- **Term paper (25% of overall grade):** There will be a 5-page term paper on a student-selected topic of relevance to this course. Please note that the subject matter and titles of all term papers must be approved in advance by the course instructor. All term papers are due on or before 5:00 pm on Wednesday, **May 5**.

Students will be required to write a term paper that reviews a significant area of relevance to the course material. The subject matter and titles of all term papers must be approved in advance by the course instructor. **All term papers must be submitted as .pdf files**

- The term paper must represent students' own original work and provide an in-depth review of an aspect of the course. The paper will count for 25% of the final grade in this class.
- Students are free to choose their own topics, but all topics must be approved by the course coordinator. Students should not start serious work on a research paper until they have received approval from the course coordinator.
- Student papers must be a minimum of five (5) pages in length, plus references. The reference list is in addition to the 5 pages minimum for text. Single-spaced type should be used, with a 12 point Ariel font. Other formatting requirements include the following: a one-inch all-around margin, all pages numbered consecutively. Papers must have an appropriate title, and students must be sure to print their own names on their papers.
- Student papers must include at least twenty (20) literature references. Students are encouraged to use the internet the campus libraries to find appropriate background information and references. The references used should primarily be published journal articles from the bio-medical literature, rather than books. Unpublished opinions from the internet and popular magazines are not appropriate sources. Numbers should be used to quote references directly in the text of term papers, like this for a single reference (1), and like this for multiple references to the same point (1, 2, 3). A list of references must appear at the end of each paper with each reference numbered in the same order it appears in the text.
- Extensive direct quotations are not appropriate for this term paper, and copying without giving credit is never acceptable. Any quote used should be no longer than three (3) lines long, and should be set inside quotation marks. The source for any quote must also be fully referenced in the reference list.
- Illustrations may be used but they must be each student's original work, and not simply reproduced from existing literature sources. Students may incorporate as many Illustrations as they wish into their papers, but illustrations do not count towards the minimum five (5) pages required for each paper.
- Footnotes should not be used.

- ***In the Reference List, all Journal References should look like this:***
 1. Cadenas, E. and Davies, K.J.A. (2000) Mitochondrial free radical production, oxidative stress, and aging. *Free Radic. Biol. Med.* **29**, 222-2230.
 2. Bota, D. and Davies, K.J.A. (2002) Lon protease preferentially degrades oxidized mitochondrial aconitase by an ATP-stimulated mechanism *Nature Cell Biol.* **4**, 674-680.
 3. Ermak, G., Sojitra, S., Yin, F., Cadenas, E., Cuervo, A.M., and Davies, K.J.A. (2012) Chronic Expression of RCAN1-1L Induces Mitochondrial Autophagy and a Metabolic Shift from Oxidative Phosphorylation to Glycolysis in Neuronal Cells. *J. Biol. Chem.* **287**, 14088- 14098.

- ***In the Reference List, all Reference to a chapter in a book should look like this:***
 1. Shringarpure, R. and Davies, K.J.A. (2009) Free radicals and oxidative stress in Aging. In: Handbook of Theories of Aging (Bengston, L., Gans, D., Putney, N.M., and Silverstein, M., eds.) Springer, New York. Chapter 13, pp. 229-243.
 2. Pickering, A.M. and Davies, K.J.A. (2012) Degradation of damaged proteins – the main function of the 20S proteasome. In: The Proteasomal System in Aging & Disease (Grune, T., ed.) Elsevier, New York. Chapter 3.2, [Prog Mol Biol Transl Sci.](#);109: 227-248.

All Term Papers will only be accepted as .pdf files

Statement on Academic Conduct, Diversity & Inclusion, Emergency Preparedness, and Support Systems

Students with Disabilities: (the information below was provided by the office of the Provost) Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure that the letter is delivered to the instructor as early in the semester as possible. DSP is located on campus in STU301 and is open from 8:30 am -5:00 pm Monday through Friday. The phone number for DSP is 213-740-0776 email: ability@usc.edu; web address: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html

Policies and Class Etiquette:

Students are expected to be courteous to others and arrive to class, in person or on-line, on time. *Students must turn off cellular phones and pagers during class* as well as any other electronic device that may ring or otherwise disrupt class. Personal laptops may be used for note-taking but not for 'recreational' purposes during class time. 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 during class discussions is expected of all students.

Statement on Academic Integrity:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by the instructor. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code (see University Governance,

Section 11.00), while the recommended sanctions are located in Appendix A. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>

Statement of Diversity & Inclusion

The USC Leonard Davis School of Gerontology is committed to creating an inclusive classroom environment that values the diversity of all its members. The School is committed to providing a purposefully inclusive community where all members and visitors are free from all intolerant behavior (including but not limited to harassment, verbal or written abuse, threats, ridicule, or intimidation). We encourage all members within our community to embrace and learn from the diversity within our classroom, school, and university.

Diversity at USC: Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university’s site on Campus Safety and Emergency Preparedness.

Support Systems

Student Health Counseling Services - (213) 740-7711 – 24/7 on call
engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call
engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086
equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710
studentaffairs.usc.edu/ssu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu

Non-emergency assistance or information.