Biol 490: Biology of Aging

Spring 2020, UNC-Chapel Hill

Topic: What is aging and how it is regulated?

Course objective: This course is designed for undergraduates who are interested in the topic of aging and understanding how aging is controlled at an advanced level. Emphasis will be placed on molecular and cellular mechanisms of aging in metazoans. Emphasis will also be placed on how progress and discoveries are made in the field of aging.

Prerequisites: Permission of the instructor. The course will be based on review articles and primary research papers, so it would be helpful if students had a working understanding of experimental biology.

Lectures: T, Th: 9:30am - 10:45am, Wilson 202

Instructor: Shawn Ahmed (shawn@med.unc.edu), Professor of Biology and Genetics

Office Hours: Thursday from 2:00pm - 3:00pm (216 Fordham Hall) and by appointment

Course Website: https://sakai.unc.edu/portal/site/3df17cc2-c24c-48c0-86ab-ec24fcd51493. Primary research papers, review articles, powerpoint presentations will be posted in the Resources section of the UNC Sakai site above. Please read research papers before class, so that you will be prepared to discuss them.

Course Goals: The broad objective of this course is to discuss the topic of aging and how to study it. Analysis of the molecular and cellular basis of aging has been an area of significant research for almost 30 years. This field has been relatively open with regards to development of models for how aging occurs. To understand how models are created and tested, we will discuss how to gather and interpret experimental data in the context of aging. Classical and modern techniques will be considered.

Course structure: The class will include a combination of Socratic lecture, interactive dialogue, and student-led discussion of primary scientific literature. Class discussions will be from primary scientific research articles. You may wish to review introductory cell biology, molecular biology or biochemistry material that you have previously had, which may be relevant to papers we discuss.

Assignments: Review articles and research papers will be used to explore topics in depth and at a complex level. We will also discuss factors about how research studies are initiated, conducted and completed. The papers will be posed in Sakai. You should expect to spend about 1-4 hours per week on the reading assignments.

Grading: Students will be evaluated based on written exams, based on their participation in class, and based on the quality of their oral presentations at the end of the semester.

75% - Written exams - two mid-terms and a final - open book. Exams will consist of questions that are meant to emphasize a conceptual understanding of how aging is studied.

15% - Class participation - small groups will lead discussion of specific figures from research articles. You can contribute to the discussion by asking or answering questions, by responding to comments by other students, by explaining figures or text from the article being discussed, or simply by contributing to the discussion in small groups.

10% - Research project. Find a primary research paper relevant to a class topic that interests you. Do some research on the topic (based on Introductions and Discussions of related papers and review articles), write a 1 page summary of the paper and a 1 page plan for future experiments. Please complete by March 1.

Diversity Statement: The instructor of this course values the perspectives of individuals from all backgrounds reflecting the diversity of our students. Diversity can be broadly defined to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. This classroom should be an inclusive learning space for all students.

Syllabus

Jan 9	Introduction, universal phenomenon of aging
Jan 14	Evolution of aging
Jan 16	Model organisms in aging research: invertebrates
Jan 21	Model organisms in aging research: vertebrates
Jan 23	Human centenarians
Jan 28	Conserved aging pathways: sirtuins, insulin/IGF1 signaling
Jan 30	Conserved aging pathways: mTOR, microbiome
Feb 4	Cellular senescence, ALT
Feb 6	Telomerase, animal species, development, telomerase KO, cloning

Feb 11	**Exam 1**
Feb 13	Cancer and aging, p53 pathway
Feb 18	Cell death: apoptosis, necrosis
Feb 20	Aging in p53 mutant mice
Feb 25	SIPS, OIS
Feb 27	Oxidative theory of aging
Mar 3	Accumulation of mutations in nuclear genome
Mar 5	Accumulation of mutations in mitochondrial genome
Mar 10	no class - Spring Break
Mar 12	no class - Spring Break
Mar 17	Epigenetic changes
Mar 19	DNA repair
Mar 24	**Exam II**
Mar 26	Human progeroid syndromes I: Werner syndrome
Mar 31	Human progeroid syndromes II: H-G progeria, others
Apr 2	Mechanisms of aging: proteostasis
Apr 7	no class
Apr 9	Stem cells
Apr 14	Aging of organ systems
Apr 16	Interventions to slow down aging: caloric restriction
Apr 21	Interventions to slow down aging: exercise, dietary supplements
Apr 23	Geriatrics

May 1 Final Exam - 8:00 am (Wilson 202)