

Biol 3140: Biology of Aging **Fall 2014**

Instructors

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Meeting time and place

Depending on the day of the week our class will meet in different places but we will always meet at the same time 1-1:50.

- Monday and Wednesday: Ruffner B008
- Friday: Clark Hall 103

Office hours are as follows:

- Monday 2-3:00 (DR): Gilmer 047
- Wednesday 11-12:00 (KBK): Gilmer 056
- Friday 9-10:00 (KBK): Gilmer 056

Course Description

Why do we age? How can some species, like lobster, escape aging? We would all like to understand human aging but, as you will see, even if that is our motivation we cannot experiment with humans and it is only through experiments with other species that the hypotheses about the causes of aging can be tested. Beyond the lab, we can also look at species in the wild, such as lobsters, mayflies, and trees to uncover extreme variation in the patterns of aging in the natural world.

How do evolutionary theories, ecology, cell biology and genetics help us to understand variation in the patterns of aging across species from bacteria to plants to *Drosophila*? Different disciplines across biology study aging with different tools and we will integrate these approaches to synthesize what is known across multiple fields. Most people come to this subject expecting one answer so please do not get frustrated when you find that there are many reasons that organisms age. This is a very active field of research and we do not yet know all of the answers.

My broader goal is to provide you with skills to understand how science is done. You will learn how to read primary scientific literature and how to interpret data. In the future when you read in the *New York Times* about the latest discoveries, you can put them into context and make your own evaluation about the validity of new findings. Someday, in your lifetime, someone will develop an intervention to slow the process of aging in humans, and I hope that you will be able to understand the biology of these interventions and be in a position to address the implications of these discoveries for society.

Course Objectives

In this course you will learn about the biology of aging across all species and you will develop skills to think like a scientist. Specifically I expect that you will be able to,

- Identify and explain variation in the patterns of aging.
- Know how aging might be manipulated in the future.
- Synthesize different disciplinary approaches to understand aging.
- Acquire and demonstrate an ability to read primary scientific literature, to interpret results and to understand how science is done.
- Develop a lifelong interest in aging, and in science in general.

Your role

To succeed in this class you need to come to class because it is here that we will do most of our learning. I write on the board, I draw graphs, I diagram concepts I encourage discussion and expansion of concepts not included in my power points and you can only get this if you are present.

The class will be a mixed format of lecture, interrupted by give-and-take questions, and individual or group problems. We are too large to be a seminar but in this active learning environment I do not want to have a one-way conversation so please interrupt me during lectures with questions about the topic being discussed or comments about a recent (but relevant) article you read about the topic.

This is a cumulative course, not only in the sense that you will develop a cumulative knowledge about the biology of aging, but also because tools that you will learn to measure aging in the first week of class will be used throughout the semester. To succeed you will thus need to keep up with the readings and be sure to come to see me if you are having problems with any of the assignments or the material. I recognize that we have a range of students in this class that includes first- to fourth-year students and Biology and non-Biology majors. I will do my best to give everyone a common background to understand the materials. I hope that you will also do your best to recognize when you might need more background readings or extra help and that you will come to see either me or Karen, my teaching assistant.

Finally, there is no textbook for the class and all readings are derived from the primary literature that will be provided in a weekly folder on the class Collab page. At the beginning of the semester I will provide guides to help you learn to read these papers. To prepare for class there will be homework questions about the readings and/or the lecture material, and these will also be in the weekly folder. After class I suggest that you go back and read the paper again, together with your notes, to put all of the pieces together.

Assessment

Lecture questions: There will be a number of in-class activities that will provide you with an opportunity to engage with the course material and to check your understanding. These will include **iClicker** questions during lecture and an occasional one-sentence summary, or one question query, after a lecture. Many of these questions are designed to guide you through the lecture material. In addition, during the course of the semester there will be at least 55 designated 'pop-quiz' clicker or short-answer questions. These pop-quiz questions will review material from a previous lecture and should be straight forward if you regularly keep up with the material. You can receive a maximum grade of 50 correct answers on these questions and please note that there will be more than 50 quiz questions during the semester thus you will not be penalized if you must miss a class.

Homework: The homework activities are designed to guide your review of the class material and your reading of the literature. Following nearly all lectures, you will have a few homework questions about the lecture and/or the reading for the next class. Many of these questions are from old exams and will give you an opportunity to review and apply what you have learned. Homework questions about the reading will provide you with a guide to understanding the most important parts of the assigned papers. Homework will be submitted on the **Assignments** tab in Collab and you will receive full credit for all assignments handed in with thoughtful answers. Each week we will check a subset of assignments handed in and will discuss common problems or questions with the assignments in the next class.

Mid-Term Tests: These tests will be a combination of multiple choice, short answer and graphing and will assess the knowledge and skills you have developed in each of the three sections of the course. Please remember that many of the homework and in-class exercises are test questions from previous semesters so you should have a good sense of the format and type of question to expect on these tests. In order to relieve test anxiety you will be allowed to bring one note card (4x6) to the tests with any notes that you may need.

Final Exam: This exam will be cumulative and 50% of it will focus on a recently published paper. One of the major objectives of the class is to help you learn to read and understand scientific literature and you will have many opportunities to do this during the semester. During this exam you will be given a research paper that addresses some aspect of aging that you have never seen before. You will have the chance to interpret the results and put them in the context of what you have learned. You will have plenty of time, all three hours of the scheduled exam time, to read the paper and respond to the associated questions. Again, you may bring a small note card into this exam.

Grades

The different components of your final grade will be weighted as follows: Pop-quiz questions (15%), Homework (5%), Midterm Tests (20% each, total 60%), Final Exam (20%). The letter grades will be set using the cutoffs of 90/100 (lowest A-), 80/100 (lowest B-) etc. but these guidelines are a minimum and may be lowered if the median grade for the class is lower than 80.

Academic Integrity

I have every expectation that you will take your academic work seriously and that you will do it with honor, as expected in the UVA community. There will be many opportunities to work with other students on the course material, both in class and outside, but all tests must be pledged and done independently and without notes. Violations of the UVA Honor Code will be referred to the Honor Council.

Missed exams

Make-up tests are only allowed under extreme circumstances and you must contact me 24 hours before an exam. Please note that you must notify me before an assignment or test that you will not be doing it at the scheduled time. Otherwise you will receive no credit for the scheduled assignment.

Course Schedule

There are three major sections of this course and some of the major questions/topics to be covered are outlined on the weekly schedule given below. Please see the **Resources Link** for week-by-week folders with readings, homework, and power points.

I. NATURAL HISTORY AND DEMOGRAPHY OF AGING

Week 1 (August 27-29): What is aging?

Week 2 (September 1-5): How do we measure aging?

Week 3 (September 8-12): What are the patterns of aging across species in wild populations?

Week 4 (September 15-19): How can aging be measured in an individual?

Sept 19: Test #1

II. WHY THEORIES OF AGING

Week 5 (September 22-26): Selection retires in old age

Week 6 (Sept. 29-Oct 3): Is human lifespan shortened by reproduction?

Week 7 (Oct 6-10): Why do whales and humans have menopause?

Week 8 (Oct 13-17): Is evolution needed to understand aging?

Oct 13: FALL BREAK

Oct 17: Test #2

III. HOW THEORIES OF AGING

Week 9 (Oct 20-24): Does cell aging really protect us from cancer?

Week 10 (Oct 27-31): Every breath you take hastens your death.

Week 11 (Nov 3-7): Eat less and live longer?

Week 12 (Nov 10-14): Homology in aging pathways from nematodes to mice to humans.

Nov 10 and 12: No class (see homework assignment)

Week 13 (Nov 17-21): A little stress is good for you

Nov 21: Test #3

Week 14 (Nov 24-28): To live long you must carefully choose your parents

Nov 26-28: THANKSGIVING BREAK

Week 15 (Dec 1-5): What do we still not know about aging?

FINAL EXAM: Dec 13 (Saturday) 9-12 Gilmer 190

Important dates

- **Homework:** The due date for homework will be given with the assignment and there will be no credit for late work.
- **Tests and Exam:** Three midterm tests will be given during class on Sept. 19, Oct 17 and Nov 21 and the Final Exam will be given on December 13.
- **Registration:** The College dates for dropping are Sept. 10th (no penalty) and Oct 10th ('W' Grade).