Bi410/510 Biology of Aging

Aging affects most living organisms and is the primary risk factor for common human diseases such as cancer, cardiovascular disorders, and neurodegeneration. Perhaps surprisingly, rates of aging are under genetic control and vary widely among different species. This course will use primary literature to examine the molecular and cellular mechanisms that regulate aging and to explore approaches that slow or reverse the aging process. Students will be required to complete regular homework assignments and in-class quizzes. During the second half of the course, students will work in small groups to prepare for in-class oral debates on assigned topics. Students will participate in these debates and will also submit their debate arguments in written form.

Learning objectives
After completing this course students will be able to:
- explain the aging process at a molecular/cellular level, including how it is analyzed and quantified
- distinguish between alternative evolutionary explanations of aging
- interpret and evaluate experimental data from primary biological literature
- evaluate potential strategies for altering the aging process
- formulate logical scientific arguments and communicate them orally and in writing

Course website
All course materials will be available through Canvas.

Office hours and email
I will not hold regular office hours, but I welcome requests to meet by appointment. Please email me to schedule an appointment, or you may also email me with questions or comments (**herman@uoregon.edu**). Please send messages from your **uoregon account** and include **BI410/510** in the header. Your email correspondences are an extension of your class participation, so please maintain a professional tone. I will generally respond to email messages within one or two days.

Required reading
The schedule of required readings is listed in the schedule below. All are available as PDF files posted on Canvas. Please complete the readings BEFORE the class indicated.

Homework assignments
There will be eight homework assignments that will cover the required readings and material discussed in class. Homeworks will be posted on Canvas: answer the questions and upload them to Canvas. Homeworks will be posted by the end of Monday and will be due by 11AM on Wednesdays (listed in the schedule below): each homework will consist of short questions on material from Monday's class and the required readings for the Wednesday class. Late homeworks will not be accepted. Students are permitted to discuss the questions with each other, but their answers must be their own independent work.

Lecture notes
The course format will be a combination of lectures, class exercises, and discussions. I will post my lecture notes on Canvas AFTER the lecture, but these notes are NOT a substitute for coming to class.

Grading policy

Homeworks (25%): There will be eight homeworks (see above) each due by Wed 11AM (see schedule below). Late homeworks will not be accepted.

Quizzes (25%): There will be seven quizzes (~15 minutes each) that will take place at the beginning of Monday classes (see schedule below). These will cover material from the previous week.

Attendance (5%): Attendance will be taken in each class period. The course will be a richer experience for those who read the assigned material beforehand and attend and participate in class discussions.

Debate (35%): During the second half of the course, students will work in small groups (10 groups of 3 students each) to prepare for in-class oral debates on assigned topics. Students will participate in these debates *(15%)* and will also submit their debate arguments in written form *(20%)*. Detailed guidelines and criteria for assessment will be provided.

Debate assessment (5%): Following specific guidelines that will be provided, each student will submit a written assessment of the debates that they do not directly participate in.

Mind map (5%): Each student will submit a mind map on the topic of aging. Guidelines and criteria for assessment will be provided.

Academic Integrity: All students are expected to conform to the student conduct code (http://dos.uoregon.edu/conduct). You are encouraged to discuss ideas with each other. However, all submitted written work, including answers to homework questions and quizzes, debate arguments and assessments, and mind maps must be your original work. Proper citation of sources is required in all written work and oral presentations.

Inclusiveness: UO is working to create inclusive learning environments. Please notify me if there are aspects of instruction or design of this course that result in barriers to your participation. You may also wish to contact the Accessible Education Center (541-346-1155; usaec@uoregon.edu).

Date	Topic	Required readings	Homeworks and Quizzes
Week 1	**I. What is aging?**		
M 4/3	1. What is aging?	none	none
W 4/5	2. Evolutionary explanations for aging	2a. Octopus and the puzzle of aging 2b. Is aging programmed? "Intro", "Discussion" 2c. Evolution of aging: "Introduction" only	**Homework 1 DUE 11 am**
Week 2			
M 4/10	3. Is aging inevitable?	3. Hydra do not age (2015)	**QUIZ 1**
W 4/12	4. Aging cells accumulate lifespan-limiting material	4a. Using yeast to study aging: up through "The basic methodology and new variants" 4b. Asymmetric partitioning of "aging factors" between mother and daughter cells (2015)	**Homework 2 DUE 11am**
Week 3	**II. Aging is caused by the accumulation of damage**		
M 4/17	5. DNA damage accumulates in aging cells	5a. Aging as imperfect homeostasis: up through "Loss of telomeres" 5b. Molecular biology of the gene: p 247-254 5c. The hallmarks of aging: "Introduction," "Genomic instability," "Telomere attrition"	**QUIZ 2**
W 4/19	6. Preventing DNA damage increases longevity	6. Increasing telomerase slows aging in cancer-resistant mice (2008)	**Homework 3 DUE 11am**
Week 4			
M 4/24	7. DNA damage causes cells to enter a "senescent" state	5c. The hallmarks of aging: "Cellular senescence" 7. Cellular senescence	**QUIZ 3**
W 4/26	8. Senescent cells interfere with the function of healthy cells	8. Senescent cells shorten healthy lifespan (2016)	**Homework 4 DUE 11am**
Week 5			
M 5/1	9. Damaged proteins accumulate in aging cells **Debate topics assigned**	5c. The hallmarks of aging: "Loss of proteostasis" 9. Neuronal aggregates: through "Autophagy: the cardinal clearance pathway"	**QUIZ 4**
W 5/3	10. Preventing the accumulation of damaged proteins increases longevity	10. Increasing autophagy in fly neurons increases longevity	**Homework 5 DUE 11am**
Week 6	**III. Long-lived mutants are missing pathways that promote aging**		
M 5/8	11. Long-lived worms: the IGF-1/Insulin/FOXO pathway	11a.The first long-lived mutants 11b. The genetics of aging: through "IGF/Insulin signaling" plus correction	**QUIZ 5**
W 5/10	12. How does FOXO keep neurons young?	12. Targets of FOXO in adult worm neurons	**Homework 6 DUE 11am**

Date	Topic	Required readings	Homeworks and Quizzes
Week 7			
M 5/15	13. Long-lived yeast: the mTOR pathway and dietary restriction	13a. Minireview accompanying yeast paper 13b. Long-lived yeast mutants include those lacking TOR1	• **QUIZ 6** • **Debate outline DUE**
W 5/17	14. mTOR also promotes aging in mouse	14. Reducing mTor increases mouse longevity	**Homework 7 DUE 11am**
Week 8	**IV. Intervening in human aging**		
M 5/22	15. The search for anti-aging interventions	15a. Lifespan vs. healthspan 15b. The search for anti-aging interventions	**QUIZ 7**
W 5/29	16. Using worms to ID anti-aging drugs	16. Using worms to ID drugs that increase longevity	**Homework 8 DUE 11 am**
Week 9			
M 5/29	**Memorial Day**	**NO CLASS!**	
W 5/31	**DEBATES 1 & 2**		
Week 10			
M 6/5	**DEBATES 3 & 4**		
W 6/7	**DEBATE 5**		
Finals week			
M 6/12			• **Debate write-up DUE** • **Assessments of other debates DUE** • **Mind map DUE**