

Physiology of Aging Syllabus, Fall 2022

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Prerequisites: This course requires a basic knowledge of cell biology that can be obtained in courses like: BIOL 203 OR KINE 200 OR KINE 304

Textbook: None

Goals: To build your basic knowledge of the physiological processes associated with aging including common pathologies. To develop your ability to analyze and present scientific research papers in aging.

Grading:

Research Paper Discussions	90 pts.	Weekly (9 total, 90 pts. each)
Test #1	40 pts.	Sept. 27
Test #2	40 pts.	Oct. 27
Test #3	40 pts.	Dec. 1
Final Exam (Comprehensive)	<u>40 pts.</u>	Dec. 16, 2:00-5:00 (tentative)
TOTAL	250 pts.	

Tests:

Tests will be multiple-choice. If an alternate date is needed for tests due to scheduling conflicts, an earlier test date will be allowed if arranged at least one week prior with the professor. If a later date is needed due to illness or personal crisis (contact the Dean of Students), the test can be taken within one week after the test without penalty. Without an excuse, a late test will be allowed, but **5% will be deducted if taken within one week, and 10% will be deducted if taken later than one week after the test date.**

Alternate dates for the final exam are allowed but **require approval from the Dean of Students.**

Preparation for tests: Test questions typically require that you not only master the terminology and sequence of events in a physiological process, but also be able to apply the knowledge to new situations. Study questions will be provided before each test. It is highly recommended that you read the Blackboard notes for each lecture **before** attending the lecture.

Paper Discussions:

Paper discussions will consist of reading an assigned original research paper, and then writing a brief 1-page summary of the paper (**5 points, due by 10:00 AM the day of the discussion; late summaries will lose 0.5 point**), and discussing the paper in class (**5 points**).

The written summary should include, *in your own words*, the purpose/hypothesis of the paper, a description of the key figures/tables including **what the data shows** and **what it means**, and overall conclusions/significance of the paper. You can write it in paragraph or outline/bullet-point form. **Submit your summaries on Blackboard by the deadline.**

Your small group will be assigned a figure or table to present, and you will have time in class to discuss the figure/table and organize your presentation within your small group before presenting to the class. Your group should present: 1) overall purpose of the figure, 2) each panel of the figure include what the axes mean and what the figure shows, 3) overall conclusion of the figure, 4) any limitations or problems with the methodology used or conclusions made by the authors.

Questions regarding the papers will appear on tests, so attendance and participation in important.

Missed Discussions: If you are going to miss a paper discussion, you may turn in a more detailed written summary (~4 pages) instead, which will be **due by 5:00 on the day of the discussion**, or points will be deducted (5% if turned in within 1 week, 10% after 1 week). Be advised that it is difficult to earn full credit with this written option. **You will only be able to take this option for 2 paper discussions.**

Final grading:

Final grading is based on the standard scale cut-points (e.g., A=93%, A-=90%, B+=87%, B=93%, B-=80%, etc.), however, if the mean is <80%, then grading is on the curve, with the mean representing the lowest B. Grades are generally not rounded up unless the score is within 0.5 points of the next grade bracket. *There is no opportunity for extra credit assignments in this course.*

Topics:

- I. Introduction to Aging and Human Longevity
 - A. What is Aging & How is it Studied
 - B. History of Human Life Span
 - C. Diseases of Aging
- II. Theories of Life Span and Aging
 - A. Comparative Approaches, Physiological Correlates, Genetic Models
 - B. Cellular Senescence and Death
 - C. Oxidants and Antioxidants in Aging
 - D. Caloric Restriction and the Insulin/IGF-1 Pathway
 - E. Genes Associated with Longevity
- III. Systemic Alterations with Aging
 - A. Nervous System
 - B. Sensory Systems
 - C. Endocrine System
 - D. Cardiovascular System
 - E. Respiratory System
 - F. Renal System
 - G. Urinary and Reproductive Systems
 - H. Musculo-Skeletal System; Skin
- IV. Strategies for Healthful Aging

Schedule:

Thurs., Sept. 1	Lecture #1: Introduction to Aging/Longevity
Tues., Sept. 6	Lecture #2: Theories of Life Span and Aging (Genetic Models, Telomeres)
Thurs., Sept. 8	Paper #1
Tues., Sept. 13	Lecture #3: Theories of Aging (Oxidative Stress)
Thurs., Sept. 15	Paper #2
Tues., Sept. 20	Lecture #4: Hallmarks of Aging, Caloric Restriction, Strategies to Slow Aging
Thurs., Sept. 22	Paper #3
Tues., Sept. 27	TEST #1
Thurs., Sept. 29	Lecture #5: Nervous System (Structural Changes, Memory, Dementia)
Tues., Oct. 4	Paper #4
Thurs., Oct. 6	Lecture #6: Nervous System (Alzheimer's, Motor Control, Parkinson's)
Tues. Oct. 11	Paper #5
Thurs., Oct. 13	FALL BREAK
Tues., Oct. 18	Lecture #7: Nervous System (Sleep, Vision, Hearing)
Thurs., Oct. 20	Paper #6
Tues., Oct. 25	Lecture #8: Endocrine System (Stress)
Thurs., Oct. 27	TEST #2
Tues., Nov. 1	ELECTION DAY
Thurs., Nov. 3	Lecture #9: Endocrine System (Metabolism), Cardiovascular System
Tues., Nov. 8	Paper #7
Thurs., Nov. 10	Lecture #10: Atherosclerosis, Respiratory and Renal Systems
Tues., Nov. 15	Paper #8
Thurs., Nov. 17	Lecture #11: Urinary and Reproductive Systems, Bones/Joints
Tues., Nov. 22	Video: The 90+ Study – REMOTE
Thur., Nov. 24	THANKSGIVING
Tues., Nov. 29	Lecture #12: Muscle, Skin
Thurs., Dec. 1	TEST #3
Tues., Dec. 6	Paper #9
Thurs., Dec. 8	Lecture #13: Strategies for Healthful Aging

FINAL EXAM **Fri., Dec. 16, 2:00-5:00 (tentative)**

Accommodations: It is the policy of William & Mary to accommodate students with disabilities and qualifying diagnosed conditions in accordance with federal and state laws. Any student who feels s/he may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at sas@wm.edu to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please visit www.wm.edu/sas. Department Diversity Plan: <https://www.wm.edu/as/kinesiology/diversity-plan/index.php>.

Discussion Papers

- 1) Xu, et al. Senolytics improve physical function and increase life span in old age. Nature Medicine 24:1246-56, 2018.
- 2) Fahy, et al. Reversal of epigenetic aging and immunosenescent trends in humans. Aging Cell 00:e13028, 2019.
- 3) Spadaor, et al. Caloric restriction in humans reveals immunometabolic regulators of health span. Science 375:671-677, 2022.
- 4) Yoshida, et al. Extracellular vesicle-contained eNAMPT delays aging and extends lifespan in mice. Cell Metabolism 30:329-42, 2019.
- 5) Lourenco, et al. Exercise-linked FNDC5/irisin rescues synaptic plasticity and memory defects in Alzheimer's models. Nature Medicine 25:165-75, 2019.
- 6) Horowitz, et al. Blood factors transfer beneficial effects of exercise on neurogenesis and cognition in the aged brain. Science 367-173, 2020.
- 7) Holth, et al. The sleep-wake cycle regulates brain interstitial fluid tau in mice and CSF in humans. Science 363:880-84, 2019.
- 8) Lu, et al. Reprogramming to recover youthful epigenetic information and restore vision. Nature 588:124-129, 2020.
- 9) Palla, et al. Inhibition of prostaglandin-degrading enzyme 15-PGDH rejuvenates aged muscle mass and strength. Science 371:eabc8059, 2021.