

SYLLABUS - NEUROPHYSIOLOGY OF AGING
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Office Hours: Mon 12:30-1:30, Fri 1:00-2:00

Attribute: COLL 400. Satisfies the major writing requirement in Kinesiology & Health Sciences, and Neuroscience (when co-enrolled with NSCI 300).

Prerequisites: Human Physiology (KINE 304) or Neurobiology (BIOL 345)

Textbook: None, we will use current scientific journal articles

Goals: To provide in-depth knowledge of the physiological changes in the nervous system with aging, including common pathologies, and to refine skills needed to evaluate and synthesize the scientific literature. This includes lectures on each topic, systematic analysis of the basic scientific literature, construction of an original research proposal, and oral presentation of the proposal.

Grading:

Research Paper Discussions	90 pts.	Weekly (9 total, 10 pts. each)
Written Research Proposal	60 pts.	
Oral Presentation	40 pts.	
Ask Questions During Presentations	10 pts.	(5 questions, 2 pts. each)
Quiz #1	30 pts.	
Quiz #2	<u>30 pts.</u>	
TOTAL	260 pts.	

Quizzes: Quizzes are multiple-choice, but you have the opportunity to explain any answer and potentially earn partial credit. It is possible to take a quiz early (if pre-arranged ~1 week in advance with instructor). Late quizzes are allowed in case of illness or personal hardship (as approved by Dean of Students). It is also allowed by choice, but will result in a point deduction (5% if taken within 1 week, 10% after 1 week).

Final Exam: Because this is a seminar course, there is no final exam.

Paper Discussions:

Paper discussions will consist of reading an assigned original research paper, and presenting an assigned figure/table with your small group (**10 pts. each paper, 90 pts. total**).

Your figure/table presentation should include:

- 1) the overall purpose of the experiments
- 2) an explanation of each panel of data, including the methods/approach used (if not obvious)
- 3) the significance of the data and its importance to the paper overall
- 4) any limitations of the data

In class format:

- 1) instructor will present the background, hypothesis, and general methods of the paper
- 2) your small group will have some time to organize your figure/table presentation
- 3) small groups will then present figures to class
- 4) instructor will present conclusions, significance, limitations

Missed Discussions: If you are going to miss a paper discussion, you may turn in (by e-mail) a detailed written analysis (3-5 pages; essay style) which includes the purpose/hypothesis of the paper, an explanation of the data and significance of each figure/table, and overall conclusions, significance, and limitations of the paper. The analysis is **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). **You will only be able to take this option for 2 paper discussions.** If you miss more than 2 paper discussions, there is no opportunity to make-up the work.

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.

Course Project:

Students will write a research proposal (60 pts) on one of the topics discussed in class and present it to the class (40 pts) in a way that a non-scientist could understand. The written proposal will include:

- a) Abstract (1 page) written in lay-person terms.
- b) Background on the topic (3-5 pages), including all previous relevant studies performed on the topic, detailed explanations of the pathways/processes being studied, rationale for the proposed experiment. Generally, at least 10 references (usually more) are needed to sufficiently explain the current knowledge on the topic.
- c) Hypothesis (1 paragraph) sufficiently focused that it can be tested with a few experiments
- d) Study Design (2-4 pages): explain the experimental design, test subjects/model, methods used
- e) Potential results and what they would mean (1-2 pages): consider all experimental outcomes
- f) Significance of the study (1-2 paragraphs): explain how would it contribute to our knowledge

The oral presentation should:

- a) be ~15 minutes in length (~10 Powerpoint Slides)
- b) be composed to communicate with a lay audience
- c) include a simple visual model of the pathway, process, or problem to be examined
- d) a clear rationale for the study and why the question is important
- e) simple explanations of the approaches and techniques to be used and their limitations
- f) predicted results and what they would mean

Ask Questions: You will be expected to ask a total of 5 questions during the student talks (2 pts. each, 10 pts. total). The abstract for each talk will be available to the class before each presentation. **You will turn in a written copy of your question/s to the instructor at the end of the class period on the days you ask your question/s.**

Lecture Topics:

- 1) Introduction to Aging and Human Longevity
 - a) What is Aging & How is it Studied
 - b) History of Human Life Span
 - c) Biological Hallmarks of Aging
- 2) General Changes in the Nervous System with Aging
 - a) Structural changes in the brain – neuron number/function, glial cells, connectivity, synaptic plasticity, neurotransmitters
 - b) Discrete areas of neuron loss
 - c) Abnormal inclusions in the brain
 - d) Overview of functional changes in the brain
- 3) Learning, Memory, Dementias, Alzheimer's Disease
 - a) Overview of brain areas and processes involved in learning and memory
 - b) Specific changes in memory and learning processes with aging
 - c) Types of dementias
 - d) Alzheimer's disease – risk factors, genetics, cellular/molecular mechanisms, treatments
 - e) Multi-infarct dementia and stroke
- 4) Motor Control, Parkinson's Disease
 - a) Overview of brain areas and processes involved in motor control
 - b) Specific changes in motor control and gait with aging
 - c) Parkinson's disease – risk factors, genetics, cellular/molecular mechanisms, treatments
- 5) Sleep and Circadian Rhythms
 - a) Overview of neural control of circadian rhythms and sleep
 - b) Specific changes in circadian and sleep patterns with aging
 - c) Link between sleep disturbances and dementia
 - d) Discovery and importance of the glymphatic system and the role of sleep in its function
- 6) Vision and Hearing
 - a) Overview of the visual system
 - b) Changes in the structure and function of the visual system with aging
 - c) Diseases of the eye with aging – pathology and treatments
 - d) Overview of the auditory system
 - e) Changes in structure and function of the auditory system with aging
 - f) Four types of presbycusis with aging – pathology and treatments
- 7) Neuroendocrine Control of Stress Responses
 - a) The hypothalamic-pituitary-adrenal axis' role in stress responses
 - b) Other neural-hormonal responses to stress
 - c) Changes in stress responses with aging
 - d) Link between chronic stress and accelerated aging

Schedule

Wed., Jan. 16	Lecture #1: Introduction to the Science of Aging/Longevity	
Mon., Jan. 21	Lecture #2: General Changes in Nervous System with Aging	
Wed., Jan. 23	Paper #1 and general information about scientific journals	
Mon., Jan. 28	Lecture #3: Learning/Memory, Dementias	
Wed., Jan. 30	Paper #2	
Mon., Feb. 4	Lecture #4: Alzheimer's Disease	[Topic & References Due]
Wed., Feb. 6	Paper #3	
Mon., Feb. 11	Lecture #5: Motor Control, Parkinson's Disease	
Wed., Feb. 13	Paper #4	
Mon., Feb. 18	Lecture #6: Sleep and Circadian Rhythms	
Wed., Feb. 20	Paper #5	
Mon., Feb. 25	Quiz #1	
Wed., Feb. 27	Paper #6	
SPRING BREAK		
Mon., Mar. 11	Lecture #7: Vision and Hearing	[First Draft Due, 5:00 PM]
Wed., Mar. 13	Paper #7	
Mon., Mar. 18	Lecture #8: Neuroendocrine Control of Stress Responses	
Wed., Mar. 20	Paper #8	
Mon., Mar. 25	Lecture #9: Anti-aging Interventions	
Wed., Mar. 27	Paper #9	
Mon., Apr. 1	Quiz #2	
Wed., Apr. 3	TBA	[small group discussion of project abstracts]
Mon., Apr. 8	Student Presentations	
Wed., April 10	Student Presentations	
Mon., April 15	Student Presentations	
Wed., April 17	Student Presentations	
Mon., April 22	Student Presentations	
Wed., April 24	Student Presentations	[Final Draft Due, 5:00 PM]
Wed., May 8	Final Presentation Powerpoint Due by 2:00 PM Sharp	

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 757-221-2509 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.