

Psychology 5089: Cognitive Aging, Neurodegeneration, and Neuroplasticity

Professor: Scott M. Hayes, Ph.D.

Time: Tuesdays and Thursdays (12:45 pm to 2:05 pm)

Location: Psychology Building

Format: Lecture

Credits: 3

Prerequisites: A grade of C- or above in 2220, and 2300, and 3313 or 3513; or a grade of B or above in 3313 and Neurosc 3000, and Neuroscience major; or Grad standing

Instructor contact information: email: hayes.1074@osu.edu; phone: 614-292-3357

Office Hours (Room 143, Psychology Building): Thursdays 11:00 to 12:00 or by appointment

Course Assistant:

Contact Information:

Office Hours: by appointment

Course Overview: This course will cover changes in adult cognition (emphasis on memory) and the brain (emphasis on structural and functional MRI studies) as a result of normal aging and age-related neurodegenerative diseases (such as Alzheimer's disease and vascular dementia). The course will also cover factors that contribute to neuroplasticity and may attenuate age- and disease-related neural and cognitive decline, such as nutrition, fitness, physical activity, exercise, and videogaming. Course content will thus cover the spectrum of cognitive and brain health among older adults: from the super-agers to those with dementia.

Major themes:

This course will cover 3 major themes:

- 1. The effects of aging on cognition and the brain.** The course will cover age-related trajectories of performance across cognitive domains with a focus on memory. The course will also cover structural and functional MRI studies that have examined age-related brain alterations.
- 2. Cognitive and neural correlates of age-related neurodegenerative disease.** The course will cover the cognitive and neural transition from normal aging to dementia. Students will learn the defining features of cognitive impairments and brain alterations in older adults who do not yet meet criteria for dementia, such as mild cognitive impairment, vascular cognitive impairment (no dementia), and motoric cognitive risk syndrome. Students will also learn about the hallmark cognitive and brain changes in common neurodegenerative diseases, such as Alzheimer's disease.
- 3. Factors associated with neuroplasticity.** Although there is a common belief that there is ubiquitous cognitive and neural decline as we age, there is in fact remarkable individual variability. The course will cover the latest research identifying factors that may attenuate age- and disease-related cognitive and neural decline. The course will cover the relationship among modifiable factors, such as physical activity, fitness, nutrition, videogaming, cognitive health and brain health.

Learning Objectives:

1. Students will be able to describe the trajectory of cognitive decline across different cognitive domains.
2. Students will be able to describe which brain structures are most susceptible to age-related decline.
3. Students will be able to describe different types of age-related changes in brain activation and brain connectivity.
4. Students will be able to describe prodromal disease states based on cognitive and brain data.
5. Students will be able to differentiate the presentation of various neurodegenerative diseases, such as Alzheimer's and cerebrovascular disease

6. Students will be able to describe the evidence for multiple interventions (various types of exercise, videogaming) to attenuate cognitive and neural decline in aging and disease.
7. Students will learn to work within a small group to lead a class discussion.
8. Students will learn to give a scientific oral presentation.

Materials. The primary source of materials will be a textbook (Physical Activity and the Aging Brain, 2017, R.W. Watson (Ed.), ISBN: 978-0-12-805094-1) and scientific journal articles that will be made available in Carmen.

EVALUATION

Exams. There will be three exams: two midterm exams and a final exam. The second midterm exam will primarily focus on material covered since the first midterm. The final exam will focus primarily on topics covered in the last third of the course. Note, however, the topics covered on these exams incorporate prior concepts and thus knowledge of the prior material will be expected to answer questions on the final exam successfully. Thus, exams should be considered cumulative. Exams will cover material from the readings and lectures. Each exam will consist of multiple choice and possibly some short answer and/or essay questions. Makeup exams will be considered only in the most dire of situations and will require professional documentation.

Midterm Exam 1 (100 points)

Midterm Exam 2 (100 points)

Final Exam (120 points)

Group Projects: Groups consisting of undergraduate and graduate students will be assigned at the beginning of the semester. Group size will be determined based on the number of enrolled students. Your group will work together on the following:

Reaction Presentations (75 points). For each class there will be a group lead reaction presentation. The assigned group will be responsible for generating critical points of discussion and thought questions for the class (based on the assigned readings) as well as facilitating class discussion. You will be expected to have your thought-provoking comments and questions prepared prior to class (in powerpoint). **Graduate students** will be assigned as group leaders and have the primary role in facilitating discussion, although **undergraduates** are also expected to contribute.

Class Exercises (50 points). During each class we will take at least one 5-minute exercise break (which have been linked to better exam scores in an academic setting; Fenesi et al., 2016). Your group will design a 5 min exercise program and lead the class through your designed program at least one time during the semester. Grade is based on participation—leading the class through the program your group designs (25 points)—as well as participation during the other group’s class exercises throughout the semester (25 points).

Cognitive and Brain Health Project (100 points; 5-point deduction for each class missed when a group activity was scheduled; 5 point deduction for each day late to upload your powerpoint presentation). For this assignment, you will identify a health-related behavior that you would like to change during the semester. You should pick a topic and behavior that you think will have an impact on your cognitive performance and/or brain health (nutrition, avoiding sedentary behavior, physical activity, sleep, etc). During class, groups will discuss the targeted behavior, why you selected it, and your intervention plan [including intervention modality and dose (e.g., frequency, intensity, duration), selection of outcome measures, tracking adherence, barriers to success]. The plan needs to be specific and have well-defined outcome measures. For example, “get in better shape”, “eat healthy”, “sleep better” are examples of appropriate general topics, but then you would need to get more specific. How exactly are you going to define “better shape”? Stronger? Faster? Ability to exercise longer? What types of physical activities will you do? How will you define adherence? How will you track your progress (or lack thereof)? You will check in with your group throughout the semester to discuss your progress. The purpose of the group is to discuss your idea with others so that they can give you feedback on your project and presentation. Note: you do not have to focus on exercise or physical

activity—this is just one example. On the first of April, you will upload your powerpoint presentation to your group page on Carmen Canvas. **Undergraduates** will give data-blitz style presentations, that is, the presentation should be 5 min, and part of your grade will be based on your ability to effectively deliver your presentation in the allotted time. **Graduate students** will give 15 min presentations and be expected to provide more depth on their chosen topic, including appropriate scientific citations in the introduction and discussion and relevant theoretical issues.

Extra Credit: Participation. I will ask the class questions throughout the lectures. Regular participation in class: 1% addition to your final grade. Regular participation is defined as responding in greater than 50% of the classes.

Grading scale = University standard (but I will curve up if there's a need)

Grade	%	Grade	%	Grade	%	Grade	%
		B+	87-89.9	C+	77-79.9	D+	67-69.9
A	93-100	B	83-86.9	C	73-76.9	D	60-66.9
A-	90-92.9	B-	80-82.9	C-	70-72.9	E	Below 60

There can be no rounding to the next higher level, as this constitutes giving points that a student didn't earn (which is not ethical).

Attendance:

Class attendance is required on dates of your group activities. Otherwise, attendance is strongly encouraged, but not required*(*see grading of group projects). Exam materials will draw heavily from the assigned readings and lectures (which will include novel information not in the assigned readings).

If you miss a class, you are responsible for all material covered, as well as any announcements made in your absence.

I do **not** provide copies of my slides or notes (under any circumstances). There are multiple reasons for this, including: 1) the more deeply you process information, the more likely you are to remember it. For instance, your memory is better if you are actively listening to the lecture and physically writing than if you are absent-mindedly typing what I say verbatim on a laptop (memory concepts: levels of processing effect; generation effect). If you read the materials at least one day prior to the lecture, you are also going to benefit from sleep-related memory consolidation as well as the spaced learning effect (i.e., you are more likely to remember info if the memory encoding events are separated in time).

Make-up Policies:

- Court appearances, vacations, job attendance, and mild illness do NOT count as emergencies and will not result in a make-up without penalties applied
- **No** make-ups will be given early
- Non-emergency conditions under which you will be eligible for a make-up exam
 - Internship/grad school interview – you must provide evidence on school letterhead that documents the offer of interview – if you do not have a letter on official letterhead, instructional staff will follow up with the school/internship to verify that you do indeed have the interview that day
 - OSU sponsored event (e.g., athletic event, national mock trial event, etc.) – you must provide official documentation on OSU letterhead
 - You bring me documentation at least **one calendar week** prior to the scheduled exam
 - Even in instances when letterhead is provided, follow up by instructional staff may occur
- If you have an emergency and are unable to attend class on an exam day, you will be eligible for a make-up without grade penalty, so long as you meet the following criteria:
 - Funeral for a loved one – provide the obituary and written explanation of the person's relationship to you – you must contact me about this as soon as possible, but **no later than 24 hours after missing the exam**
 - Mental Health or Medical Emergency – provide documentation from a professional medical source **ON LETTERHEAD** - you must contact me about this as soon as possible, but **no later than 24 hours after the exam you missed**

- The letter must clearly state that you had an **emergency** that precluded your attendance in class – mild illness and/or a visit to the clinic will not be considered an excuse for missing
- If you miss the exam for any other reason, do not have documentation that supports an emergency condition, or do not follow any one of the above guidelines, you may schedule a make-up time, so long as you contact me **within 24 hours of missing the exam** – the following penalties apply in this case:
 - Make-up taken within 3 business days of the class taking the exam = 30% penalty
 - Make-up taken >3 business days, but less than 1 week of the class taking the exam = 40% penalty
 - Any request for a make-up beyond 24 hours after the class has taken the exam, or not taken prior to 1 week passing since the class took the exam will not be considered, unless the direst of situations can be documented

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Disability Services: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Mental Health: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student’s ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life’s Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling [614-292-5766](tel:614-292-5766). CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at [614-292-5766](tel:614-292-5766) and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Sexual Misconduct/Relationship Violence: Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Diversity: The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Course Calendar (Subject to Change)

Date	Topic	Required Readings
January 7	Course Introduction	Fenesi, 2018;
January 9	Small Group Activity: Cognitive and Brain Health Project (Design Phase)	
January 14	Cognitive Aging	Park & Reuter-Lorenz , 2009;
January 16	Memory & Aging	Josefsson et al., 2012
January 21	Brain Aging: Structure	Raz et al., 2005; Gorbach et al., 2017;
January 23	Brain Aging: Diffusion Tensor Imaging	Lovden et al., 2017; Cabeza et al., 2019
January 28	Brain Aging: resting state fMRI	Salami et al., 2018; Cassady et al., 2019;
January 30	Brain Aging: task-related fMRI	Chan et al., 2014
February 4	<u>Mid-Term Exam 1</u>	
February 6	Small Group Activity: Health Behavior Change Project: Adherence Assessment, feasibility of outcome metrics	
February 11	Mild Cognitive Impairment	Rentz et al., 2018
February 13	Alzheimer's disease	Sperling et al., 2018
February 18	Vascular cognitive impairment, No Dementia (VCIND)	Skrobot et al., 2018
February 20	Vascular Dementia	Wallin et al., 2018
February 25	Motoric Cognitive Risk	Blumen et al., 2018; Maguire et al., 2018
February 27	mild TBI and Chronic Traumatic Encephalopathy	Hayes et al., 2017;
March 4	Nutrition, cognition, and the brain	Morris et al; 2015a; Morris et al., 2015b; Ozawa et al., 2017
March 6	<u>Mid-Term Exam 2</u>	
March 11 & 13	Spring Break	
March 18	Small Group Activity: Health Behavior Change Project (Adherence Assessment II; Preliminary assessment of outcome metrics, rough draft of presentation)	
March 20	Aerobic exercise and cognition	Colcombe & Kramer, 2003; Sofi et al., 2013
March 25	Aerobic exercise and the brain	Voss et al, 2015; Lisanne et al., 2018
March 27	Resistance training and cognition	Liu-Ambrose, 2018
April 1	Resistance training and the brain	Liu-Ambrose, 2017
April 3	Data Blitz Presentations Begin	
April 8	Mobility and cognition	Bean et al., 2016
April 10	Mobility and the brain	Verghaese et al., 2016
April 15	Exergaming and cognition	Anderson Hanley et al., 2017; Barcelos et al., 2015
April 17	Exergaming and the brain	Anderson-Hanley et al., 2018; Anderson-Hanley et al., 2012
April 27	Final Exam 8:00 to 9:45 AM	