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**Course Description:** We all know -- or think we know -- that the mind is in the brain. Indeed, in modern society, we are as likely to say that we think with our brains as we are to say that we think with our minds. But "mind" is a psychological construct, whereas "brain" is a biological organ -- how are we to understand the relationship between these two very different entities? Cognitive neuroscience is the scientific field that seeks to answer this question by developing a detailed understanding of how the mind is implemented by the brain. Using techniques such as neuroimaging, testing of brain-damaged patients, and neurophysiological recording from individual neurons, cognitive neuroscience seeks to understand the neural systems that underlie mental life. Questions we will address in the course include: What is the basic structure and function of the nervous system? How can we use experimental techniques to probe the neural systems that support mental functioning? What are the brain structures that support fundamental mental abilities such as perception, recognition, memory, attention, planning, and consciousness? How, exactly, are these mental functions implemented by these brain regions?

**Textbook:** M.S. Gazzaniga, R. Ivry, & G.R. Mangun, (2014). *Cognitive Neuroscience: The biology of the mind*. Fourth Edition. New York: W. W. Norton & Company, Inc. (ISBN-13 978-0393913484). Available at the Penn bookstore, or on Amazon.

**Note that we are using the FOURTH edition of Gazzaniga (Orange/Turquoise cover), which is substantially different from the 3rd edition (Blue/Black cover).**

**Supplementary Textbooks:**

These books are not required, but might be helpful if you want an alternative treatment of the material.

Ward, J. (2015). *The Student's Guide to Cognitive Neuroscience*. Third Edition. Psychology Press. (ISBN 978-1848720022). Provides a short and very clear summary of many of the major topics of the course.

M.F. Bear, B.W. Connors, MA Paradiso. (2006). *Neuroscience: Exploring the Brain*. Third Edition. (ISBN 978-0781760034). This book includes an excellent treatment of neurophysiology that is more detailed and in many ways more clear than Gazzaniga.

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**Course Web Page:** Lectures, additional readings and other important course information will be posted routinely on **Canvas**. Please monitor this website regularly. If you have suggestions for the web page, please let us know.

### **Course Policies and Requirements:**

**Syllabus:** *Read this syllabus!* It is your primary source of information about the policies and schedule of the course. We will expect you to be familiar with this information. Ignorance of the law (in this case, the syllabus) is no excuse.

**Lectures:** This course will be taught in a lecture-based format. You are encouraged to interrupt the lecture frequently with questions. If there is something that you do not understand in class, speak up! It is likely that many of your classmates do not understand it either.

If you want to do well in the class, it is best to attend the lectures. If you cannot attend a lecture, you should attempt to get the notes of a fellow student who did attend. The lecture slides will be posted on Canvas *after* the lecture. However, be forewarned that the slides are only part of the lecture and may not convey information that was presented orally. Neither the posted slides nor the textbook provide an adequate substitute for notetaking in class.

Note that although you are encouraged to come to lecture, you are not required to do so. Please do ***not*** come to class if you have other priorities -- for example, finishing work for a different class. Also, please be mindful of the policy on Electronic Devices in the Classroom, described below.

**Readings:** You should read the assigned portions of the textbook, along with any additional readings posted to Canvas. At certain points in the course, the lectures will hew closely to the textbook, while at other points the treatment in the lecture will diverge from the text. In case of divergence, you should consider the lecture as primary material and the textbook as supporting material. You should also consider any additional readings not from the textbook as primary material. Although you may be tested on *details* that were in the textbook but not the lecture, you will only be tested on *topics* covered in the lecture. If there is an exception to this rule, it will be pointed out explicitly in class and noted in the lecture slides.

**Exams:** **There will be three in-class exams. There is no final exam.** Exams will be given during class period on Feb. 17 (Tuesday), March 26 (Thursday), and April 28 (Tuesday).

The purpose of the exams is to assess basic factual knowledge of topics covered in lectures and readings, to review critical concepts and theories that are important in the field of cognitive neuroscience, and to challenge you to think about ideas presented in class. Each exam will consist of three types of questions: (i) multiple choice questions designed to assess basic knowledge presented in lecture and in readings; (ii) short answer questions designed to address detailed knowledge about topics presented in lecture and in readings; (iii) essay questions designed to assess your ability to explicate scientific arguments by integrating multiple sources of information and critically assessing experimental data. Although the essay questions will be primarily graded based on content, clarity of expression and organization of ideas will not be ignored.

Each exam will focus mostly on the material presented within the preceding segment of the course; however, the essay questions may require you to draw on basic knowledge and core

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principles that are cumulative across the course. *The exams will primarily test material presented in the lecture, except when explicitly noted.* You should consider your lecture notes to be your primary study material. In addition, review sheets will be posted for each topic to help you study for the exams. You are strongly encouraged to work out the questions on the review sheets as the questions on the exam are often (but not always) similar.

Grades: Your grade will be calculated as follows:

- 50% Highest exam score
- 50% Second highest exam score

Your lowest exam score will be dropped.

In addition, if you wish to earn a flat A in the course, you must take (and perform creditably on) the third exam. The highest grade obtainable if you only take the first two exams is an A-.

Make-Up Policies: No make-up exams will be scheduled (except in case of conflict with a religious holiday). If you miss an exam, this counts as your “dropped” exam. **If you miss two exams, you will automatically fail the course.**

As per university policy, an exception to the “no-make up” rule occurs if an exam conflicts with a religious holiday. Please look at the dates for the exams now. If any exam conflicts with a religious holiday that you observe, you must let the instructor know by e-mail by the end of the second week of the course.

Re-grading Policy: If you have a question or concern that there was an error in grading an exam, you must submit your request to the teaching assistants *in writing* to have the exam regraded, no more than one week after the exam was returned in class. No regrade requests will be considered beyond this date. Your request must explain the specific error that you think was made. If you submit a request, the exam will be regraded in its entirety, and *the final grade might be higher or lower than your original grade.* Please only submit a re-grade request if you genuinely believe that an error has been made--a judgment call that could have gone either way is not an error. Please note that although you are welcome to complete your exams in pencil, no exams written in pencil will be regraded.

Office Hours/Email Policy: The instructor and the teaching assistants will have office hours every week, which you are encouraged to attend if you have any questions about the content or structure of the course. Please only e-mail the instructor questions that can be answered in a few sentences or less. If you have a question that requires a longer response, come to office hours. If you cannot make office hours at the posted times, you are more than welcome to e-mail to set up an appointment for a different time.

Electronic Devices in the Classroom: This is a laptop-free class. **Laptops and tablets are not allowed.** Notes should be taken on paper, unless there is a medical reason why this is impossible.

This policy is for the benefit of you and your fellow students. Even with the best intentions, the pull of email, instant messages, and social media is pretty much irresistible. You might think that this is not a problem for learning, and that you can multitask without any problem. However, there is considerable research indicating that this is not the case. One study found that after responding to email or text messages, people took more than 15 minutes to re- focus on the

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“serious mental tasks” they had been performing before the interruption. Another study found that test performance was significantly lower for students who used email, chat programs, or facebook during class than for students who did not. Remarkably, a recent study found that even when students use laptops “correctly”, they do worse on exams than students who take notes on paper. On top of all this, it is distracting for your fellow students if you are accessing email or facebook in class: a 2013 study found that laptop use impaired academic performance not only for students using a laptop, but for students within view of a laptop screen even if they themselves were not using a laptop. The use of a laptop removes you mentally from the classroom and makes it harder for me to teach and for you to learn. For all these reasons, notes in this class should be taken on paper. Please consult with me if this presents an insurmountable problem for you.

Cell phones should be set to silent and (ideally) stowed away in a backpack or a coat pocket. There is a clock in the room if you need to know the time. If you would like to use a cell phone or other device to record the lecture, please get permission in advance.

Academic Integrity: Please note that Penn has strict rules on academic integrity (see [www.upenn.edu/academicintegrity](http://www.upenn.edu/academicintegrity)). Violations of the rules will be reported to the Office of Student Conduct and will likely result in automatic failure of the course.

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*Course Schedule*

	<u><i>Tuesday</i></u>	<u><i>Thursday</i></u>	<u><i>Reading</i></u>
Wk 1		<b>Jan 15</b> Introduction	
Wk 2	<b>Jan 20</b> History	<b>Jan 22</b> Neuroanatomy & Neurophysiology 1	Gazzaniga, Ch. 2 (Ch. 1 optional)
Wk 3	<b>Jan 27</b> Neuroanatomy & Neurophysiology 2	<b>Jan 29</b> Neuroanatomy & Neurophysiology 3	
Wk 4	<b>Feb 3</b> Methods 1	<b>Feb 5</b> Methods 2	Gazzaniga, Ch. 3
Wk 5	<b>Feb 10</b> Methods 3	<b>Feb 12</b> Methods 4	
Wk 6	<b>Feb 17</b> <i>In-Class Exam #1</i>	<b>Feb 19</b> Perception 1	Gazzaniga Ch. 5
Wk 7	<b>Feb 24</b> Perception 2	<b>Feb 26</b> Object Recognition 1	Gazzaniga, Ch. 6
Wk 8	<b>March 3</b> Object Recognition 2	<b>March 5</b> Object Recognition 3	
	<i>Spring Break</i>		
Wk 9	<b>March 17</b> Object Recognition 4	<b>March 19</b> Attention 1	Gazzaniga, Ch. 7
Wk 10	<b>March 24</b> Attention 2	<b>March 26</b> <i>In-Class Exam #2</i>	
Wk 11	<b>March 31</b> Memory 1	<b>April 2</b> Memory 2	Gazzaniga, Ch. 9
Wk 12	<b>April 7</b> Memory 3	<b>April 9</b> Memory 4	
Wk 13	<b>April 14</b> Cognitive Control 1	<b>April 16</b> Cognitive Control 2	Gazzaniga, Ch. 12
Wk 14	<b>April 21</b> Cognitive Control 3	<b>April 23</b> Consciousness	Gazzaniga, Ch. 14
Wk 15	<b>April 28</b> <i>In-Class Exam #3</i>		