**SYLLABUS**

**Psychology 435: The neuroscience of attention and attentional disorders (WI 2021)**

Wednesday 1:00 – 2:30 pm, online, synchronous

Instructor: Professor Martin Sarter  
Email: msarter@umich.edu  
Office Hours: Tuesday 2:00-3:00 PM, or by appointment (online, synchronous)

**Brief description:**

Attentional processes and capacities are fundamental components of our cognitive capacities. Impairments in the ability to detect, select and process stimuli and to manage attentional capacities rapidly escalate into major cognitive disorders. Attentional impairments are key to understanding the cognitive decline associated with normal and pathological aging, schizophrenia, ADHD, and other disorders. The course focuses on the neurobiological systems and cellular mechanisms that control attentional functions and are responsible for the decline of such processes in neuropsychiatric and neuro-degenerative disorders.

**What are the objectives of this course?**

This is an upper-level course on the neuronal mechanisms of attention. You will become familiar with diverse research approaches, ranging from brain imaging to molecular and cellular research, designed to identify how the brain deploys attention, and for what purpose, what effects attention has on neuronal information processing, what causes attention, and how attention can lapse, why it declines in various patient populations, and how such decline contributes to the disease-defining symptoms. Throughout, the emphasis will be on identifying specific brain-behavior relationships.

The ideas covered in the course may be more complicated than those you have encountered in previous courses. One of the main goals of the course is to help you move beyond learning simple facts from readings as you've done in lower-level courses. Instead, you'll learn how to read original research papers and put ideas together - important skills for graduate or medical school.

This course will involve immersion in primary scientific literature. This is a reading-intensive course where class sessions are primarily discussion-based.

My goal is that you will leave this class with three main skills: 1. Applying intellectual rigor to the field of the neurobiology of attention. 2. The ability to read and critique empirical scientific papers. 3. The ability to synthesize scientific evidence and use this evidence to speculate, in writing, about how we can build brains with better attention systems.

**What are the pre-requisites for this course?**

- Psych 230 or an equivalent introduction to neuroscience is required for this class; taking Psych 230 concurrently is not sufficient. **This class requires that you have a solid understanding about how neurons work and integrate information, how neurons form circuits, how pre-and post-synaptic receptors work. You know about EPSPs, IPSPs and action potentials, ionotropic and metabotropic receptors, receptive field properties in V1, and a little something about major neuroscience methods used in research (such as imaging, ERPs, field potentials, single unit recordings).**

Some of the neuroscientific mechanisms discussed in class or in the readings may be unfamiliar to you, depending on your prior class work in this field. If the readings indicate that you have gaps in your understanding of the neuroscience described in the readings, please bring this up in the class. Even better, do yourself and the class (and me) a favor by informing me, prior to the next class period, that there may be issues concerning fundamental neuroscience concepts or mechanisms. This will allow me to address such issues early in class.
Structure of the class meetings:

1. **Discussion of BABBE essays** (15 min). This will be a discussion, led by Sarter, of particularly intriguing ideas from your essays (authors will not be named). In addition, important issues which arose from your essays will be clarified.

2. **Mini-Lecture. Intro to today’s topic** (30 min). This typically will consist of a short lecture to introduce the field(s) of research covered in this class meeting. Students were encouraged to participate, discuss, ask for clarifications, etc.

3. **BABBE PREP: Paper presentation** (20-25 min). Each seminar will end with a presentation of the paper that will be the primary foundation of your essays **due the following Sunday at midnight** (below). As there will be 10 BABBE Preps, 3 students will work as a team per prep (sign-up soon: CANVAS – PAGES, EDIT PAGE). Students will use slides of figures taken from the BABBE paper supporting sources to explain, at least to a substantial degree, the question, the methods, and the results described in this paper. Possible starting points for essays will conclude this presentation.

We will break for 2-3 min following parts 2 and 3. Class recordings will be available for streaming on Canvas.

**Grading and associated online etiquette:**

**Overall grading philosophy:** For a 400-level class, I believe that the focus on getting a top grade and doing well in exams is in the way of real learning – learning of concepts and rigorous ways of thinking about productive cognitive and behavioral neuroscience research. Therefore, the final grade will be based on the graded essays and your participation in class (50/50). In CANVAS you can find an example of a BABBE that would get a B, so you can calibrate this part.

**Class participation** includes primarily the presentation a BABBE PREP but extends to all class components. Various other types of contributions are possible, such as, for example, based on your expertise, introducing the class to a relevant method (e.g., how to analyze ERPs or extract oscillations from LFPs, or fMRI). Asking questions about things you don’t know or do not understand is also an important aspect of class participation. To support active class participation, please **turn on video and audio throughout the class period.** The chat room will not be used – everybody should feel free to jump in anytime.

**Concerning class participation,** it is my experience that students are often concerned that they don’t sound competent, or possibly not as competent as others, and therefore they hesitate to participate. For example, often a student will not ask a question about a method because they feel this may reveal their limited understanding of this subject matter. I will work super hard to remove this barrier. After all, we all are not that smart, really (just look at this world). I will lead by example by asking the dumbest questions (I got a reputation for that anyways). So, relax, ask the question, participate and learn.

**Build-A-Better-Brain” Essay (BABBE; rhymes with baby)**

Each class will address brain mechanisms mediating aspects of attention. These mechanisms are deduced from research at various levels of analysis, from brain imaging to neurophysiological or electrochemical recordings and to neuropathological studies.

The essay should discuss how the relationships between brain mechanisms and attention, that were covered in the readings, could be exploited to “build a better brain”, that is, to enhance attentional capacity, to protect against the development of attentional impairments, or attenuate such impairments, and so forth. In short, you should use the reading in order to **speculate** about treatments or manipulations designed to enhance the brain’s capacity to mediate attentional processes and capacities. One or two key papers for each BABBE will be discussed in class, led by students, to set the stage for your essay (see file name “BABBE…”).

For these essays, it is less important that your ideas are neuroscientifically realistic accurate or even feasible. Rather, it will count that you propose something creative. On the one hand you should not suggest something obviously trivial and uninspiring (such as doubling the size of the cortex). On the other hand, you should not
shy away from suggesting something bold and may be even an idea that is somewhat in the domain of sci-fi (e.g., double the number of connections between frontoparietal regions or increasing the density of NMDA receptors in the primarily visual cortex). Your essay may also want to address the potential limitations and “costs” of “turning the brain screw” into one direction.

We may have a good laugh about outlandish means and methods or may get scared about the brain you have been trying to build, but we will find your goals and your ideas to be creative and instructive.

You may write the essay individually or discuss and write it together with one - only one - other student – then both would submit the same essay and get the same grade. For an A, I will expect a duo-essay to be a tad more sophisticated than solo-essays (after all, two brains were at work!).

Students are encouraged to freely discuss the BABBE paper, particularly to help each other clarifying methods and results, on Piazza. I will occasionally watch this discussion and contribute if needed.

Format: Max two pages, single spaced, no references, 1-inch margins. Put your name(s) into the header. Don’t reiterate much of the content of the underlying papers. Rather, focus on enhancing brain-behavior relationship for enhancing or rescuing attention. The papers are due the following Sunday at midnight (via CANVAS). An example of a (solo-)BABBE (graded with a B) is available in CANVAS.

Tentative Schedule

Subject to change depending on class discussion and interests. Changes will be announced in class and via the course website.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 20</td>
<td>Class organization; Folk psychology of attention &amp; grand theories of attention – but is the construct needed &amp; does the brain need a separate attention system?</td>
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<td>Jan 27</td>
<td>Attention as cause versus effect; The big picture on the brain attention systems; de-confounding attention from reward &amp; reward anticipation.</td>
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<td>Feb 3</td>
<td>Neuronal systems controlling attentional resources: where in the brain is the “top” in top-down, or the “supervisory attentional system”, and how do they work?</td>
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<td>Feb 17</td>
<td>Visual attention: beyond the visual cortex. Biased Competition Model.</td>
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<td>Feb 24</td>
<td>Well-Being Day – no class.</td>
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<td>March 3</td>
<td>Cholinergic mechanisms.</td>
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<td>March 10</td>
<td>Dopaminergic and noradrenergic mechanisms.</td>
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<td>March 17</td>
<td>Neurobiology of ADHD and mechanisms mediating the pro-attentional (?) effects psychostimulants</td>
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<td>March 24</td>
<td>Attentional impairments: key to understanding the neurobiology of schizophrenia;</td>
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<td>March 31</td>
<td>Attentional-motor interface decline in aging and PD, with a focus on gait disorders.</td>
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<td>April 7</td>
<td>Neuronal mechanisms mediating distractors, attentional lapses, change blindness and other attentional mishaps.</td>
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<td>April 14</td>
<td>Attention: key to consciousness?</td>
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Policies
The slides and class recordings shared with you are owned and copyrighted by the instructor and the University of Michigan. You are not allowed to disseminate the materials without permission.

1. Course lectures will be audio/video recorded. As part of your participation in this course, you may be recorded. If you do not wish to be recorded, please contact the instructor to discuss alternative arrangements.
2. Students may not record or distribute any class activity without written permission from the instructor, except as necessary as part of approved accommodations for students with disabilities. Any approved recordings may only be used for the student’s own private use.

Student Sexual Misconduct Policy
Title IX prohibits discrimination on the basis of sex, which includes sexual misconduct — including harassment, domestic and dating violence, sexual assault, and stalking. We understand that sexual violence can undermine students’ academic success and we encourage anyone dealing with sexual misconduct to talk to someone about their experience, so they can get the support they need. Confidential support and academic advocacy can be found with the Sexual Assault Prevention and Awareness Center (SAPAC) on their 24-hour crisis line, 734.936.3333 and at sapac.umich.edu. Alleged violations can be non-confidentially reported to the Office for Institutional Equity (OIE) at institutional.equity@umich.edu You may find alternate syllabus statements and more information at sapac.umich.edu/article/faculty-resources-sample-syllabus-language

Students with Disabilities
If you think you may need an accommodation for a disability, please let me know at the beginning of the term. Next, you should contact the Services for Students with Disabilities (SSD) office. Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation (VISA) form and we can arrange for your accommodation. Any information you provide is private and confidential and will be treated as such. If you already have a VISA form from SSD, please present this form to me at the beginning of the term, but no later than at least two weeks prior to the need for the accommodation so that there is enough time for the appropriate arrangements to be made. You may find alternate syllabus statements and more information at ssd.umich.edu/article/syllabus-statement

Academic Misconduct
The University of Michigan community functions best when its members treat one another with honesty, fairness, respect, and trust. The college promotes the assumption of personal responsibility and integrity, and prohibits all forms of academic dishonesty and misconduct. All cases of academic misconduct will be referred to the Office of the Assistant Dean for Undergraduate Education. Being found responsible for academic misconduct will usually result in a grade sanction, in addition to any sanction from the college. For more information, including examples of behaviors that are considered academic misconduct and potential sanctions, please see lsa.umich.edu/lsa/academics/academic-integrity.html

Student Mental Health and Wellbeing
The University of Michigan is committed to advancing the mental health and wellbeing of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, contact Counseling and Psychological Services (CAPS) at 734.764.8312 and caps.umich.edu during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. You may also consult University Health Service (UHS) at 734.764.8320 and uhs.umich.edu/mentalhealthsvcs, or for alcohol or drug concerns, see uhs.umich.edu/aodresources. For a listing of other mental health resources available on and off campus, visit umich.edu/~mhealth/