PSYC 301

Biological Bases of Behavior
Fall, 2015

Course description

PSYC 301 explores the anatomical and physiological systems that underlie animal behavior. It provides an introduction into the field of behavioral neuroscience. Major new discoveries in the field are appearing almost daily, and they are fundamentally changing our ways of thinking about brain function. This course will involve you in the excitement of our growing understanding of the nervous system and how it works.

All behavior arises from electrical and chemical activity in the nervous system. This includes everything from the simplest behaviors (reflexes, for instance) to the most complex such as problem solving, judgement, choosing a spouse, and creativity. Advances in brain imaging, molecular genetics, techniques to record the activity of neurons, both individually and as networks, all have made the linkage between brain and behavior obvious and increasingly understandable. Some of the research focuses on diseases of the nervous system like schizophrenia, depression, autism, Alzheimer’s disease, and Parkinson’s disease. Some of the most exciting research, however, seeks answers to some of the Really Big Questions: How are memories stored? Why do we sleep? How do light, sounds, odors become our perceptions of the world? What is consciousness?

To understand how the nervous system creates and controls behavior, we will start by studying how the nervous system is put together (neuroanatomy) and how nerve cells communicate and process information (neurophysiology). We will devote considerable time to the synapse and to neurotransmitters and their receptors because these hold the key to understanding many aspects of normal and abnormal behavior.

In the second portion of the course, we will concentrate on how the nervous system detects and interprets characteristics of the external world through the various sensory systems (vision, touch, and pain will be our examples). We will also examine how the nervous system can use information from the external world to direct and coordinate complex movements like walking or writing or juggling, i.e. sensorimotor integration.

We will turn for the final portion of the course to the neural bases of more complex behaviors. A major theme rests on the realization that the nervous system is always changing throughout our lives. Our survey will include nervous system development, learning (and forgetting), recovery from injury to the nervous system, sexual behavior, and sleep.
**READINGS**

**Required**

- **Biopsychology (9th Edition)**
  by John P.J. Pinel
  ISBN: 978-020591-5576
  Available as a bundle with the coloring book – $208.55.
  (please see announcements on Canvas about other options.)

**Optional**

- **A Colorful Introduction to the Anatomy of the Human Brain**
  by John P.J. Pinel,
  ISBN: 978-0205548-8743

- **The Human Brain Book**
  by Rita Carter
  ISBN: 0-7566-5441-6

**Additional readings**

There will be additional required readings that concern practical applications of neuroscience research and that present thought-provoking ideas about the brain and behavior. These articles will come from the primary scientific literature or from sources more geared to a well-educated general audience. There will be different required readings for each exam. I will post the readings on CANVAS in the Modules section.

You should read these articles thoroughly and carefully. The exams will include specific questions drawn from them.

**GRADING**

**Philosophy**

Exams are not anyone’s favorite part of a course, but they serve important purposes. They are excellent motivators for studying and learning. I use them as a teaching tool by designing questions that bring together ideas or make specific points. They are a mechanism for evaluation of how you’re doing during the course, and how well you performed throughout the whole course. Easy exams do not fulfill any of those purposes. Students do generally find PSYC 301 exams challenging, and the exams require significant preparation to achieve high scores. I am reasonably generous about curving exam scores when it is appropriate.

There will be **three in-class examinations** during the semester. The final course grade will be computed using the two highest scores from the three in-class exams, i.e. the lowest score will be dropped. Although this means that you could theoretically miss an exam without penalty, skipping an exam without a highly compelling reason to do so is not a good idea.

Clicker points and quiz points will be added to the relevant in-class exam score (see below).

All students must take the **comprehensive final examination**.
Grades

All exams in the course (including the final) will be weighted equally in computing the final grade. For example, if your grades on the in-class tests were 90%, 80%, 70% and you earned 100% on the final, your overall course score would be 90%. Letter grades will be assigned using an equal divisions scale, e.g. 80.00 to 83.29 = B-, 83.30 to 86.69 = B, 86.70 to 89.99 = B+

There will be no extra-credit assignments. There will be no retakes of examinations.

Makeup exams

A makeup exam can be given in cases where an unexpected, major problem (severe illness/injury, hospitalization, kidnapping, death, etc.) prevents a student from attending an exam. The student or a guardian must email me or call me PRIOR to the exam to inform me of the situation. At the earliest possible time, the student must present me with official, written documentation of the reason for missing the exam. A note from a parent or roommate is not official documentation. If the student does not inform me prior to the exam or does not present me with timely, complete documentation, there will be no makeup and the student's score for the exam will be zero (0%). To be fair to everyone, I strictly follow this policy.

Incompletes

An "incomplete" will be assigned as a grade only in cases of compelling and documented need. Incompletes are normally reserved for students experiencing a catastrophic event near the end of the semester. To qualify for an incomplete, the student must have finished a substantial portion of the course and be performing at a "C" level or better. The student will be asked to sign an "incomplete contract" stipulating the requirements and date for the completion of the course and assignment of a final grade.

Electronic devices in class

Many of the faculty at College Park are becoming increasingly concerned by the negative effects electronics in the classroom are having on student learning and test performance. Computers, tablets, and phones present an irresistible distraction, detract from the cooperative learning environment, and unfairly affect other students. Based on ever-increasing volumes of research evidence, the distractions created by electronics in the classroom interfere with learning. For this reason many of my colleagues ban electronics entirely, as do I as well in some of my classes. The policy in PSYC 301 is:

Phones should be turned off during lecture. There should never be texting or email-checking or phone conversations during class. Turn your phones completely off.

Laptops and tablets are allowed when they are used specifically and solely for taking notes.

Any student failing to observe this policy may be required to leave the classroom.

CANVAS for PSYC 301

We have a CANVAS site for the course and will be using it extensively. It will be:

• a source for basic information (syllabus, readings, etc.) and readings
• a communication channel for course information of immediate importance
• a convenient way for students to communicate and work together
• a source for study materials before each test
• the mechanism for accessing recorded lectures via Panopto
• a vehicle for reporting and keeping track of grades

To access CANVAS, go to ELMS https://elms.umd.edu/ which is both a portal and a source of help and information about the system. If you have trouble logging on, try the OIT Help Desk http://www.helpdesk.umd.edu/

In some cases, announcements important to the whole class, e.g. review sessions, class schedule changes, will be posted there. You can choose your personal CANVAS settings so that you are notified of information added to CANVAS. Be sure the setting for Announcements is 'ASAP' so that you don’t miss time-critical information.
<table>
<thead>
<tr>
<th>LEARNING RESOURCES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clickers</td>
<td>We may use clicker questions during. Every student is expected to have a dedicated clicker (not smart phone) and to have it properly registered and fully functional. It is each student’s own responsibility to have a working clicker in class. To get information or help with anything clicker-related, go to: Clickers Office. <a href="http://www.clickers.umd.edu/frontpage">http://www.clickers.umd.edu/frontpage</a>. ResponseWare will not be available. Clicker software was upgraded over the summer so students should visit the clicker office website to get details on any changes in their registration. Clicker scores can add up to 4 exam percentage points to the next in-class exam score. It always takes a while for everyone to get set up, so clicker questions in the first four lectures will be practice and the responses not counted if they are used.</td>
</tr>
<tr>
<td>Images and videos</td>
<td>I will post the images used in each lecture up on CANVAS in the Modules section. It is not always possible to post the videos I show in class because the files can be very large. The Panopto system uploads videos of each lecture to CANVAS. However, Panopto does not always work, so you cannot assume that every lecture will be recorded.</td>
</tr>
<tr>
<td>Practice quizzes</td>
<td>On Monday of each week starting September 14, Kristi will post a practice quiz on CANVAS. The quiz will normally be 6-10 questions in the same format as the exam questions. You can take the quiz as many times as you like until you get all the questions correct. Each quiz you complete with a score of 100% will add one (1) percentage point to your grade on the test covering the material in the quizzes. An important point: neuroeducation research shows that studying is most effective when done shortly after first presentation of the material and consistently throughout the period between tests. As part of my anti-cramming initiative, the practice quizzes will be available for one week and then replaced by a new quiz. Old quizzes will NOT be available, so take them regularly.</td>
</tr>
<tr>
<td>Weekly reviews</td>
<td>We will have review sessions each week starting the week of September 9th to be ran by Kristi. These will be ‘Question/Answer’ format. You’ll have a chance to clarify points you might have missed in lecture, discuss concepts that you don’t quite understand, go over graphs and images from lecture - basically talk about anything you want. These sessions will also be a good opportunity to discuss the assigned readings. Attendance is optional. No new material will be presented in the review sessions. The reviews will be in Room PLS 1117 on Wednesdays from 4:00 - 5:00 PM.</td>
</tr>
<tr>
<td>Studying strategies</td>
<td>Neuroscience and psychology research regarding learning, memory, and sleep have come up with strategies for studying based on good, solid science. There are also ways to optimize your classroom experience. I have listed many of these on the Exam Study Materials page of our CANVAS site. In addition, several of the required readings deal with these topics. All the suggestions and strategies in the world will be for naught unless you actually use them. In some cases that will involve major changes in the way you approach learning and studying. Even though it feels awkward at first, it’s worth giving new strategies a try. What have you got to lose?</td>
</tr>
<tr>
<td>Office hours</td>
<td>I have scheduled office hours on every day of the week except Friday, and Kristi has office hours on Friday as well. Use them! We can talk about the material covered in lecture, study strategies, exciting neuroscience research - whatever will be useful and interesting for you. Avoid last-minute cramming - it doesn’t work. Come to office hours regularly, not just a day or two before the exam.</td>
</tr>
</tbody>
</table>
### Academic integrity

Essential to the fundamental purpose of the University is the commitment to the principles of truth and academic honesty. Accordingly, the Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld. While all members of the University share this responsibility, The Code of Academic Integrity is designed so that special responsibility for upholding the principle of academic honesty lies with the students. It is the responsibility of each student to understand what actions constitute a violation of the Code and understand the consequences of Code violation.

The University of Maryland Honor System is fully described at [Student Honor Council](http://shc.umd.edu/SHC/Default.aspx).

### Students with disabilities

If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms that you can provide to your professors as proof of your eligibility for accommodations. **This form should be provided at the beginning of the semester. Special arrangements for each individual test should be made at least a week before the test date.** The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at [The Counseling Center](http://www.counseling.umd.edu/)

### Religious observances

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. **It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance.** Notice should be provided as soon as possible, but no later than the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam promptly can have very serious academic consequences.

### Course evaluations

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning. CourseEvalUM will be open for you to complete your evaluations for fall semester courses between approximately Mid November and early December. You can go directly to ([https://www.courseevalum.umd.edu/](https://www.courseevalum.umd.edu/)) to complete your evaluations. By completing all of your course evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

---

© 2015 David D. Yager/Dirk Parham as to this syllabus, all lectures, and all course materials.

Class meetings and course materials, including instructions, presentations, assessments, content outlines, and similar materials are the intellectual property of the course instructor and protected by legal copyright. You may take notes and make copies of course materials for your own personal use. You may not, nor may you allow others to, distribute lecture notes and course materials publicly whether or not a fee is charged without the express written consent of the instructor.
## Class Schedule

The first five lectures provide an overview of the anatomy of the nervous system and its cells. We will make a link between structure and function (where it is + what it does) and introduce some of the other ‘Big Ideas’ of nervous system structure (bilateral symmetry, contralaterality, neurogenesis, and others). We will also discuss current ideas about brain networks, the ‘connectome,’ and hemispheric asymmetry.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 31</td>
<td>Introduction to the course; structure of neurons</td>
</tr>
<tr>
<td>September 2</td>
<td>Glia and their diverse functions</td>
</tr>
<tr>
<td>September 7</td>
<td>No Class</td>
</tr>
<tr>
<td>September 9</td>
<td>Brain and spinal cord anatomy I</td>
</tr>
<tr>
<td>September 14</td>
<td>Brain and spinal cord anatomy II</td>
</tr>
<tr>
<td>September 16</td>
<td>Brain networks – functional specialization (or not …)</td>
</tr>
<tr>
<td>September 21</td>
<td>Resting membrane potentials</td>
</tr>
<tr>
<td>September 23</td>
<td>Neural signals – PSPs and Aps</td>
</tr>
<tr>
<td>September 28</td>
<td>The synapse – structure and function</td>
</tr>
<tr>
<td>September 30</td>
<td>In-class examination</td>
</tr>
<tr>
<td>October 5</td>
<td>Neurotransmitters and receptors</td>
</tr>
<tr>
<td>October 7</td>
<td>Neurotransmitters and behavior; schizophrenia, Parkinson’s disease</td>
</tr>
<tr>
<td>October 12</td>
<td>Sensory systems: touch and pain</td>
</tr>
<tr>
<td>October 14</td>
<td>Sensory systems: visual system basics</td>
</tr>
<tr>
<td>October 19</td>
<td>Sensory systems: visual pathways; retinotopic maps</td>
</tr>
</tbody>
</table>
October 21  Sensory systems – visual perception
October 26  Sensorimotor integration – central processing; mirror systems
October 28  Sensorimotor integration – peripheral execution and control
November 2  In-class examination

Everything animals—including humans—do, regardless of complexity, arises from action potentials, postsynaptic potentials, and synapses. How you can get such complex and elaborate behaviors from electrical and chemical signals within a three-pound hunk of fat (the brain) largely remains a mystery. Neuroscientists do, however, have many pieces of the puzzle for some complex behaviors, and we will look briefly at several of those. One goal of this last section of the course is to pull together many concepts from the earlier parts of the course.

First, the nervous system is ALWAYS changing. What forms do the changes take? What are the mechanisms? What guides change? We will approach *plasticity* from several perspectives starting with the effects of experience on the structure and growth of the CNS and the changes in the brain following injury.

November 4  Neurogenesis – CNS development; connections, gut bacteria?
November 9  Developmental and compensatory plasticity in the CNS
November 11  Developmental plasticity + adult behavior – hormones, sex, anxiety

Second, how does the nervous system store information and, in the process, create a sense of time?

November 16  Early studies on the neurobiology of memory and amnesia
November 18  Anatomy and physiology of memory
November 23  Remembering, revising, and forgetting; Alzheimer’s disease
November 25  Thanksgiving Break

Finally, biological rhythms profoundly affect our behaviors. Circadian disruptions figure prominently in many maladies including depression and bipolar disorder. Sleep is one of the most prominent rhythmic behaviors. What is sleep, what goes on in the nervous system while we sleep, and, most important and most puzzling, why is sleep so important that we simply can’t live without it.

November 30  Circadian rhythms using alertness and sleep as examples
December 2  A night of sleep – behavior, neurobiology and neuropharmacology
December 7  Sleep and CNS plasticity – Do we sleep to remember or sleep to forget?
December 9  In-class examination
December 17  Final examination – 4:00-6:00PM
## Readings by topic

These are guidelines, not assignments. There may be other sections of the books as well that are relevant to each topic. These readings are from the 9th edition of Pinel. Supplement with sections from the coloring book as relevant.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Chapters/Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNS cells and anatomy</td>
<td>Pinel – Chapters 1, 2, 3, and 17.1; skip appendices</td>
</tr>
<tr>
<td>Brain networks</td>
<td>Pinel – Chapter 16</td>
</tr>
<tr>
<td>Neurophysiology</td>
<td>Pinel – Chapter 4.1–4.5</td>
</tr>
<tr>
<td>Transmitters, receptors, and drugs</td>
<td>Pinel – Chapters 2.3–2.5, 4.6–4.7, 10.2, 15.4, and 18</td>
</tr>
<tr>
<td>Sensory systems</td>
<td>Pinel – Chapters 7.1, 7.3, and 6</td>
</tr>
<tr>
<td>Motor systems</td>
<td>Pinel – Chapter 8</td>
</tr>
<tr>
<td>Development and plasticity</td>
<td>Pinel – Chapters 2, 9, 10.4–10.5, 13, and 16.1–16.6</td>
</tr>
<tr>
<td>Memory</td>
<td>Pinel – Chapter 11</td>
</tr>
<tr>
<td>Rhythms and sleep</td>
<td>Pinel – Chapter 14</td>
</tr>
</tbody>
</table>