Overview:
Learning is a critical component of adaptive behavior in animals and humans. This course will expose students to key concepts, theories, and experimental paradigms for studying human learning. The goal is to provide an integrative view of the area that crosses both classic approaches (e.g., classical conditioning, instrumental learning) as well as modern issues (e.g., cognitive neuroscience of learning, language learning, social learning, computational approaches). Special attention will be given to exploring what is known about the neural substrates of learning and memory, as well as computational and mathematical theories. In addition, the class is oriented toward a understanding of the evolution of ideas about learning in the field. Students will leave the course as sophisticated consumers of learning research and be able to apply learning concepts directly to their own research. This course fulfills part of the introductory “core” cognition requirements for the NYU psychology program. As such there will be a series of exams throughout the semester that assess mastery of the key concepts.

Grading:
Active class participation (15%) and homeworks and assignments based on readings (15%), two exams (each worth 35%).

Course Website:
Bookmark and check back often for announcements and links to the readings:
http://smash.psych.nyu.edu/courses/fall10/learning

Textbook:
Learning and Memory: From Brain to Behavior by Gluck, Mercado, and Myers (should be available at the NYU Bookstore). The Gluck text is geared at a slightly introductory level but provides a useful “frame” within which to structure our dialog this semester. As fulfilling the core course requirement, there are basic issues that not all students in our program may have been exposed to (e.g., many have not had a undergrad course in neuroscience let alone psychology). The text will help fill those gaps when they arise. In addition to the readings from the text (which provide a broad, modern overview of various topics), there will be a number of supplementary readings from other texts and original research articles. Going back and forth between both the textbook readings and the original research articles will hopefully give students insight into the deeper issues as well as helping to contextualize the work in ways the original authors of were unable to do. Early in the course we will read classic papers, but later will see how these ideas have continued to resonate in modern
learning research (e.g., statistical learning, structure learning, reinforcement learning, etc...). 

Note: At various point there are a lot of readings for this course. It is a core course and so is reading-intensive. If you aren’t reading 20-30 hours a week you aren’t reading enough in grad school. This should help increase your average.

Tentative Class Schedule (readings for the following week will be places online immediately after class):

<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 14</td>
<td>1. Introduction/Overview - What is learning? Historical ideas and the birth of the modern science of learning. Additional topics include learning/performance, innate behaviors versus adaptation (nature/nurture), critical periods, models and mechanisms, and levels of analysis</td>
</tr>
</tbody>
</table>

Textbook reading: Gluck, Ch. 1 - The psychology of learning and memory


Optional Readings (discussed in lecture):


<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Sept 21 | **2. Basic concepts in neuroscience of learning and memory** - In the following weeks we will explore a number of basic phenomena of learning. However, it is helpful to begin by casting these ideas against the backdrop of contemporary neuroscience. Today’s lecture will be a basic whirlwind tour of the neural processes thought to underly learning and memory. We’ll talk about the function of neurons, the specialization of function in the brain, basic learning mechanisms (hebbian learning, LTP), and modern techniques for studying learning and memory (fMRI, EEG, etc...)

Since this is primarily an introduction/review for students who have no prior exposure to neuroscience, we will default primarily to the book for neuroscience background, then turn to the paper readings for the evolution of a view of the organization of learning and memory in the brain.

Textbook Reading: Ch. 2 - *The neuroscience of Learning and Memory*

**Foundational Work:**


<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Sept 28  | **3. Non-associative/Perceptual forms of Learning** - This lecture will cover basic, non-associative forms of learning including unsupervised learning, perceptual learning, habituation/sensitization (incl. habituation as a empirical technique for studying learning in non-linguistic animals), latent learning, feature learning, imprinting, priming, repetition suppression, etc.... We will talk about both psychological, neural, and computational properties of these forms of learning.  

Textbook reading: Gluck, Ch. 6 - Non-associative learning  

Foundational:  

Contemporary Work:  


Optional (if you have an interest in the study of non-verbal primates):  
<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Oct 5 | 4. **Classical Conditioning I** - Pavlov, basic procedure, phenomena and terms (CS/US, etc...), basic findings, blocking and overshadowing, etc..., Rescorla-Wagner model, Pearce-Hall model and the role of attention/associability in classical conditioning, basic neural substrates of classical conditioning, interactions with other learning systems (e.g., role of hippocampus in trace conditioning)  

Textbook reading: Gluck, Ch 7 - Classical Conditioning


| Oct 12 | 5. **Classical Conditioning II** - modern theories including causal interpretations of classical conditioning, context-dependent learning, second-order condition (temporal-difference model and relationship to Rescorla-Wagner), neural basis of prediction errors  


<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
</table>
| Oct 19 | **6. Instrumental Conditioning I** - law of effect, role of reinforcement, stimulus control, choice behavior, matching law, concurrent schedules, self control/impulsivity - Assign Homework I  
Textbook reading: Gluck, Ch 8 - Instrumental Conditioning, up to pg. 318  
Textbook reading: Gluck, Ch 8 - Instrumental Conditioning, pg. 318 till end  
<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 2</td>
<td><strong>8. Generalization and Discrimination</strong> - Pearce (configural) vs. R-W (elemental), stimulus generalization, attention learning, context dependent learning</td>
</tr>
<tr>
<td></td>
<td>Textbook reading: Gluck, Ch 9 - Generalization, Discrimination, and the Representation of Similarity</td>
</tr>
<tr>
<td>Nov 9</td>
<td><strong>No class - traveling for grant panel</strong></td>
</tr>
<tr>
<td>Nov 16</td>
<td><strong>9. Cognitive forms of learning</strong> - more complex forms of generalization: category and concept learning, multiple system views in the categorization literature and their relation to multiple systems of conditioning</td>
</tr>
<tr>
<td></td>
<td>Textbook reading: Gluck, Ch. 4 - Skill Memory</td>
</tr>
<tr>
<td>Nov 23</td>
<td><strong>10. Cognitive forms of learning II</strong> - hypothesis testing, learning with rule or associations causal learning, learning by analogy to previous examples</td>
</tr>
</tbody>
</table>
**Nov 30**

**11. Learning and language** - Are languages learned? Statistical learning, grammar learning, word learning

Textbook reading: Gluck, Ch 13 - Language Learning


Optional:

**Dec 7**

**12. Observational Learning** - Learning from other people, pedagogical reasoning, copying, imitation, mirror neuron systems, observational learning

Textbook reading: Gluck, Ch 11 - Observational Learning


**Dec 14**

**13. Final Day - Various topics** - Developmental, aging, and effects of brain damage on learning and memory

Textbook reading: Gluck, Ch 12 - Learning and memory across the lifespan - Exam II

**This course is a synthesis of a couple courses I took as a student and from colleagues both at NYU and other places. Special thanks to Yael Niv, Nathaniel Daw, Rob Goldstone, and Brad Love for inadvertent contributions.**