**COGS-201 course plan, Winter 2016**

All enrolled will be expected to attend COGS-107b lectures (Tu, Th 12:30p-1:50p in CICC 101). All enrolled will also be responsible for all midterm and final exams given in COGS-107b.

The COGS-201 ‘section’ will meet on Wednesdays from 2:00p-3:20p in CSB-003 during which time Professor Nitz will provide lecture and discussion of assigned readings. The assigned reading(s) for each week (given below) are available at – [www.dnitz.com](http://www.dnitz.com). All students will be responsible for two exams on this material that will be given during COGS-201’s 5th and 10th weeks. Exams will cover not only details of the assigned readings, but also related lecture material/topics. Exams will be composed of 4-6 questions requiring short written answers (1/4 – 2/3 page). At least 3 such questions will be provided 1 week in advance of the exam itself. Students are encouraged to work together to generate correct answers prior to exam day, but will complete the exam itself independently.

**The assigned readings and related topics are:**

**Week 1:** Positional Mapping


The lecture/discussion will cover essentially all known forms of mapping of positional relationships between organism’s and their environment including: ‘place cells’; ‘grid cells’; ‘border cells’; ‘route cells’; and ‘head direction cells’.

**Week 2:** Mapping Time


Lecture will consider the means by which time intervals can be registered in the activity of prefrontal cortex neurons. Introduction to working memory.

**Week 3:** Neural Dynamics in Parietal Cortex


Lecture will consider the parietal cortex and the mechanisms by which it encodes conjunctions of egocentric relationships and egocentric/allocentric relationships.

**Week 4:** Basal Forebrain Control of Cortical Responsivity

Spatiotemporal Specificity in Cholinergic Control of Cortical Function – Munoz and Rudy, Current Opinion in Neurobiology, 2014.

Lecture will consider the structure of the basal forebrain projection system, its role in modulation of cortex (and impact on cortical EEG), and, more generally, the major multi-region systems of the brain.

Week 5:

Exam on readings and related lecture for weeks 1-4.

Week 6: Motivated Behavior and the Basal Ganglia


Dopamine Neurons Encoding Long-Term Memory of Object Value for Habitual Behavior – Kim et al., Cell, 2015.

Lecture will build on the COGS-107b consideration of basal ganglia direct and indirect systems to consider how basal ganglia dynamics can alter behavior.

Week 7:


Phase Relationship Between Hippocampal Place Units and the EEG Theta Rhythm – O'Keefe and Recce, Hippocampus, 1993.

Lecture will connect these two articles to consider the conjunction of spatial mapping and episodic memory.

Week 8: Synaptic Plasticity and Neural Representation


Lecture will complement that of COGS-107b by looking deeper into the nature of synaptic plasticity as it relates to spike sequences, dendritic locations, and rate versus temporal codes.

Week 9:
*The Dual-State Theory of Prefrontal Cortex Dopamine Function with Relevance to Catechol-o-Methyltransferase Genotype* – Durstewitz and Seamans, Biological Psychiatry, 2008

Lecture will consider the article in detail with particular attention to how cell assemblies change across time and the dependence of this on dopamine.

**Week 10:**

Exam on readings and related lecture for weeks 6-9.