Supplemental Document 1

Drugs, the Brain and Behavior

Tuesday and Thursday: 5:00-6:15pm

I. Rationale:

This course is designed for students with an interest in brain function and dys- (or altered) function, as well as brain pharmacology.

II. Course Aims and Objectives:

Aims:

To familiarize students with the science of the diseases and disorders that affect brain function and behavior, as well as the relevant pharmacology.

Specific Learning Objectives:

By the end of this course, students will be able to:

- use knowledge of normal brain function to explain specific diseases/disorders
- explain basic mechanisms of neural function and dysfunction
- describe clinical presentations of nervous system diseases
- explain treatment options and mechanisms of therapeutic action
- knowledgeably discuss and critique papers
- explain research techniques used in modern neuroscience.
- weigh both the value and limitations of different animal models of disease
- weigh the pros and cons of current competing theories
- explain pharmacology as both a research tool and as a clinical tool to treat brain dysfunction.

III. Format and Procedures:

This course meets twice a week. Classes will be either lectures in which new material will be presented or paper discussions, in which students will lead a critical analysis of a paper relevant to a preceding lecture.

IV. Course Requirements:

1. Class attendance and participation policy:

Attendance and participation are mandatory. You are expected to participate in both the lectures (by asking questions and answering questions) and the paper presentations (by leading discussions and asking questions during discussions you are not leading). While attendance and participation will not be averaged into your grade, they will be taken into account when determining your final grade in the class (e.g., the difference between an A and A-, or B and B+ when your grade is borderline).

2. Course readings:

Background readings are posted to the course blackboard website and **due the day of class.** You are responsible for the knowing the information in the readings.

Before every paper presentation, students not responsible for leading the discussion must submit **2 questions** about the paper by **9am on the day prior to the presentation**. Late questions will be given half-credit if submitted within one week of the presentation. Questions must be submitted via the course Blackboard site (campus.georgetown.edu).

V. Grading Procedures:

Undergraduate students:

Midterm Examination = 30%
Final Examination = 30%
Presentation(s) = 30%
Paper Questions = 10%

*The lowest grade out of the midterm, final, and paper presentation grades may be **replaced** by an optional term paper (details below).

Graduate students:

Midterm Examination = 20%
Final Examination = 20%
Presentation(s) = 30%
Paper Questions = 10%
Term Paper (details below) = 20%

Term Paper – An **8-10 page** (double-spaced) paper on a topic of your choosing. You must get approval of your topic from an instructor beforehand, no later than two weeks after the midterm. The topic must be focused on a dysfunction or disease covered in class. You must include at least 7 primary sources not used in class (n.b. this does not include review articles). When you bring your topic for approval, please come prepared with a preliminary thesis statement and 1-page outline incorporating at least 3 primary sources. The term paper is due the last day of class.

VI. Academic Integrity

Each student in this course is expected to abide by the Georgetown University Honor Pledge. Any work submitted by a student in this course for academic credit will be the student's own work. Any violation of the Honor Pledge will result in no credit for the given assignment and automatic reporting of the violation to the Honor Council.

Fall 2010

	Topic	Key Concepts	Key Techniques (by unit)
9/2	Intro	Structure of the nervous system, neurons, glia	
		Neurotransmitters and receptors, the action potential	
9/7	**How to present a paper**		**Regulatory Systems**
	Homeostasis & Stress	Homeostasis, autonomic NS, hormone signaling	Animal models of behavior
9/9	Homeostasis & Stress (con't)	Negative feedback, transcription factors	Radioimmunoassay
	Reward and Addiction	Reward pathways, disinhibition	In situ hybridization
9/14	Reward and Addiction (con't)	Mechanisms of drug action	Intracerebral microinjections
	Paper presentation		Single unit recording
9/16	Reward and Addiction (con't)	Animal models, coincidence detection, second messengers	
9/21	Ingestive Behavior & Eating Disorders	Peptide neurotransmitters	
9/23	Ingestive Behavior & Eating Disorders (con't)		
	Paper presentation		
9/28	Neural Circuits of Mood Regulation	Neurotransmitter lifecycle, placebos	**Mood Regulation**
	Major Depressive Disorder	Transporters, autoreceptors, desensitization	Receptor binding
9/30	Major Depressive Disorder (con't)	Brain imaging, methods for manipulating human brain (DBS,MS)	BrdU/ Immunohistochemistry
	Paper presentation		fMRI
10/5	Anxiety Disorders	Receptor subtypes, receptor subunits, drug specificity	
10/7	Bipolar	Validity of animal models; timescales of drug action	
	Paper presentation		
10/12	OCD	Psychosurgery	**Executive Function**
	Executive Function	(Human) lesions: necessary, sufficient, specific	Microdialysis
10/14	Executive Function (con't)		PET
	Schizophrenia	Animal models, competing hypotheses	Neuropsych tasks
10/19	Schizophrenia (con't)	Genetics/heritability/twin studies/diathesis-stress	DCS, TMS
10/21	ADHD	Microcircuits, neurotransmitters as neuromodulators	
10/26	ADHD (con't)	Inverted-U curve, adaptation vs. compensation	
	Paper presentation		
10/28	**Midterm**		
11/2	Development (Cognitive)	Principles of development, learning mechanisms	**Development**
11/4	Development (Toxicology)	Neurogenesis, cell death	Transgenics knock-in, out, down
11/9	Mental Retardation	Synaptogenesis, pruning	Patch clamp
11/11	Reproductive Behavior	Critical periods, priming	RNAi/shRNA/viral vectors
11/16	Social Behavior	(Animal) lesions	
	Paper presentation		
11/18	Social behavior	shRNA, viral vectors	
	Psychopathology	DSM	
11/23	Autism	Heterogeneity of diagnosis	
	Paper presentation		
11/30	Autism (con't)		
	Circadian Rhythms	Transcription, translation, protein synthesis feedback	**Biological Rhythms**
12/2	Sleep and Arousal	EEG, delta, gamma, theta waves	Local field potentials
12/7	Sleep and Arousal (con't)	Competition between NT states, NT activity as 'switches'	EEG
	Paper Presentation		Western blot
12/9	Brainstem Control of Life	Hindbrain control of respiration, heart rate, conservation across species	Northern blot

Spring 2011

	Topic	Key Concepts	Key Techniques (by unit)
1/13	Introduction	Structure of the nervous system, neurons, glia, neurotransmitters and receptors, the action potential	
1/18	Development	Chemoattractants/repulsants	**Development**
		Inside-out patterning of cortex	Histology
1/20	Neurogenesis and Survival	Cell death (apoptosis v necrosis), trophic factors, pruning	BrdU immunohistochemistry
			Recombinant DNA technology
1/25	CNS Injury	Differences between CNS and PNS	**Neural Injury & Recovery**
1/27	**How to present a paper**		Transplants (stem cells)
	Spinal Injury	Functional anatomy of the spinal cord	Validity of animal models
2/1	Spinal Injury (con't)		
	Recovery of Function (CNS)	Principles of recovery (differences from development)	
2/3	Recovery of Function (PNS)	Principles of recovery (differences from CNS)	
	Paper Presentation		
2/8	Touch and Pain	Pain circuitry in the spinal cord, signal transduction	
2/10	Phantom Limb Syndrome	Balance of inhibition and excitation in the brain	
	Paper Presentation		
2/15	Multiple Sclerosis and Neuroimmune Disorders	Immune system basics, role of myelin and glia, action potential transmission	
2/17	Vision	Receptive field organization: simple to complex	**Sensation & Perception**
2/22	Object and Space Perception	Dorsal-ventral streams	Human lesions
2/24	Neglect	Top-down vs. bottom-up attentional mechanisms	Functional imaging
	Paper Presentation		
3/1	Language	Brain areas: necessary, sufficient, or specialized?	
3/3	**Midterm**		
3/15	Basal Ganglia	Coincidence detection, NT synthesis,	**Basal Ganglia**
3/17	Basal Ganglia (con't)	Receptor subtypes, ionotropic/metabotropic receptors	EEG
3/22	Parkinson's Disease	Nature/nurture, neurotoxins	Local field potentials
3/24	Parkinson's Disease		Microdialysis
	Huntington's Disease	Genetics	Animal lesions
3/29	Epilepsy	Relationships between excitation and inhibition	Single unit recording
	Paper Presentation		Gene therapy
3/31	Epilepsy	Circuitry of eplilepsy	Neurotoxins
4/5	HIV dementia/infectious disease	Brain defenses, microglia, astrocytes, blood brain barrier	
	Paper Presentation		
4/7	Memory / LTP	Relationship between cellular changes and behavior	**Networks for Learning**
4/12	Memory (con't)	Taxonomy of memory; implicit memory	PET
			Structural imaging
4/14	Memory (con't)	Explicit memory	Patch-clamp
	Paper Presentation		Western blot
4/19	Memory (con't)	Structure/function relationships	ELISA
	Spatial memory	Pattern separation vs pattern completion	Extracellular recordings
4/26	AD Cognition	Neuropsychology/behavioral testing; imaging and diagnosis	
	AD Basic Science	Protein modifications, nootropics	
4/28	AD Basic Science	Drug targets	
	Paper Presentation		