COGS 107B
Monday 2pm Sections

Thomas Donoghue
Midterm 1 -
Any Q's / Issues?
Schedule

Jan. 16th — NO SECTION (Holiday)
Jan. 23rd — Intro Section
Jan. 30th — Midterm 1 Review / Questions
  MIDTERM 1 — Feb 2nd
Feb. 6th — Normal Section
Feb. 13th — Section + Midterm 2 Questions / Review
Feb. 20th — NO SECTION (Holiday)
  MIDTERM 2 — Feb 23rd
Feb. 27rd — Normal Section
March 6th — Normal Section
March 13th — Final Review / Questions
  FINAL EXAM — March 16th
Neuromodulators & Drugs of Abuse

- Ionotrophic vs. Metabotropic (G-protein)

- 5-HT, NE, HA, DA, ACh

- Small number of cells in specific nuclei, with widespread projections

- Agonist vs. Antagonist

- What is a drug?

- What makes a chemical be a psychoactive drug?

- Why do drugs have side effects?
Ionotropic vs. Metabotropic

**Ionotropic:**
- Ligand-gated ion channels
  - Neurotransmitter binds
  - Channel opens
  - Ions flow across membrane

**Metabotropic:**
- G-protein-coupled receptors
  - Neurotransmitter binds
  - G-protein is activated
  - G-protein subunits or intracellular messengers modulate ion channels
Functional Anatomy

How ‘function’ and ‘anatomy’ interact.

How the function of the brain can constrain effective connectivity.
Serotonin (5-HT)

- Found in the Raphe Nuclei of the brainstem
- Serotonin is linked to mood. Frequently the target for anti-depressants (SSRIs).
- Also involved in: sleep, memory, appetite, sex
- Ecstasy – blocks or reverses 5-HT transporters
Histamine (HA)

- Found in the posterior hypothalamus
- Histamine projections increase wakefulness and prevent sleep
- Anti-Histamines: used for allergies, but also cause drowsiness. (Histamine antagonists)
NorEpinephrine (NE)

- aka NorAdrenaline
- Found in the Locus Coeruleus
- Functions include alertness, arousal and the reward system
- NorEpinephrine is also a target for anti-depressants (MAOIs)
AcetylCholine (ACh)

- Found in the Pontine & Basal Forebrain
- Involved in plasticity, arousal, attention and reward
- In the peripheral nervous system (PNS), is an excitatory neurotransmitter (NT) used at neuromuscular junctions (NMJs)
- Nicotine is an ACh agonist
- Damage to the ACh system has been implicated in Alzheimers
Dopamine (DA)

- Found in the Ventral Tegmental Area and in the Substantia Nigra (midbrain areas)
- DA is involved in reward and movement
- Parkinsons is a specific loss of Dopaminergic neurons in the Substantia Nigra
- Cocaine: DA agonist (amongst other things)
- L-DOPA is a DA precursor, used to treat Parkinson's. DA agonists are used for ADHD.
The Reward Pathway

- DA pathway: Ventral Tegmental Area (VTA) – Nucleus Accumbens (NA) – Prefrontal Cortex (PFC)

- Rats will self-stimulate the reward pathway over and above all else, and starve to death

- Drug of abuse (drugs that lead to addiction) all seem to ‘take over’ the reward pathway, regardless of their primary effects.
Other Drugs

- Alcohol - GABA agonist & Glutamate antagonist
- Caffeine - Adenosine antagonist
- Marijuana - Activates Cannabinoid receptors
- LSD - non-specific agonist DA, NE, 5-HT
- MethAmphetamine - powerful DA agonist
- Ketamine - NMDA (Glu receptor) antagonist
- Heroin - Opioid agonist