Midterm 1- Study Guide

Chapter 1: Basic Pharmacology (Lec 1, 2)

- How do we define drugs? → the challenge comes from the fact that drugs are often defined by user intent
- How do we name drugs (general characteristics of each)? → what is a chemical name, generic name (contains the "stem", trade name (can be patented), street name (can vary with time and place)
- What is off-label use?
- Characteristics of a dose-response curve, how to interpret a dose-response curve***
- Range starts so low there's no detectable effect → range so high there's no further response
- Median effective dose (ED), median lethal dose (LD)
- Effectiveness and potency
- What happens when you mix them? – antagonism, potentiation
- First order vs. zero order kinetics
- Drugs that are administered intravenously are NOT subject to first-pass metabolism
- Relative speed of routes of administration: I.V. > I.P > S.C. > I.M. > P.O.
- Therapeutic index
- Drugs are reported in mg/kg
- St John's wort- enzyme induction – decreases effectiveness of other drugs
- Pharmacokinetics = the study of how a drug moves around the body. It involves the processes of absorption, distribution, and elimination.
- Elimination is performed by the liver and the kidneys
- **Factors that alter drug metabolism**
    - Stimulation of enzyme systems (repeated drug use)
    - Depression of enzyme systems (e.g. St John's wort)
    - Age
    - Certain foods
    - Species

Chapter 2: Behavioural Analysis of Drug Effects (Lec 3, 4)

- Importance of Peter Dews' Pentobarbital/Pigeons study: The ability of the drug to stimulate or depress key pecking in pigeons depended on the schedule of reinforcement
- Fixed, variable ratio and interval (helpful video: **https://www.youtube.com/watch?v=GLx5yl0sxeM)**
- Basic research methods information: what is the independent variable and dependent variables in behavioural pharmacology research
- Balanced placebo design
- Difference between *within-subjects* and *between-subjects*
- *double-blind procedure*
- U.S. *Controlled Substances Act* (1970) and the Controlled Drugs and Substances Act (1996) classify drugs based on their abuse liability.
- Placebo effect and nocebo effect
- Three group design, usefulness in clinical trials
- Measuring human behaviour: subjective rating scales (VAS, POMS, ARCI, Liking Scales)
- Testing how drugs affect memory (N-back [short term/working memory], recall lists [long term memory])
- Testing how drugs affect inhibition: Go-no go tasks and go-stop tasks

Chapter 3: How We Adapt to Drugs – Tolerance, Sensitization, and Expectation (Lec 5)

- Concept came from Mithridates ("poison king")
- Acute tolerance: When a drug effect is greater at a specific blood level during absorption than it is at that same blood level during elimination
- Tolerance to the anorexic (increased appetite) effects of amphetamine will only develop in hungry animals in the presence of food when given repeatedly.
- Solomon and Corbit's opponent process theory
- Tolerance:
  - Tolerance to a certain effect of a drug can be slow, rapid, or not develop at all
  - Cross-tolerance occurs when tolerance to one drug can affect another drug's effectiveness.
  - Tolerance goes away after time
  - Withdrawal symptoms (when drug is stopped or dosage is decrease)- are often the opposite symptoms of those cause by the drug. This represents the body's compensation processes
- A person would be least cognitively impaired when a familiar alcoholic beverage is consumed in a familiar setting; will be most impaired when a novel beverage is consumed in a novel environment
- Siegel study: heroin in novel vs familiar environments → conditioned tolerance
- The "mystery" of heroin overdose is also due to conditioned tolerance
- Former heroin addicts may experience spontaneous withdrawal symptoms when they return to places where they had previously used heroin, even though they are no longer physically dependent due to conditioned withdrawal
- Sensitization is reverse tolerance: Refers to an <u>increased effect</u> of some aspects of a drug (e.g. with amphetamines, increased eye blinks, motor hyperactivity, talkativeness, etc)
- A drug's effect can be different depending on whether the animal/human self-administers the drug or has no control over its delivery.

Chapter 4: Neurophysiology, Neurotransmitters, and the Nervous System (Lec 6, 7)

- Neurotransmitters are stored in synaptic vesicles within the axon terminals of a neuron
- Reuptake and enzymatic degradation are two means by which neurotransmitter activity is halted.
- Cerebellum will cause a person who is intoxicated with alcohol to lose their balance
- Teratogens can interfere directly with development and cause severe structural malformations and/or disruptions may appear mild and be detectable only with careful systematic observation of an individual's behaviour → <u>functional/ behavioural teratology</u>
- Glutamate – excitatory, GABA – inhibitory
- Which neurotransmitters are the monoamines?
- Acetylcholine – nicotinic and muscarinic receptors
  - When you smoke a cigarette, the acetylcholine system is DIRECTLY stimulated
- Serotonin: neuronal cell bodies – raphe nuclei
- Dopamine- names of the 4 pathways (mesocortical, mesolimbic, nigrostriatal, tuberoinfundibular)
- Which imaging techniques are structural vs. functional
- Spatial resolution and temporal resolution trade-off
- One drawback of functional magnetic resonance imaging (fMRI) is a lag of multiple seconds between stimulus onset and signal acquisition.
- PET is ideal for examining the real-time effects of a drug of abuse and its interaction with specific neurotransmitter receptors throughout the brain

Chapter 5: Substance Use and Addictive Disorders (Lec 8,9)

- *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-5)
  - "Substance Use Disorders"
  - new: gambling (only non-substance related disorder)
  - new: craving
- Addiction has many conceptualizations, though most definitions have several elements in common: loss of control over drug taking, harmful consequences, chronic and relapsing disorder
- According to the *dependence model* of drug addiction, addicts crave a drug because it will prevent withdrawal.
- Rat Park' = scientific experiment in the 1970s that called into question the common understanding of addictive drugs
  - rats that would be addicted to morphine in a poor, isolated environment did not become addicted when they were housed in a stimulating environment with other rats.
- A neural system that controls motivation must have at least two components 1) activation, 2) direction
- Factors that have been shown to enhance the reinforcing value of a drug: previous experience with the drug, with other drugs, physical dependence (/that will cause withdrawal), genetics, other deprivations and motivations (hunger, thirst), task demands, abuse potential, dose
- Stress has long been provided as a rationale for the use of drugs by humans, and an extensive number of studies have examined the role of stress in the self administration of drugs by laboratory animals Impacts drug-taking behaviour in the following ways:
  - It enhances the acquisition of drug self-administration in laboratory animals.
  - It increases rate of responding for drug self-administration in laboratory animals.
  - It increases breaking point on a progressive ratio schedule of drug reinforcement in laboratory animals.
  - It sensitizes brain mechanisms responsible for the reinforcing value of a drug.

- Incentive sensitization theory: proposes that, with repeated administrations, the motivational and reinforcing effects of a drug become sensitized. At the same time, drug-associated cues gain incentive salience, meaning they become more attention-grabbing, attractive, and desirable.

- The hedonic dysregulation theory: proposes that excessive activation of the reward system at the neurocircuitry level triggers both within-system and between-system neuroadaptations, in order to limit drug reward.

- Evidence of cortical dysfunction and deficits in higher-order processing in drug addiction may help explain why so many substance users deny the presence or severity of their drug addiction.

- Nora Volkow: Addiction is a dysfunction in information processing and integration among multiple brain regions that comprise four interrelated circuits:

  1. regulate reward/saliency
  2. motivation/drive
  3. memory/conditioning
  4. inhibitory control/executive function