

Test II Review

Ion Channels

- Understand relative intracellular and extracellular concentrations of sodium, potassium, calcium, and chloride ions
- Describe what an ion channel is and the molecular properties that form these channels
- Describe voltage-gated and ligand-gated ion channels
- Understand and explain how sodium ion channels and potassium ion channels work

Thermodynamics of Ion Channels and Sodium/Potassium/ATP pumps

- Ion concentration gradients
- Cell membrane electric potentials
- Nernst equation and membrane equilibrium potentials
- Ion movements and resulting inhibitory/excitatory potential changes
- Sodium-potassium-ATP pump mechanism and energetics associated with this
- Free energy changes of ion movement across voltage and concentration gradients
- Second Law of Thermodynamics to predict ion movement spontaneity

G-Protein Coupled Receptors (GPCRs)

- Structure
- Detailed mechanism of action of GPCRs
- Relevance in pharmaceutical industry
- Systems of neuroreceptors that are GPCRs

Cholinergics

- Acetylcholine structure and mechanism for synthesis and hydrolysis
- Steps that occur to pass a nerve impulse from one neuron to another
- Mechanism of action for botulinum toxin
- Two major mechanisms used to reduce neurotransmitter levels at nerve synapses
- Two major classes of cholinergic receptors and the specific mechanism of action for each
- Cholinergic antagonists
- Acetylcholinesterase inhibitors
- Structure and mechanism of catalytic triad at acetylcholinesterase active site

Adrenergics

- Schematic of peripheral nervous system
- Structure of epinephrine, norepinephrine, pseudoephedrine
- Geometry of adrenergic receptors
- Major classes and roles of norepinephrine receptors
- Interaction diagram of adrenergic receptors with neurotransmitters at binding site
- MOA of activated receptors
- Decomposition via monoamine oxidase enzyme
- Medications that target adrenergic receptors and their mechanism of action
- Beta-blockers, asthma medications, local anesthetics, decongestants

Psychoactive Drugs: Stimulants

- Structures of amphetamine, methamphetamine, pseudoephedrine
- History of cocaine and amphetamines
- Mechanism of action for stimulants
- Current and historical use of amphetamines and cocaine

Psychoactive Drugs: Tranquilizers

- Structure of ethanol, GABA, GHB
- Mechanism of action of benzodiazepenes, ethanol, barbituates, sedative hypnotics
- Use in this country
- Toxic and adverse effects

Psychoactive Drugs: Anti-Depressants

- Structures of dopamine, norepinephrine, serotonin
- Prevalence of depression
- Monoamine theory of depression
- Mechanisms of actions of four classes of anti-depressants
 - MAO Inhibitors
 - Tricyclic Antidepressants (TCAs)
 - Selective Serotonin Reuptake inhibitors (SSRIs)
 - Serotonin Norepinephrine Reuptake inhibitors (SNRIs)
- Toxicity and side effects of anti-depressant medications

Psychoactive Drugs: Anti-Psychotics

- Symptoms of Schizophrenia and frequency of occurrence
- Historical discovery of substances to treat schizophrenia
- Dopamine theory of schizophrenia
- Mechanism of action of anti-psychotic medications
- Side-effects of schizophrenia medications
- Amphetamines, Parkinson medications, and schizophrenia symptoms
- Atypical anti-psychotics: development and mechanisms of action
- Effect of PCP and ketamine on NMDA receptors
- Glutamate neural activity and schizophrenia

Psychoactive Drugs: Opiates and Opioids

- Natural sources of opiates and evolutionary theories for prevalence
- History of opioid use and development by humans
- Effects of opiates and opioids on humans
- Historical discovery and marketing of heroin and aspirin
- Opioid general structure
- Mechanism of action for μ , κ , and δ opioid receptors respectively
- Endogenous opioids
- Oxycodone medications and societal issues

Local and General Anesthetics

- Mechanism of action for local anesthetics
- Relationship of pK_a to local anesthetic
- Mechanism of action for general anesthetics
- Commonly used general anesthetics