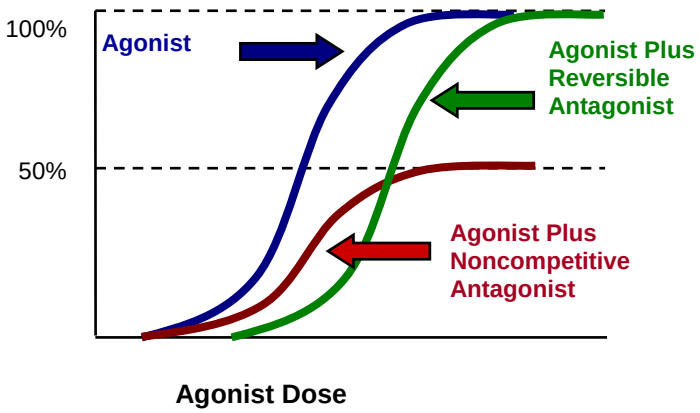
14: Pharmacology

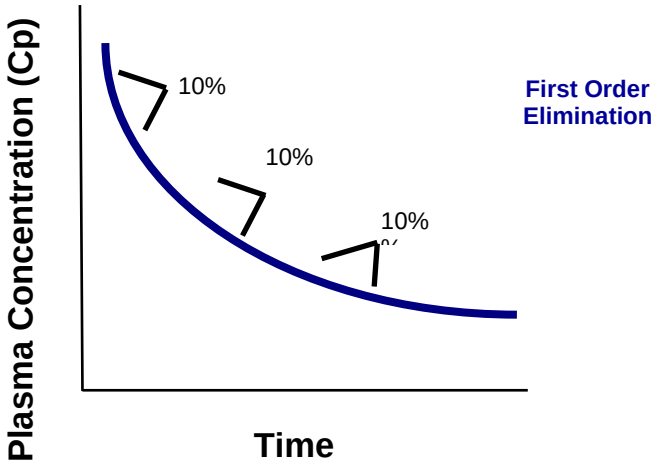
Pharmacodynamics

- **Pharmacodynamics:** the study of the relationship between drug concentration in the body, and the physiological response to that concentration of drug
  - The dose of the drug is directly linked to the magnitude of the body's response to that drug.
  - Drugs act through receptors
- **Enzyme inhibitors**: may be competitive or noncompetitive
- **Receptors:** the components of a cells or organisms that interact with a drug and initiate the chain of events that lead to the drug's observed effect
- **Coupling:** the process that links the drug occupancy of receptors to the pharmacological response
- **Agonists:** initiate changes in cell function, producing effects of various types. Their **potency** depends upon their:
  - **Affinity:** the tendency to bind to receptors
  - **Efficacy:** the ability to initiate changes once bound



Pharmacokinetics

- **Pharmacokinetics**: the study of drug movement in the body
- **Volume of distribution, clearance** and **half-life** mathematically describe the movement of a drug in the body
- **Zero-order elimination:** remains at a constant rate irrespective of the amount of drug in the body
- **First-order kinetics:** occurs when the rate of elimination is proportional to the drug concentration, such that a constant fraction of a drug is eliminated per unit time
- **Biotransformation**: the metabolic conversion of endogenous and xenobiotic chemicals to more polar, water-soluble compounds, to aid excretion from the body



Pharmacology of the Autonomic Nervous System

- **Peripheral nervous system (PNS)**
  - **Autonomic system:** conveys all outputs from the central nervous system to the rest of the body
  - **Somatic system:** Single motor neuron connects the CNS to the skeletal muscle fiber
- **Classification of Autonomic Neurons:** can be further divided in two ways, based on either the:
  - Structural features of the fibers
  - Neurotransmitters released by the fibers
- **Types of Cholinergic Receptors:** two kinds of cholinergic receptors named after the alkaloids originally used in their identification:
  - **Muscarinic receptors:** G-Protein Coupled Receptors that mediate the effects of acetylcholine at postganglionic parasympathetic synapses - primarily the heart, smooth muscle and glands
  - **Nicotinic receptors:** directly coupled to cation channels and mediate fast excitatory synaptic transmission at the neuromuscular junction, autonomic ganglia, and at various sites in the CNS
- **Cholinergic Agonists:**
  - **Direct:** bind to and activate muscarinic or nicotinic receptors
  - **Indirect**: work primarily through the inhibition of acetylcholinesterase

Toxicity and Drug Reactions

- **Symptoms of lead poisoning can be remembered using LEAAAD:**
  - **LL:** Lead Lines on gingivae and on epiphyses of long bones (seen during X-rays)
  - **EE:** Encephalopathy and Erythrpcyte basophilic stippling
  - **AA:** Abdominal colic and sideroblastic anemia
  - **D:** wrist and foot drop
- **Iron toxicity symptoms** can be distinguished based on the length of exposure:
  - Acute: gastric bleeding
  - Chronic: metabolic acidosis, scarring leading to GI obstruction
- The symptoms of **alcohol toxicity** vary by the type of alcohol. For all three alcohols, the active enzyme in the first step of metabolism is alcohol dehydrogenase.
- Toxicity is a common side effect when one drug either induces or inhibits the activity of a CYP450 enzyme that also acts on another drug. The **most common CYP450 inducers** are quinidine, barbiturates, phenytoin, rifamin, griseosulvin, carbamezapine and St. John's wort.
- **Herbal agents** may have pharmacological actions that can be toxic either alone or in specific combinations with other herbs and/or pharmaceuticals agents.
- **Echinacea:** used to treat the common cold, it may cause GI distress, drowsiness and headache
- **Melatonin:** used for jet lag and insomnia, is may also cause sedation, hypoprolactemia and suppression of midcycle LH
- **St. John's Wort:** believed to treat depression, this natural product is associated with GI distress, P450 induction, and serotonin syndrome when used in conjunction with SSRIs
- **Kava:** although it is used to treat chronic anxiety, its used has been linked to hepatotoxicity, phototoxicity and dermatoxicity
- **Ephedra:** known to have actions similar to epinephrine; side effects include CNS and cardiovascular stimulation, arrhythmia, stroke and seizure at high doses

How to Use This Cheat Sheet: These are the keys related this topic. Try to read through it carefully twice then rewrite it out on a blank sheet of paper. Review it again before the exam.