PHARMACOLOGY

Introduction to Pharmacology

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DISCLOSURE

None

OBJECTIVES

1. Define pharmacology, pharmacodynamics, and pharmacokinetics.
2. Operate drug information searches using Epocrates and LexiComp (through UpToDate).
3. Describe absorption, distribution, excretion, and metabolism.
4. List the advantages and disadvantages of different routes of administration for drugs.

PHARMACOLOGY

Science of how chemical agents, both natural and synthetic (i.e., drugs) affect biological systems

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PHARMACOLOGY THREAD

PHARMACOLOGY THREAD DESIGN

Where	What	How
FMS 501	Basic principles of PK & PD Anti-inflammatories, receptors, older adults Intro to antibiotics	Pharm Sessions CBL Cases
FMS 502	Principles of clinical use of drugs ("clinical pharmacology"): renal, cardiovascular; Applied PK & PD	Pharm Sessions Other Sessions CBL Cases
FMS 503	Principles of clinical use of drugs ("clinical pharmacology"): pulmonary; Applied PK & PD	
FMS 511-513	Principles of clinical use of drugs	
CCW/LIC	Pharmacology application Drugs for specialty areas of medicine	Seeing patients, taking medication histories, consulting references

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TEAMS

ACTIVE LEARNING

Consider teams you've been part of.

What **CONTRIBUTES** to a team's success?

What **DETRACTS** from a team's success?

PHARMACOLOGY STUDENT TEAMS

10 randomly generated teams

Complete pharmacology active learning and worksheets with your assigned teams

ACTIVE LEARNING

1. In your teams, over the next 5 minutes, please:
   a. Introduce yourselves.
   b. Create a list of at least three team rules that everyone can abide by.
   c. Create a team name.

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INTRODUCTION

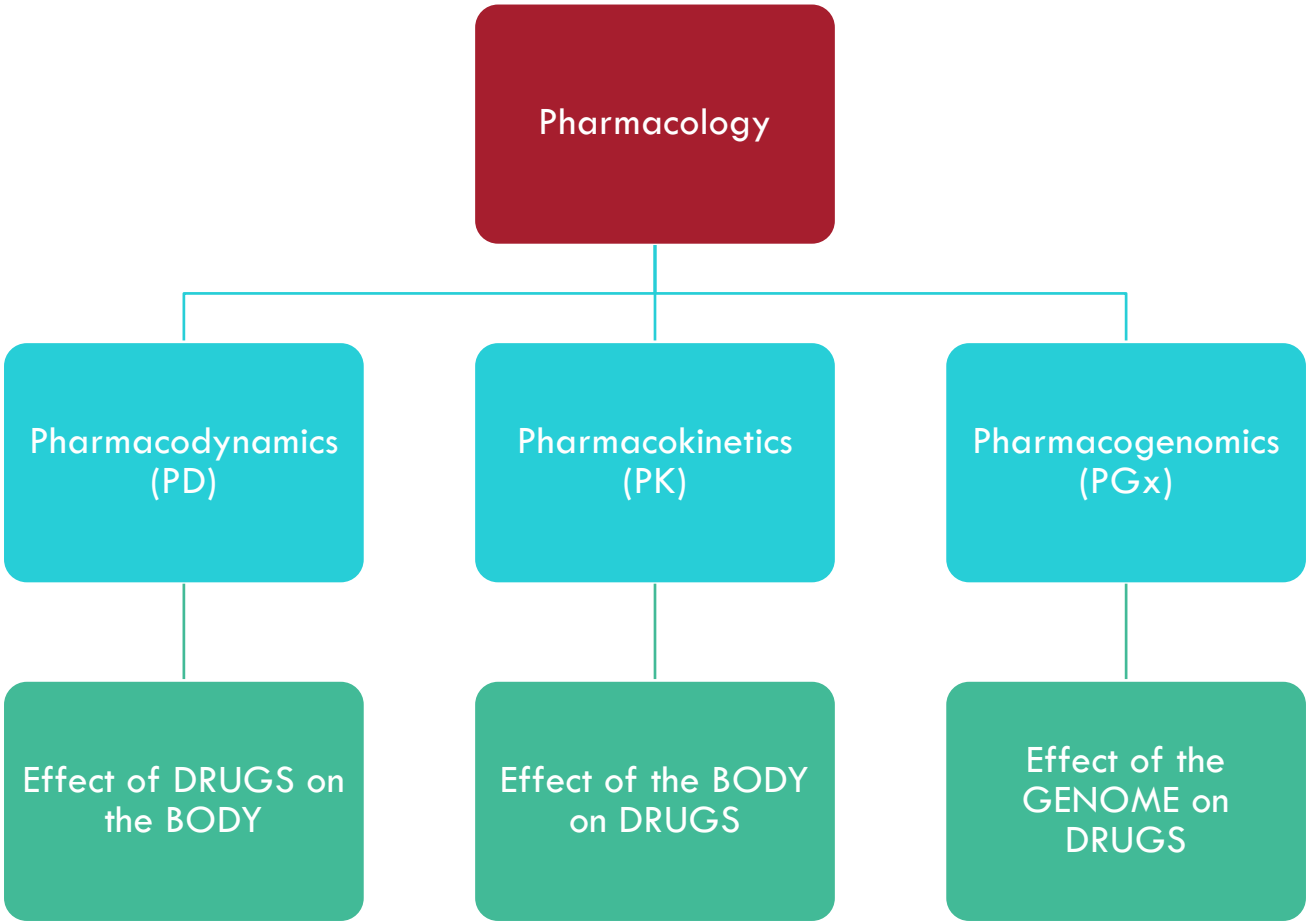
ACTIVE LEARNING

2. As a team, match the following items to their most accurate definition. Have the "reporter" from your group annotate the screen with your answer.

Term	Definition
1. **Pharmacodynamics**	A. Science of how chemical agents, both natural and synthetic (i.e., drugs) affect biological systems
2. **Pharmacokinetics**	B. Study of the biochemical, cellular, and physiological effects of drugs and their mechanisms of action.
3. **Pharmacology**	C. Study of the time course of drug absorption, distribution, metabolism, and excretion

PHARMACOLOGY DESCRIPTIONS

Pharmacology Parameter	Description
Principles of pharmacokinetics (PK)	Study of the time course of drug absorption, distribution, metabolism, and excretion
Principles of pharmacodynamics (PD)	Science of how chemical agents, both natural and synthetic (i.e., drugs) affect biological systems Dose-effect relationships, receptor agonists/antagonists
Mechanisms of action	Drug effects, adverse effects, interactions
Relevant biochemical principles	Signal transduction pathways, etc
Drugs and drug classes	How they are used to treat the conditions you study


Pharmacology
Pharmacodynamics (PD)
Pharmacokinetics (PK)
Pharmacogenomics (PGx)
Effect of DRUGS on the BODY
Effect of the BODY on DRUGS
Effect of the GENOME on DRUGS

ACTIVE LEARNING

3. A patient presents to the Emergency Department with sepsis due to bacterial meningitis.

a. How could pharmaco**kinetics** be relevant in the management of this patient?

b. How could pharmaco**dynamics** be relevant in the management of this patient?

PHARMACOLOGY LEARNER EXPECTATIONS

Some information will be provided to you (resources, pre-work, in-class, handouts, worksheets)

You will be obtaining, organizing interpreting, information on your own

In all cases, capture the following information:

Classification	Clinical Pharmacology	Biochemical Pharmacology
• **Class** • **Generic name** • Trade name	• **Clinical uses & effects** • **Adverse effects** • Administration route(s) • Key interactions • Sources of inter-patient variability	• **Mechanism of action (molecular mechanism of action, physiological receptor, effectors/transducers)** • Mechanism of adverse effects

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PHARMACOLOGY RESOURCES

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HELPFUL PHARMACOLOGY RESOURCES

Texts via WSU HSL

- Katzung and Trevor, Basic and Clinical Pharmacology, 15e.
- Katzung and Trevor, Pharmacology: Examination and Board Review, 13e. While this
- Goodman and Gillman, The Pharmacological Basis of Therapeutics, 13e
- Stringer, Basic Concepts in Pharmacology: What You Need to Know for Each Drug Class, 6e.
- Raffia, Netter's Illustrated Pharmacology, 2e.

Apps/Web-based

Epocrates
- Pushed to your iPads
- Please create a free account

Lexi-Comp Drugs

Your pre-work included creating a free Epocrates account. If you have not done so, please create a free Epocrates account ASAP. You will see CBL questions soon that will require you to look up information.

EPOCRATES DEMO

Accessing app

Searching for drugs

Go through each tab

EPOCRATES PRACTICE

4. Use Epocrates to search for the drug acetaminophen.

a. For which of the following dosage forms is it commercially available? Circle all that apply.

- Aerosol
- Capsules
- Elixir
- Injection
- Lozenge
- Mouthwash
- Ointment
- Solution
- Spray
- Suspension
- Tablets

b. What would the oral dose be for an adult using immediate-release acetaminophen for pain?

c. What is a Black Box (or Boxed) Warning? What Black Box warnings exist for acetaminophen?

d. How is acetaminophen metabolized?

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LEXI-COMP DRUGS DEMO

Accessing through Health Science Libraries

Searching for drugs

Go through each tab

LEXI-COMP PRACTICE

5. Use Lexi-Comp to search for the drug ibuprofen.

a. List three brand names for ibuprofen in the United States.

b. What would the oral dose be for an adult using immediate-release ibuprofen for pain?

c. What Boxed Warnings exist for ibuprofen?

d. What is ibuprofen's mechanism of action?

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DRUG RESOURCE PRACTICE

6. Use either Epocrates and/or Lexi-Comp to answer the following questions related to this scenario: You are out on a Friday night and overhear a group of people saying they "scored" some "Flagyl" from a friend. You glimpse green and white capsules in their hands before they swallow them with shots of tequila.

a. What is Flagyl?

b. What is Flagyl indicated for?

c. Based on the appearance of the capsules ingested, is it likely what they were using was Flagyl?

d. What are common adverse reactions to Flagyl?

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PHARMACOKINETICS

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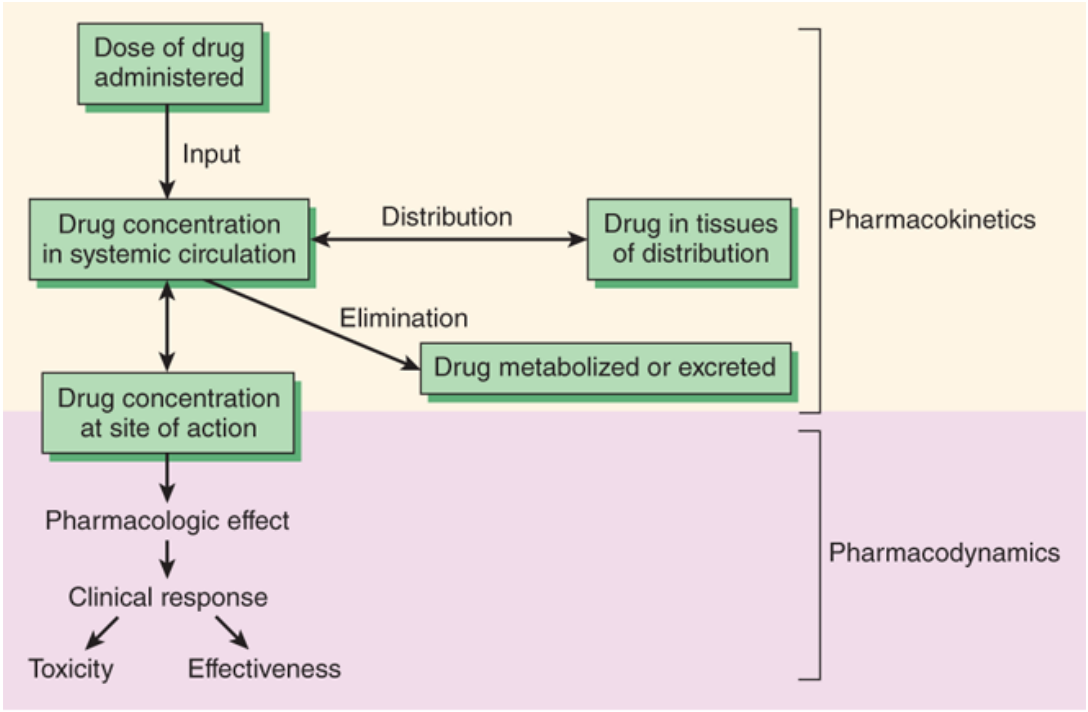
DRUG DEFINITION

Any substance that acts at the molecular level on a biological system that results in a functional change

A substance approved by the Food and Drug Administration for the treatment or prevention of disease

- Include inorganic ions, small peptides, proteins, nucleic acids, lipids, carbohydrates
- First isolated from plants and microorganisms
- Now many are partially or completely synthetic

COMPARISON



Source: Bertram G. Katzung, Todd W. Vanderah:
Basic & Clinical Pharmacology, Fifteenth Edition

PHARMACOKINETIC BASICS - ADME

Absorption	Distribution	Metabolism	Elimination
• Process that brings drug from administration into systemic circulation • Bioavailability	• How a substance is spread throughout the body • Volume of distribution	• Processing of drug by body into subsequent compounds • Hepatic or other	• Process by which drug is eliminated from body • Clearance

When poll is active, respond at **pollev.com/skyem**

Which route of administration would be absorpbed most rapidly?

SELECTED ROUTES OF DRUG ADMINISTRATION

Route	Absorption Pattern	Advantages	Limitations
Enteral (related to the digestive system)			
Oral ingestion	Variable	Safest; most convenient; economical	Patient must be cooperative; bioavailability may be limited for several reasons
Sublingual	Across oral mucosa (e.g., nitroglycerin)	Bypasses liver; avoids first-pass effect	Only certain drugs, i.e., nonionic, high lipid solubility
Rectal	Across rectal mucosa	Less first-pass metabolism vs. oral; useful when oral ingestion is not possible	Bioavailability can be incomplete; irritating to rectal mucosa

SELECTED ROUTES OF DRUG ADMINISTRATION

Route	Absorption Pattern	Advantages	Limitations
Parenteral (outside of the digestive system)			
Intravenous	Absorption circumvented; potentially immediate effects	Availability is rapid, extensive & predictable emergency use; irritating solutions can be administered	Asepsis must be maintained; injection site pain; difficult for self-medication; mistakes (once injected, no retreat)
Intramuscular	Aqueous drugs absorbed readily via diffusion, blood flow- dependent; Slow, constant absorption from repository preps	Good for moderate volumes, oily vehicles, some irritating substances	Precluded during anticoagulant therapy
Subcutaneous	Aqueous drugs absorbed readily via diffusion, blood flow- dependent; Slow, constant absorption from repository preps	Good for insoluble suspensions and implanting solid pellets	ONLY for drugs that are not irritating to tissues

SELECTED ROUTES OF DRUG ADMINISTRATION

Route	Absorption Pattern	Advantages	Limitations
Other routes			
Inhaled	Absorption through pulmonary endothelium & mucous membranes	Rapid absorption due to large surface area; gaseous and volatile drugs, e.g., anesthetics; topical application of drugs to treat pulmonary disease, e.g., asthma	Drugs should be nonirritating; important route of entry for drugs of abuse and environmental toxicants
Transnasal	Passive diffusion across respiratory endothelium directly into systemic circulation	Rapid absorption	Few products available
Transdermal	Varies based on dosage form	Effect can be local or systemic	Depends on dosage form – absorption can be variable

REFERENCE LIST

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ANY QUESTIONS?