MEDAVIE HealthEd ÉduSanté

Foundations of Pharmacology

Advanced Care Paramedicine

Module: 03

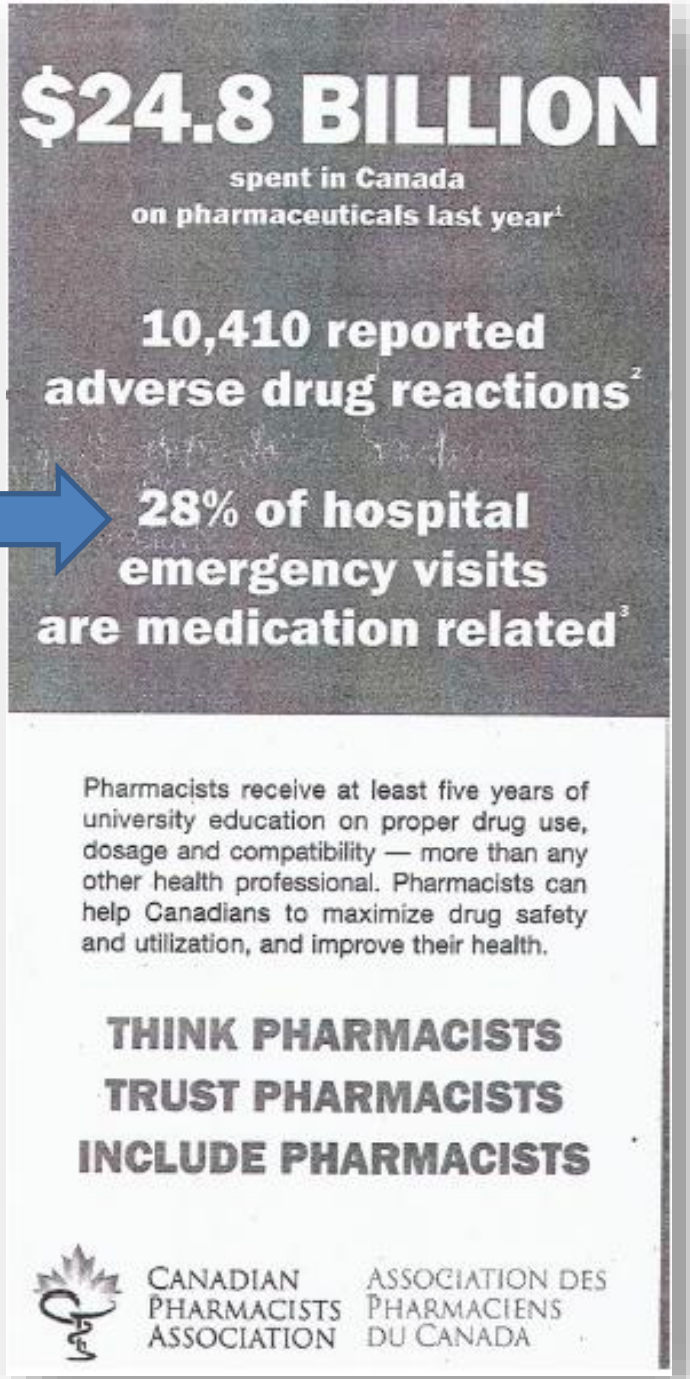
Section: 01

Pharmacology

- Pharmacology is the study of drugs and their actions on the body
- The science that is concerned with the history, origin, sources, physical and chemical properties, and uses and their effects (actions) on living organisms.
- Origins are in Latin and Greek

Pharmacology

- A Drug is broadly defined as any chemical that affects living processes.
- A Drug therapy encompasses not only the knowledge of a drug action but the relation of administration, patient assessment and clinical judgment


$24.8 BILLION
spent in Canada
on pharmaceuticals last year[1]
10,410 reported
adverse drug reactions[2]
28% of hospital
emergency visits
are medication related[3]
Pharmacists receive at least five years of university education on proper drug use, dosage and compatibility — more than any other health professional. Pharmacists can help Canadians to maximize drug safety and utilization, and improve their health.
THINK PHARMACISTS
TRUST PHARMACISTS
INCLUDE PHARMACISTS
CANADIAN PHARMACISTS ASSOCIATION
ASSOCIATION DES PHARMACIENS DU CANADA

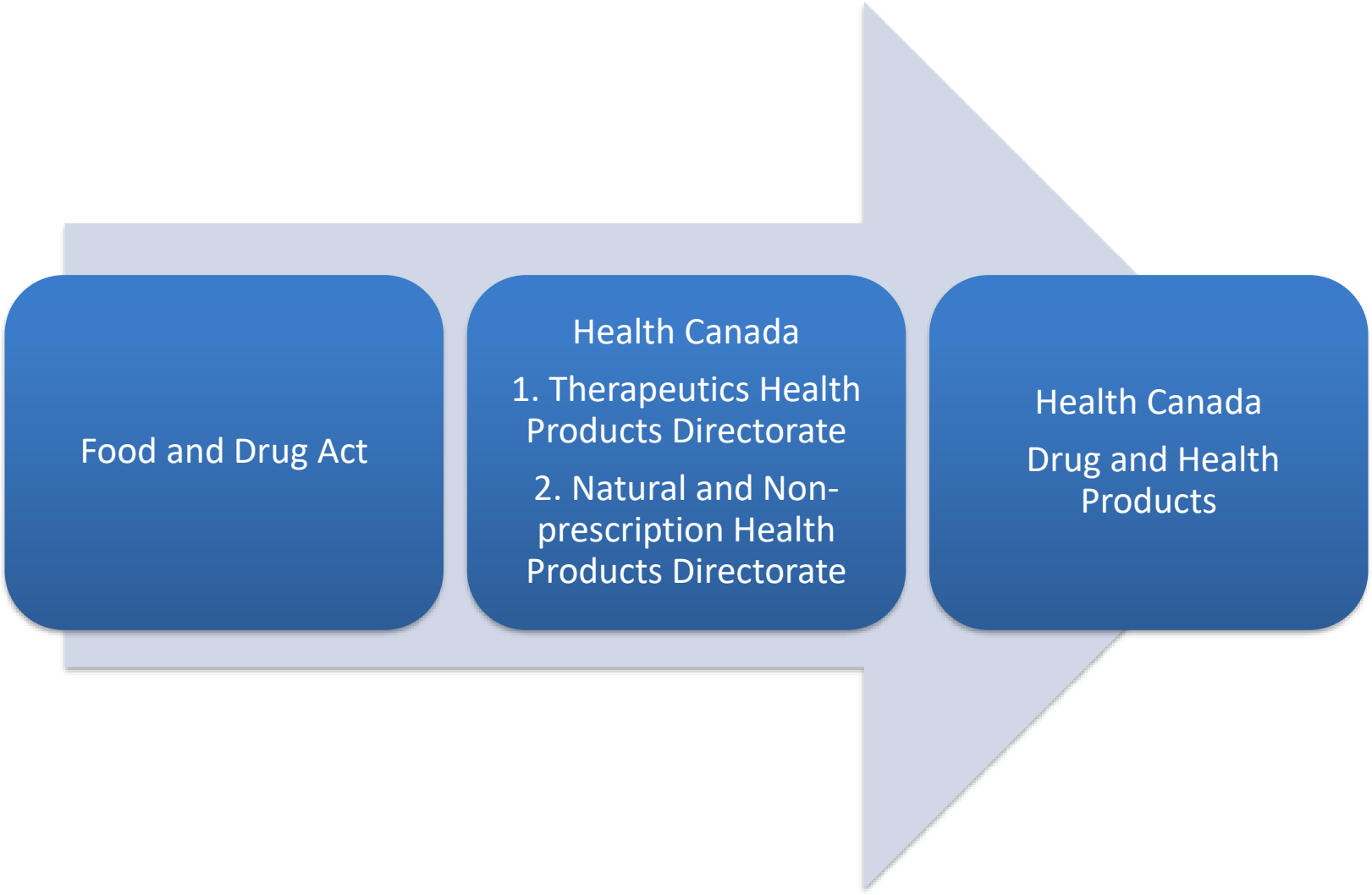
Introduction

- Drug expenditures in Canada is presumed to reach 33.9 million or 16% of Canada's health care budget in 2014
- Paramedics are responsible to provide appropriate drug therapy to patients
- What other roles can the paramedic play in a patients medication management? Determining adherence? Educator?
  - Utilize the time spent with the patient
- Medication management
  - "Medication management is defined as patient-centred care to optimize safe, effective and appropriate drug therapy. Care is provided through collaboration with patients and their health care teams."
- Drug therapy

Legislation

- Government creates acts
- Health Canada develops regulations based on Acts
  - Drugs are assigned Drug Identification numbers (DIN)
  - Natural Health Products are assigned a Natural Product Number (NPN) or Drug Identification Number-Homeopathic Medicine (DIN-HM)
  - Controlled Drugs and Substances Act

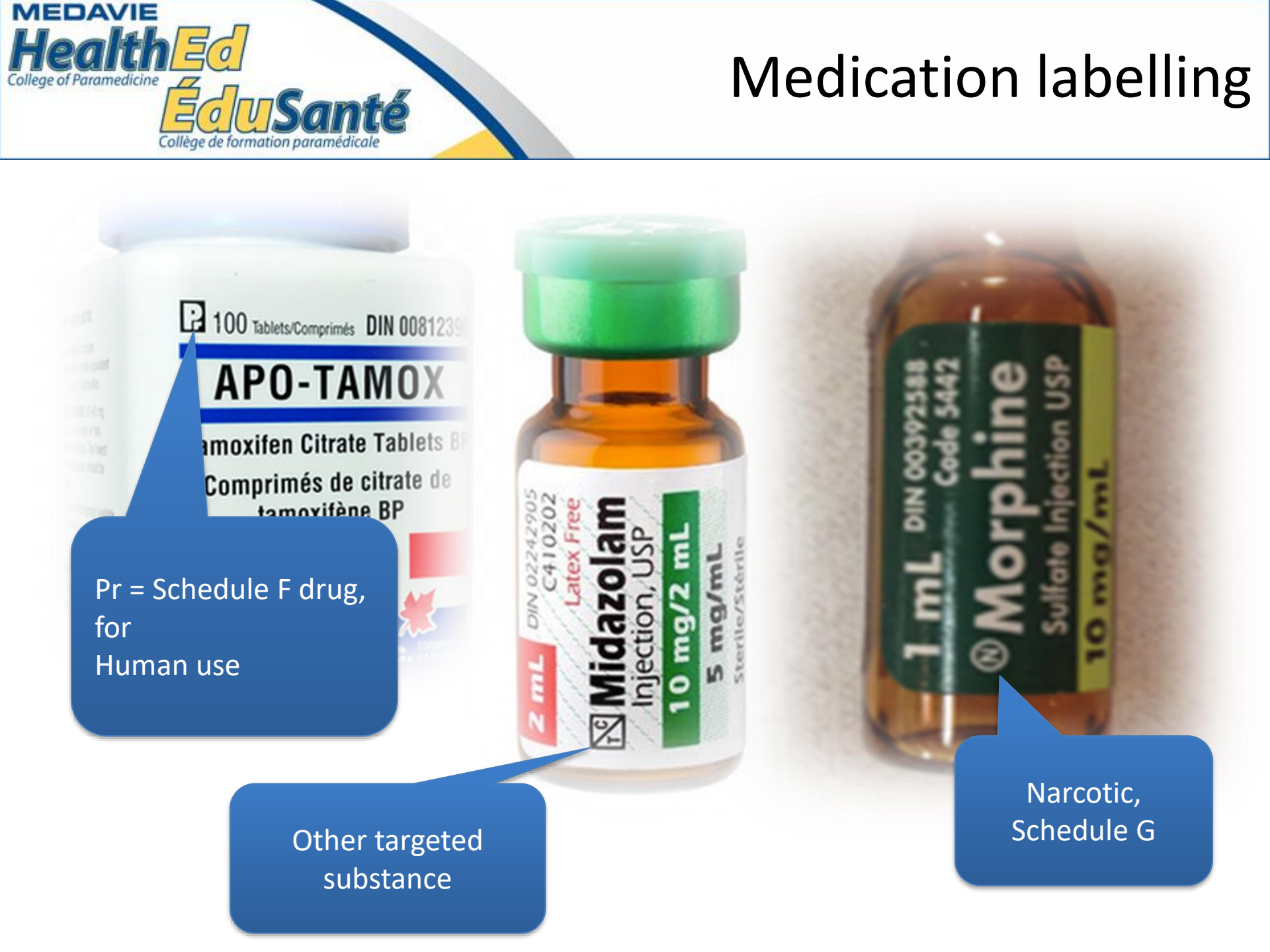
Legislation



Legislation

Schedules A-H	Canadian Food and Drug Act
A	List 36 diseases that no item can be advertised or sold as a CURE (cancer, gangrene, alcoholism…)
B	Lists the books of standards (CPS, US Pharmacopoeia)
C	Lists liver extract products
D	Lists drugs prepared from microorganisms and antibiotics for parenteral use
E	Lists sensitivity disc or tablets that cannot be sold unless each lot produced has been governmentally
F	Lists over 200 drugs that may not be used except after professional consultation Lists non-narcotic drugs that require prescription for use
G	Lists drugs that affect the CNS (Sedatives and Narcotics), controlled because of abuse potential
H	Lists drugs with no recognized medical use with significant danger (LSD)

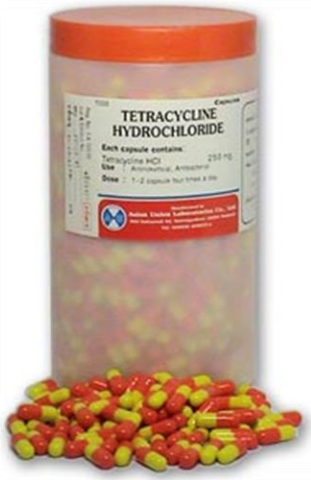
Medication labelling



Medication stability

- Drugs do not spontaneously degrade, they generally need a catalyst in the form of heat, vibration and light; all of which EMS provide in sufficient quantity
- Stability: the extent to which a pharmaceutical product possessed the same physical and chemical properties and characteristics that was possessed at the time of its manufacture. Generally we are looking for 90% retention of the active ingredient
- What can we do in EMS to prevent degradation and potentially negative patient outcomes?

203.03.04 Temperature Extremes
The agency shall have a policy/procedure for the storage of medications and IV fluids that allows for protection from extreme temperature changes. The policy shall also include a procedure for what to do if medications or IV fluids do get exposed to extreme temperatures.



Security

- No drug act regulation stating specific security requirements above generic “take all reasonable requirements to ensure security of narcotics and controlled substances”
- Due diligence would stipulate a need for record keeping to ensure stock does not go missing
- If a theft, loss or forgery occurs it must be reported to the local police immediately and to the Office of Controlled Substances no later than 10 days after its discovery
- The Office of Controlled Substances (OCS) works to ensure that drugs and controlled substances are not diverted for illegal use

Security

The Cold Chain

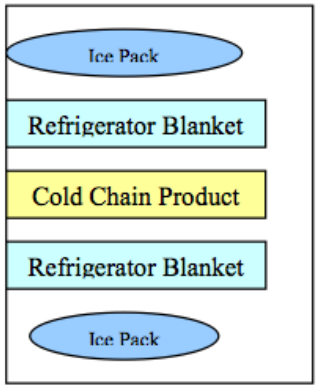
- Many medications and vaccines require a cold chain to exist between the manufacturer and the end user
- These medications must be refrigerated which the USP defines as a temperature between 2-8˚C
- If products requiring refrigeration are exposed to temperature flux outside of this range it can lead to loss of stability and denaturation
- The health care team and the confidence in the medications and vaccines they use can be lost if the cold chain is broken and the medication is not effective (anti-vaxxers)

CDHA Cold Chain Policy

- Manufacturer, distributor, policy makers, medical staff all have role to play

3. **For delivery to and from nursing units and ambulatory clinics,** pharmacy staff prepare coolers for transferring cold chain products as follows:
   - 3.1. Ice pack(s)
   - 3.2. Refrigerator blanket
   - 3.3. Cold chain product
   - 3.4. Refrigerator blanket
   - 3.5. Ice pack(s)

Igloo Cooler



MEDAVIE HealthEd College of Paramedicine

ÉduSanté Collège de formation paramédicale

Pharmacological terminology and abbreviations

- Transcription a.k.a. SIG
  - SIG = Signa = Signature = label or mark them.
  - The SIG represents the instructions that will be placed on the Rx label

TABLE 1–2
Common Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
ā	ante (before)	↑	increase
a.c.	ante cibos (before meals)	IC	intracardiac
ACh	acetylcholine	IM	intramuscular
ACLS	advanced cardiac life support	IO	intraosseous
ACS	acute coronary syndrome	IV	intravenous
admin.	administer	IVP	intravenous push
a	alpha	IVPB	intravenous piggyback
ALS	advanced life support	K^1	potassium
AMA	against medical advice	kg	kilogram
AMI	acute myocardial infarction	KO	keep open
Amp.	ampule	KVO	keep vein open
APAP	acetaminophen	LMA	laryngeal mask airway
ASA	aspirin	L	liter
b	beta	lb	pound
bid	bis in die (twice a day)	,	less than
c̄	cum (with)	LR	lactated Ringer's solution
Ca^{21}	calcium ion	$MgSO_4$	magnesium sulfate
$CaCl_2$	calcium chloride	♂	male
caps	capsules	MAX	maximum
cc	cubic centimeter	MDI	metered-dose inhaler
CC	chief complaint	m	micro
CHF	congestive heart failure	mgtt	microdrop
Cl^2	chloride ion	mg	microgram
cm	centimeter	mcg	microgram
cm^3	cubic centimeter	mm	micrometer
c/o	complains of	mEq	milliequivalent
CO	carbon monoxide	mg	milligram
CO_2	carbon dioxide	min	minute
COPD	chronic obstructive pulmonary disease	mL	milliliter
		mm	millimeter
CSM	carotid sinus massage	MS	morphine sulfate
CVA	cerebrovascular accident	MSO_4	morphine sulfate
°	degree	N_2O	nitrous oxide
°C	degrees Celsius	Na^1	sodium ion
°F	degrees Fahrenheit	$NaHCO_3$	sodium bicarbonate
D/C	discontinue	nitro	nitroglycerin
↓	decrease	NKA	no known allergies
D_5W	5 percent dextrose in water	NKDA	no known drug allergies
$D_{10}W$	10 percent dextrose in water	NTG	nitroglycerin
$D_{50}W$	50 percent dextrose in water	∅	null or none
dig	digitalis	O_2	oxygen
Dx	diagnosis	OD	overdose
ECG	electrocardiogram	OD	oculus dexter (right eye)
EKG	electrocardiogram (from German)	OS	oculus sinister (left eye)
elix	elixir	OU	oculus utro (both eyes)
EOA	esophageal obturator airway	oz	ounce
5	equal to	p	post (after)
et	and	pc	post cibos (after eating)
ET	endotracheal	PAC	premature atrial contraction
ETC	endotracheal Combitube	PEA	pulseless electrical activity
ETOH	alcohol (ethyl)	pedi	pediatric
/	female	PJC	premature junctional contrac
g	gram	po	per os (by mouth)
gr	grain	pr	per rectus (by rectum)
.	greater than	prn	pro re nata (when necessary)
gtt	gutta (drop)	PSVT	paroxysmal supraventricular tachycardia
gtts	guttae (drops)		
HHN	handheld nebulizer	q	quisque (every)
hs	hora somni (at bedtime)	qd	quisque die (every day)

(continued)

TABLE 1–2 (continued)
Common Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
qh	quisque hora (every hour)	SpO_2	oxygen saturation (oximetry)
qid	quarter in die (four times a day)	SQ or SC	subcutaneous
qod	tertio quoque die (every other day)	stat	statim (now or immediately)
qt	quart	STEMI	ST elevation myocardial infarction
®	registered trademark	SVN	small-volume nebulizer
RL	Ringer's lactate solution	tid	ter in die (three times a day)
Rx	treatment	tPA	tissue plasminogen activator
s̄	sine (without)	TKO	to keep open
SC	subcutaneous	u	unit
SK	streptokinase	ut dict	ut dictum (as directed)
sol	solution	y/o	year old

Naming of Drugs

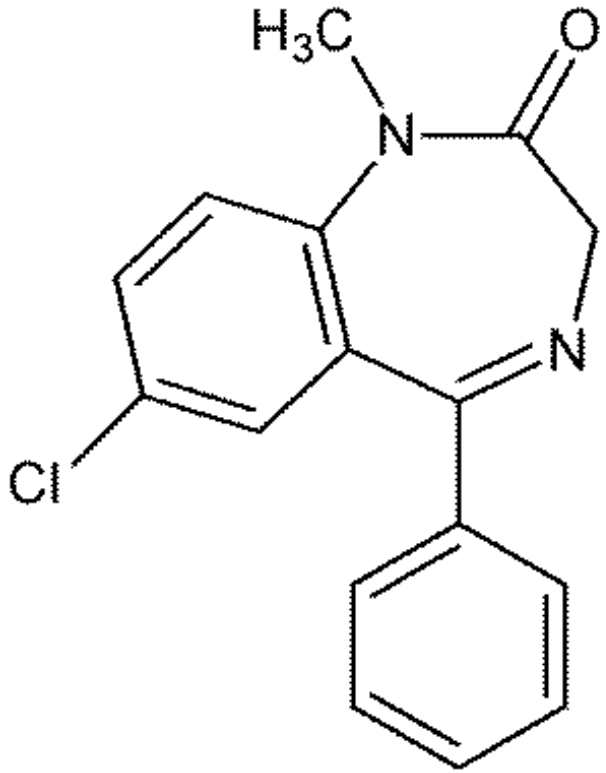
- Chemical
  - States its chemical composition and molecular structure.
- Generic
  - Often abbreviated form of chemical name
- Brand
  - The trade or proprietary name.
- Official Name
  - Followed by abbreviation to which drug standard conforms to
  - USP, NF

Names of Drugs

Chemical Name	**7-chloro-1, 3-dihydro-1 methyl-5-phenyl-2h-1, 4-benzodiazepin-2-one**
Generic Name	**Diazepam**
Brand Name	**Valium®**
Official name	**Diazepam, USP**

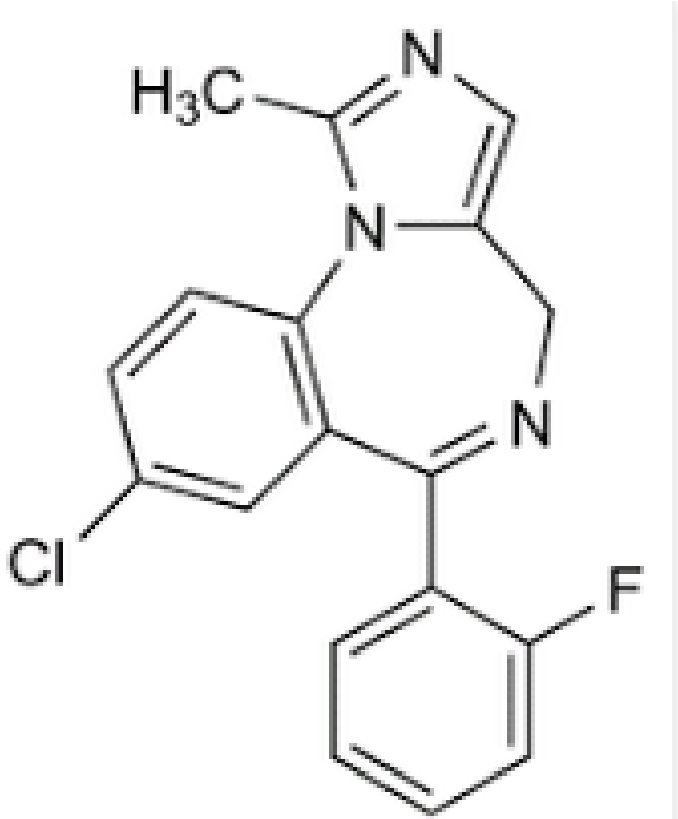
Chemical name

Diazepam



7-chloro-1, 3-dihydro-1 methyl-5-phenyl-2h-1, 4-benzodiazepin-2-one

Midazolam



8-chloro-6-(2-fluorophenyl)-1-methyl-4H-imidazo[1,5-a][1,4]benzodiazepine

Sources of Drugs

- Drug are chemical agents used in the diagnosis, treatment, or prevention of disease and come from a variety of sources
- Plants
  - Possibly the oldest source of medications
    - Atropine from the “deadly nightshade”
    - Digoxin from foxglove
    - ASA from the bark of willow trees
- Animals
  - Hormones, enzymes, fluids
    - Insulin, glucagon, cod liver oil, pepsin, pancreatin

Sources of Drugs

- Minerals
  - Metallic or nonmetallic minerals provide various inorganic material not available from plants or animals
    - Magnesium sulphate and calcium chloride
- Laboratory (synthetic)
  - Many new drugs produced in the laboratory
  - Recombinant DNA technology
    - Reordering genetic information allows researchers to develop bacteria that produce human hormones

Drug Forms

- Solid Forms:
  - Such as pills, powders, suppositories, capsules, tablets.
- Liquid Forms:
  - Such as solutions, tinctures, suspensions, emulsions, spirits, elixirs, syrups.
  - Emergency medication packaging
    - Vials, ampules, self-contained systems or syringes, nebules

Solid Forms

- Pills
  - Drugs shaped spherically to be swallowed.
- Powders
  - Not as popular as they once were.
- Tablets
  - Powders compressed into disk-like form.
- Suppositories
  - Drugs mixed with a wax-like base that melts at body temperature.
- Capsules
  - Gelatin containers filled with powders or tiny pills.

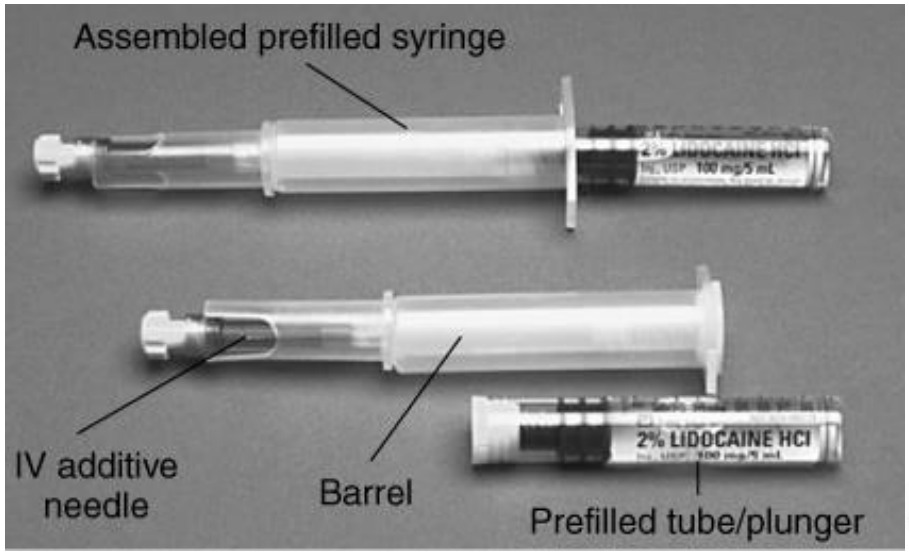
Liquid Forms

- Solutions
  - Water or oil-based.
- Tinctures
  - Prepared using an alcohol extraction process.
- Suspensions
  - Preparations in which the solid does not dissolve in the solvent.
- Emulsions
  - Suspensions with an oily substance in the solvent.

Liquid Forms

- Spirits
  - Solution of a volatile drug in alcohol.
- Elixirs
  - Alcohol and water solvent; often with flavoring.
- Syrups
  - Sugar, water, and drug solutions.

Emergency Packaging Styles



nebule

ampules

Single dose

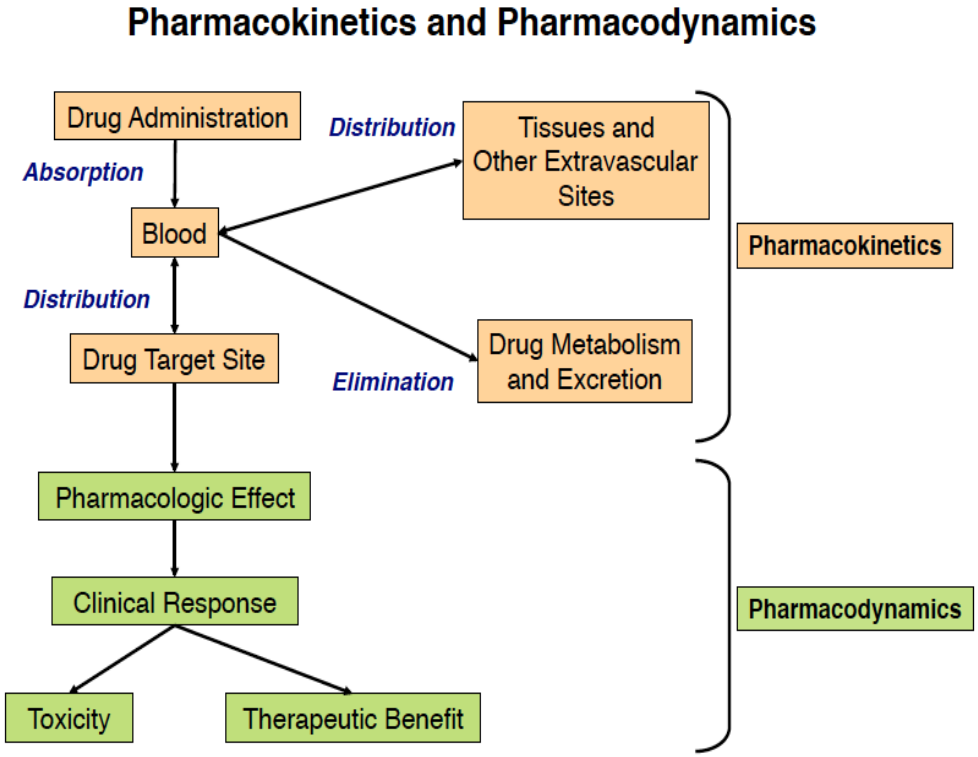
Multi dose

Pharmacology

PHARMACOKINETICS VS PHARMACODYNAMICS

Pharmacokinetics vs Pharmacodynamics

- Pharmacodynamics refers to how the **drug affects the body**
- Pharmacokinetics refers to how the **body affects the drug**



Foundations of Pharmacology

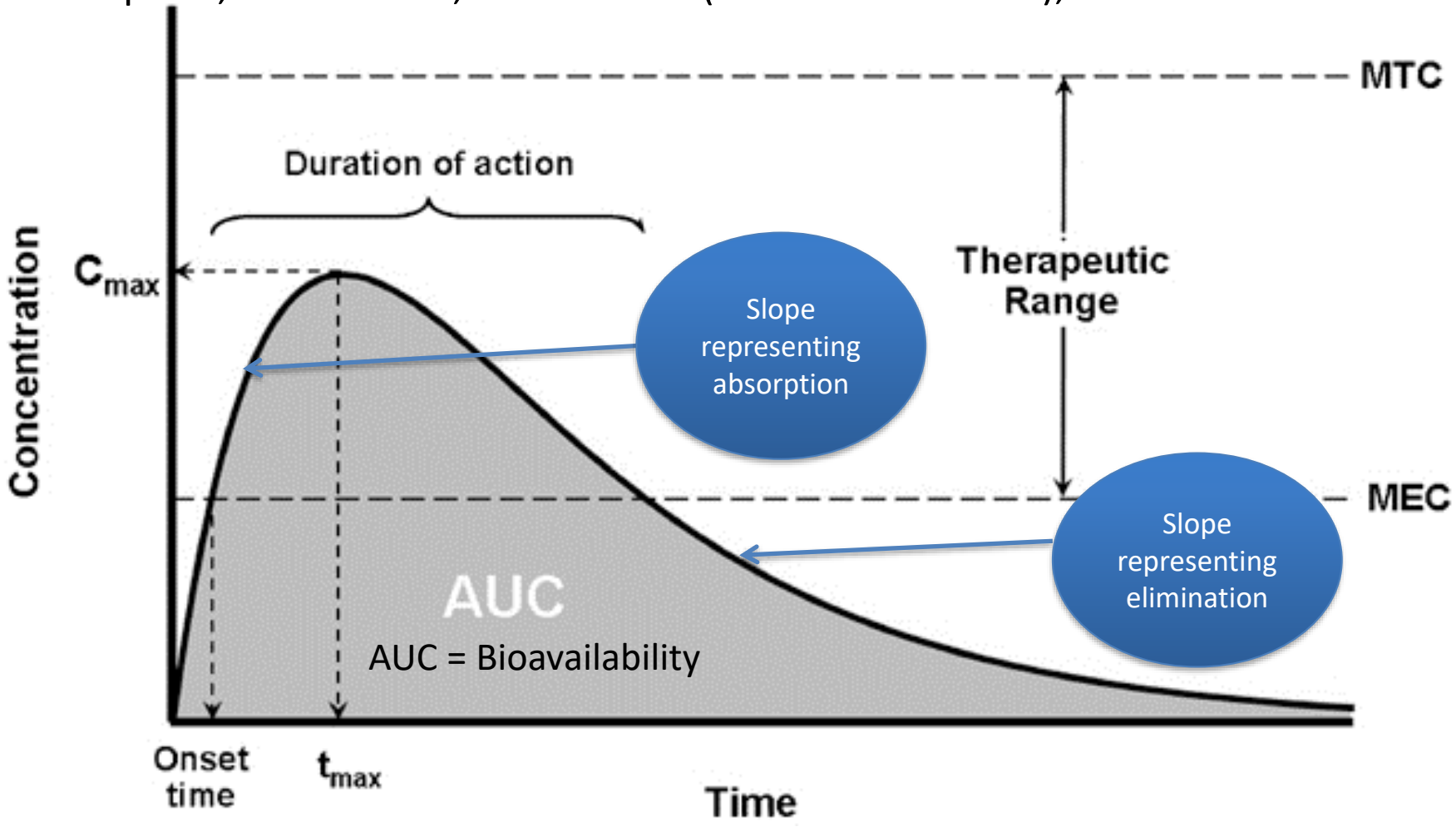
PHARMACOKINETICS

Pharmacokinetics

- The study of how drugs enter the body, reach their site of action, and eventually are eliminated
- Includes:
  - Absorption
  - Distribution
  - Metabolism (biotransformation)
  - Elimination

Pharmacokinetics

Absorption, **D**istribution, **M**etabolism (biotransformation), **E**limination = ADME

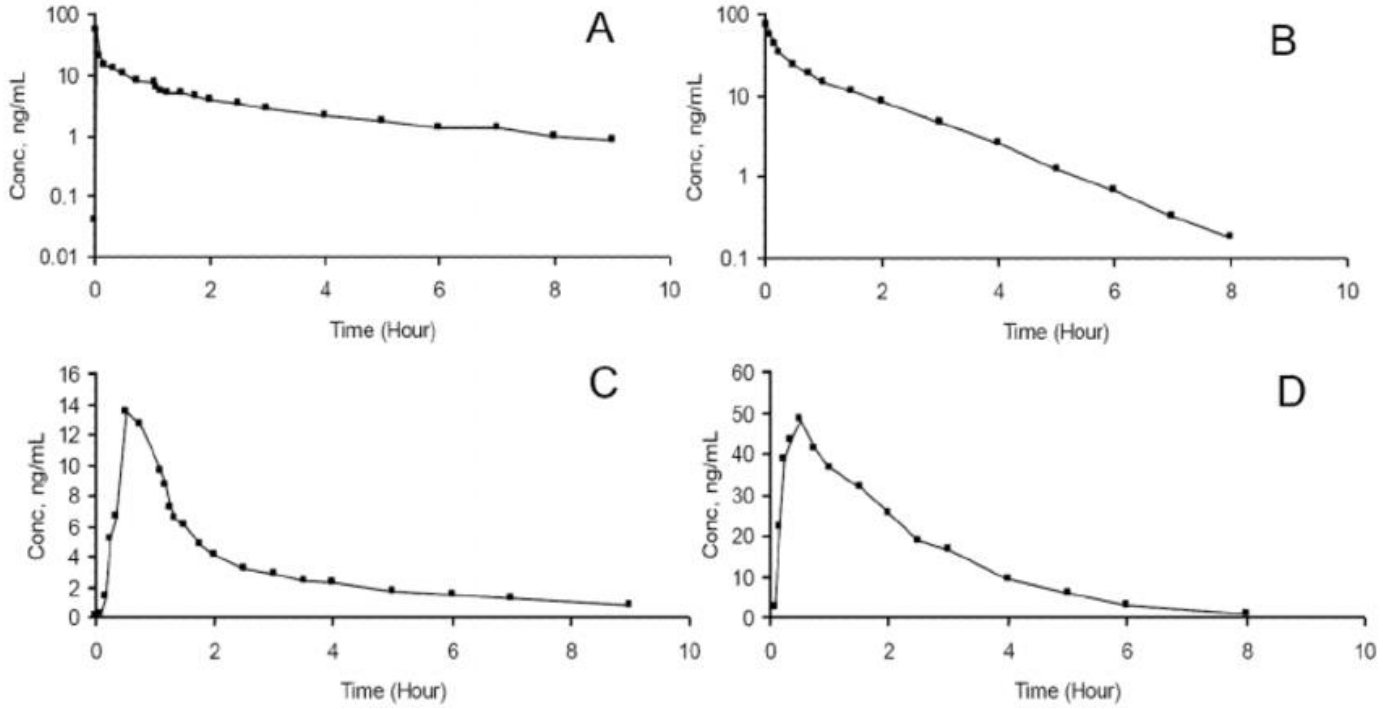


How a drug works

- Absorption
  - From site of administration to circulatory system
  - The route by which a drug moves from the site of entry into the transport medium

Absorption

- The movement of a drug from its site of administration towards its site of action, if a drug is given PO or injected into any other place other than the bloodstream, entering into the bloodstream is the first step in the process



Plasma concertation vs time profiles of Alfentanil and Midazolam after administering (A) IV Midazolam, (B) IV Alfentanil, (C) PO Midazolam, (D) PO Alfentanil

Absorption

- Factors affecting absorption

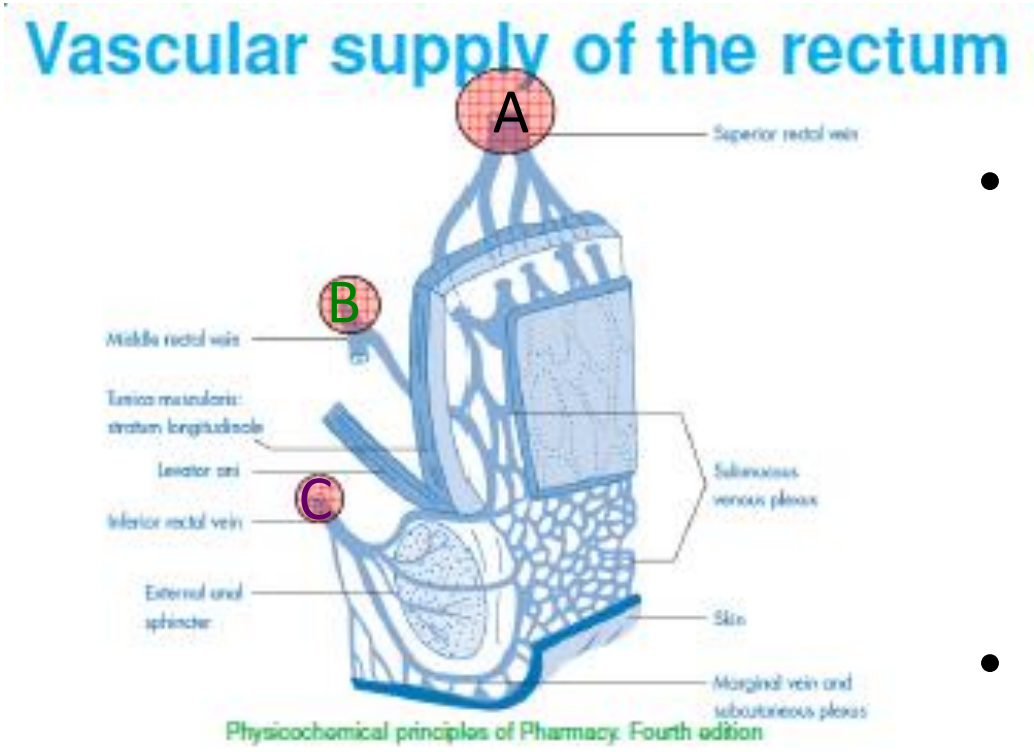
Solubility	The ability of the medication to dissolve. Fat soluble drugs can cross blood brain barrier but water soluble drugs, like penicillin, cannot
PH	Acidic drugs better absorbed in acidic environment and basic drugs better absorbed in basic environment
Surface area	The larger the surface area the more absorption
Blood supply	Medications absorb more rapidly from areas with a rich blood supply
Concentration	Simple diffusion
Molecular size of drug	Larger drugs not absorbed as efficiently

Enteral vs Parenteral

- Enteral are medications absorbed via the gastrointestinal tract
  - Does not mean they all go through first pass metabolism
- Parenteral are medications entering via all other routes

Enteral	• Per Os (PO) - is Latin for by mouth • Sublingual (SL) • Rectal (PR) • Orogastric (OG)/Nasogastric (NG) • Buccal
Parenteral	• Intravenous • Intramuscular • Subcutaneous • Intraosseous • Umbilical
Parenteral (topical)	• Percutaneous • Ocular • Nasal • Respiratory

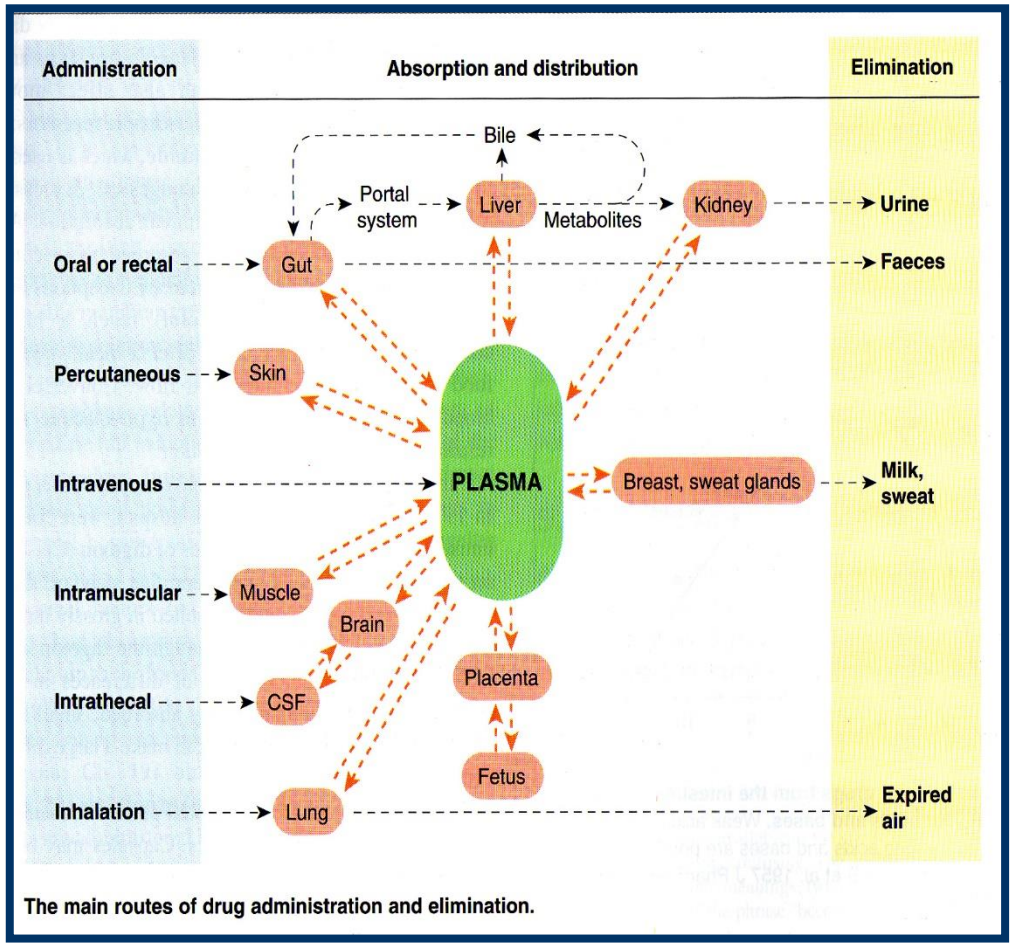
Rectal drug absorption



A. Superior rectal vein drains into the mesenteric vein which drains into portal vein
B. Middle rectal vein drains into vena cava
C. Inferior rectal vein drains into vena cava

- Example of the contrast between circumventing and entering portal circulation
  - Hence, rectal absorption can be erratic
- Drugs can be utilized via this route to treat local (hemorrhoids) or systemic (diazepam for seizures) conditions

Distribution



The main routes of drug administration and elimination.

- The process by which a medication is transported from the site of absorption to the site of action
- Must permeate physiological barriers
- Depends on physiochemical properties of drug
  - Meningitis, must have a drug that distributes to cerebrospinal fluid
  - Skin/soft tissue infections, medication the can distribute to the dermis
- Volume of distribution (Vd) – the apparent volume a drug could occupy
  - High Vd means drug distributes extensively into and retained within plasma and tissues

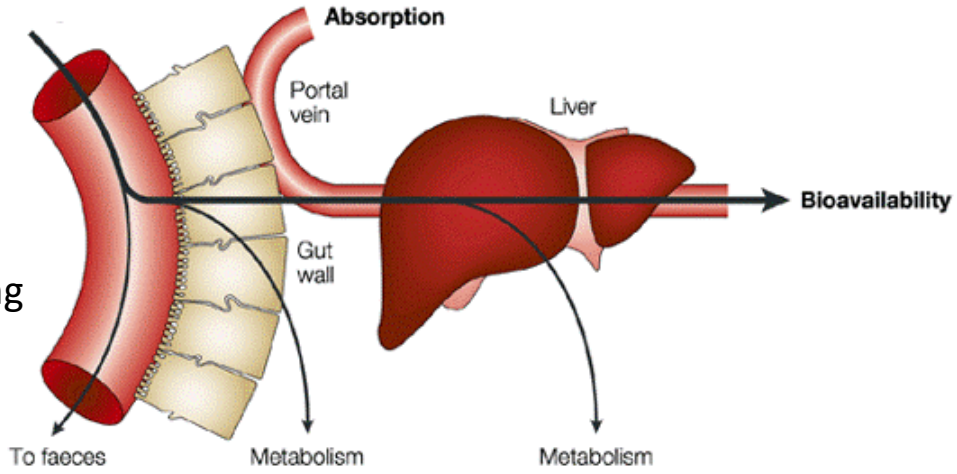
Distribution

- Several factors can affect medication distribution
- Cardiovascular function
- Regional Blood Flow
- Medication storage reservoirs
- Physiological barriers
  - Blood-Brain Barrier
  - Blood-Retinal Barrier
  - Placental Barrier
- In the body medications can be stored at various sites
- Drugs can be transported on plasma proteins
  - Albumin, Alpha$_1$-acid glycoprotein

Free Drug	Bound drug
Can be eliminated	Cannot be eliminated
Can exert pharmacological effect	Cannot exert pharmacological effect
Can bind to receptors	Bound to protein
Can distribute	Concentration in tissues limited

Metabolism (biotransformation)

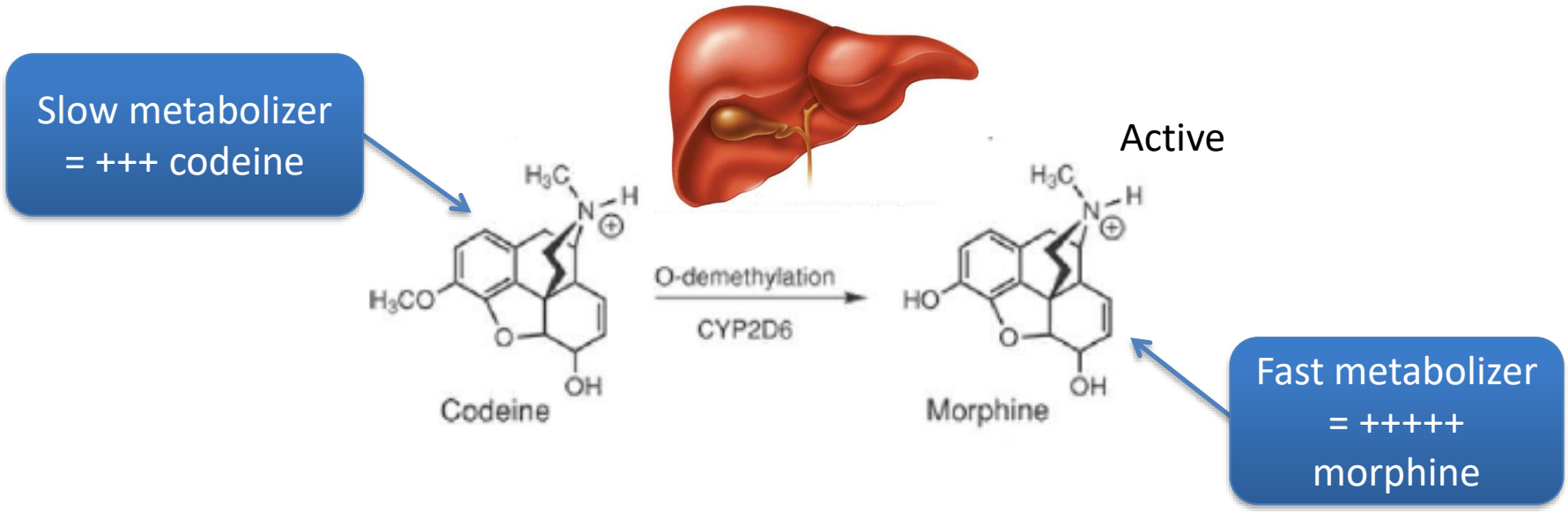
- First pass metabolism
  - Portal circulation
    - Circulatory circuit connecting two different tissues but not going to the heart in between
    - Hepatic portal circulation – nutrient rich blood (also carrying medication) is absorbed in intestine and brought to liver before entering systemic circulation



- Hepatic and intestinal enzymes (cytochrome P450)
  - The liver (and to a lesser degree the intestine) can affect how much of a medication that was absorbed in the intestine will enter circulation, resulting in reduced concentration of drug

Understanding metabolism via the Prodrug

- Pharmacogenetics is an emerging science, certain people are fast, normal or poor metabolizers in certain enzyme pathways
- A **prodrug** is a drug that needs to be activated by being metabolized
  - Codeine is not an active drug but the liver turns it into its active form, morphine. Most drugs are deactivated by metabolism



Elimination

- Half life ($T_{1/2}$)
  - Rate of elimination of drug, time required to eliminate 50% of drug
  - Drug is said to be cleared after 5 half lives
- Clearance
  - The bodies ability to remove a medication from systemic circulation
- Medications are eliminated from the body in their original form or more often as metabolites
- What organs are responsible for elimination and the medium of elimination?
- What happens to $T_{1/2}$ if your patient receives a drug eliminated by the kidney and they have renal failure?

Foundations of Pharmacology

PHARMACODYNAMICS

Pharmacodynamics

- How does the drug work on the body
- When we talk about pharmacodynamics we generally use a reversible drug-receptor model (lock and key)
  - The relationship between drug and receptor is due to molecular weight, shape, and electrical charge of a drug
  - Drugs binding to receptors the most common means of inducing pharmacological effect
- Receptors responsible for selectivity of action
- Once medications reach their targeted tissues, they begin a chain of biochemical events that ultimately leads to the physiological changes desired. These biochemical and physiological events are referred to as the mechanism of action.

Actions of Drugs

- Drugs act in one of four ways:
  - Bind to a receptor site
  - Change physical properties
  - Chemically combine with other substances
  - Alter a normal metabolic pathway

Mechanisms of Action

- To understand pharmacodynamics, you must differentiate between drug action and drug effect.
  - Drug Action
    - The interaction at the cellular level between a drug and cellular components
  - Drug Effect
    - The response resulting from drug action

Mechanism of action

- Drug receptor interaction
- Drug enzyme interaction
- Nonspecific drug interaction

Drug receptor interaction

- Drugs which act on a cellular protein, nucleic acid, enzyme, carbohydrate residue, or lipid (aka receptors) in the cell wall
- The most common form of mechanism of action

Drug enzyme interaction

- Act on the enzyme system of the cell

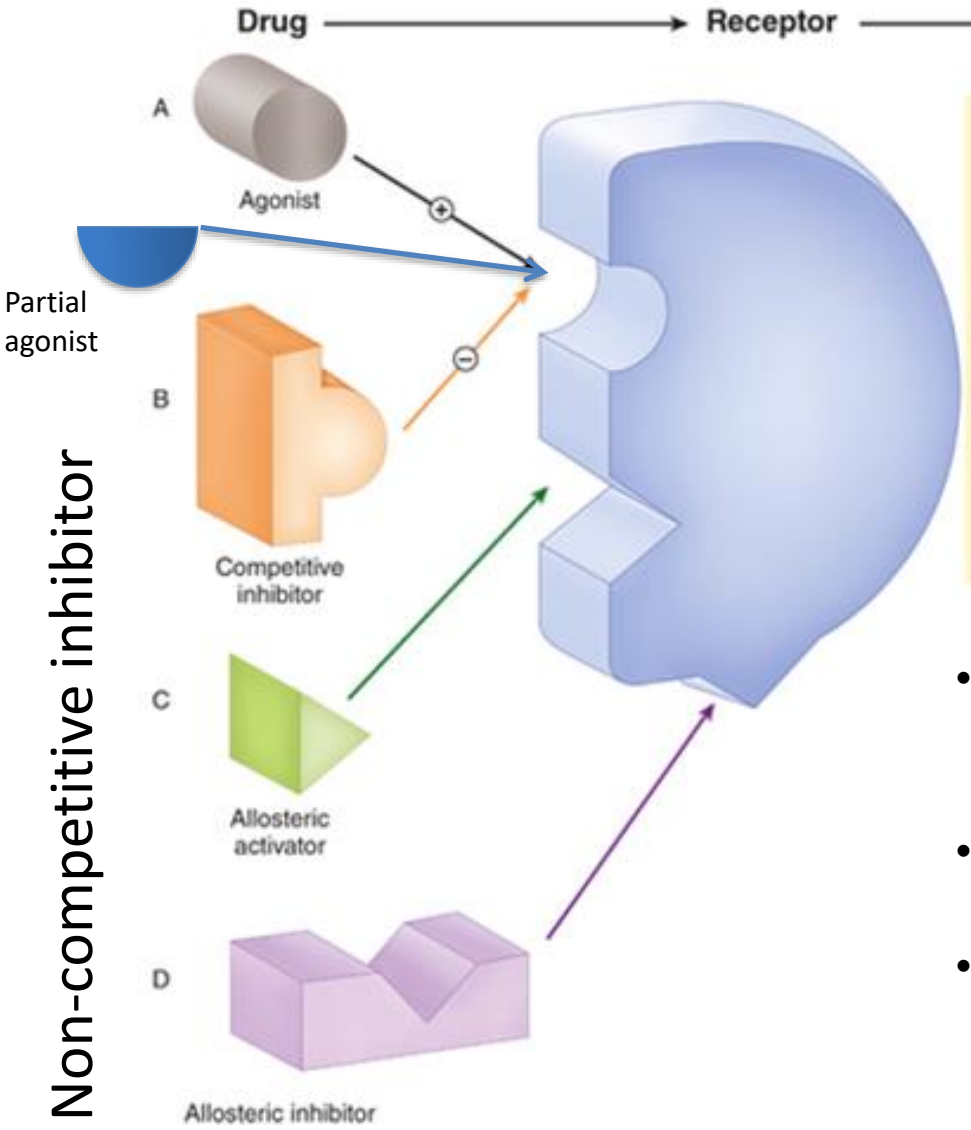
Nonspecific drug interaction

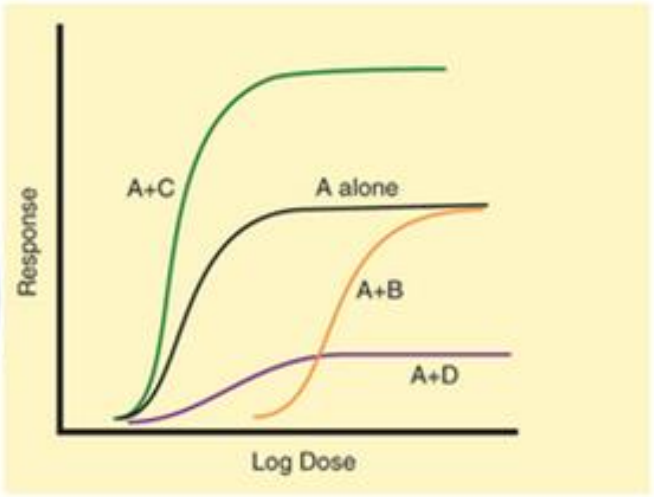
- Non specific site of action
- Cause a generalized change in the body

Drug Receptors

- Drug receptors are generally proteins present on the surface of the cell membrane.
- A drug attracted to a receptor displays an affinity for that receptor.
  - Agonist
    - A drug that creates and action
  - Antagonist
    - A drug that inhibits a reaction
      - Competitive antagonist, competes with the agonist for receptor sites (Narcan)
      - Non-competitive antagonist, inhibits agonist response regardless of agonist concentration

Agonist & Antagonist





- The force of attraction between a medication and its receptor is called their **affinity**.
- The greater the affinity the **stronger the bond.**
- Different drugs may bind to the same receptor site but with different strengths or affinity

Affinity

- The attraction of the drug to the receptor
  - High affinity
    - low concentrations bind to receptor
  - Low affinity
    - high concentrations bind to the receptor
  - No affinity
    - no binding occurs

Types of binding

- Reversible
  - ionic attraction
  - hydrogen bonds
- Slowly reversible
  - covalent binding/ irreversible
  - high affinity non-covalent binding
- Irreversible
  - Can not be reversed

Pharmacodynamics

- Sites of action of Drugs
  - Many work in motor end plates
    - Skeletal or smooth
  - Some drugs work at pre-synaptic membrane
  - Some at the post-synaptic membrane
  - Some at both (Ca^{+} Channel blockers)

Pharmacodynamics

- Sympathetic Sites

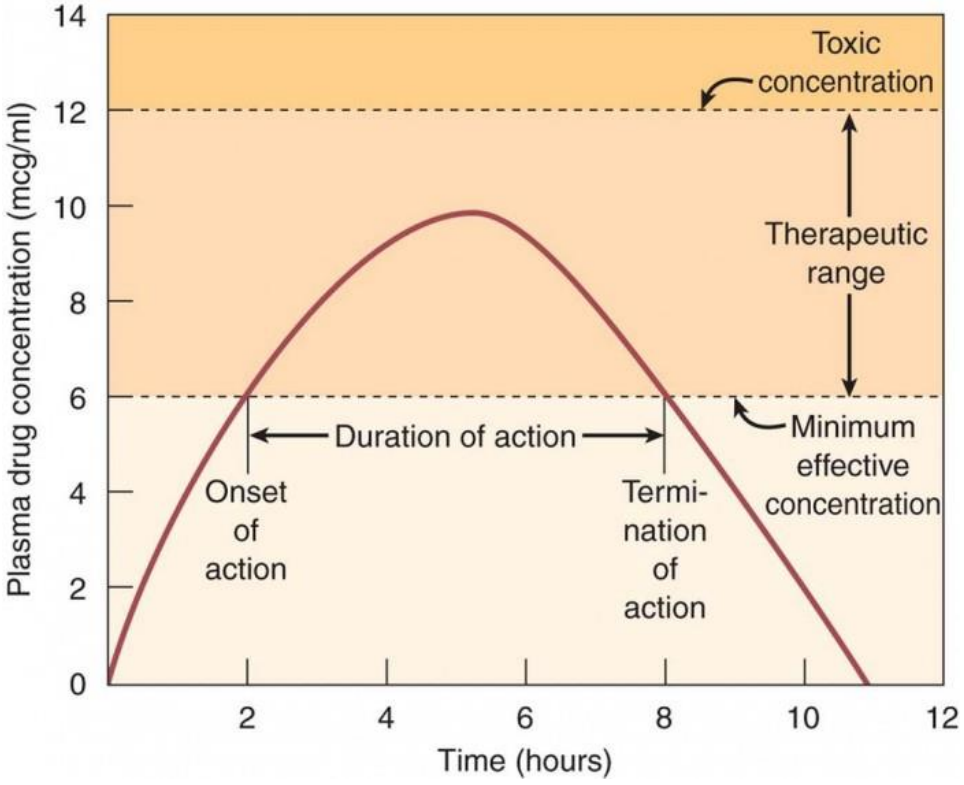
– Vasculature	Alpha	
– Heart	Beta 1	ß1
– Lungs	Beta 2	ß2
– Renal/Mesentery	Dopamine 1 & 2	D1 & D2
– Skin	Histamine 1	H1
– Stomach	Histamine 2 & 3	H2 and H3

Pharmacodynamics

- Parasympathetic Sites
  - Muscarinic receptor sites
    - Excitatory
    - Inhibitory
  - Nicotinic receptor sites
    - Excitatory (AcH)

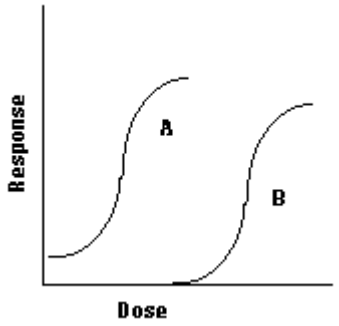
Pharmacology Terminology

- Onset of Action
  - Duration of time it takes for a drug's effects to come to prominence upon administration
- Duration of Action
  - Time of onset of action to the end of action



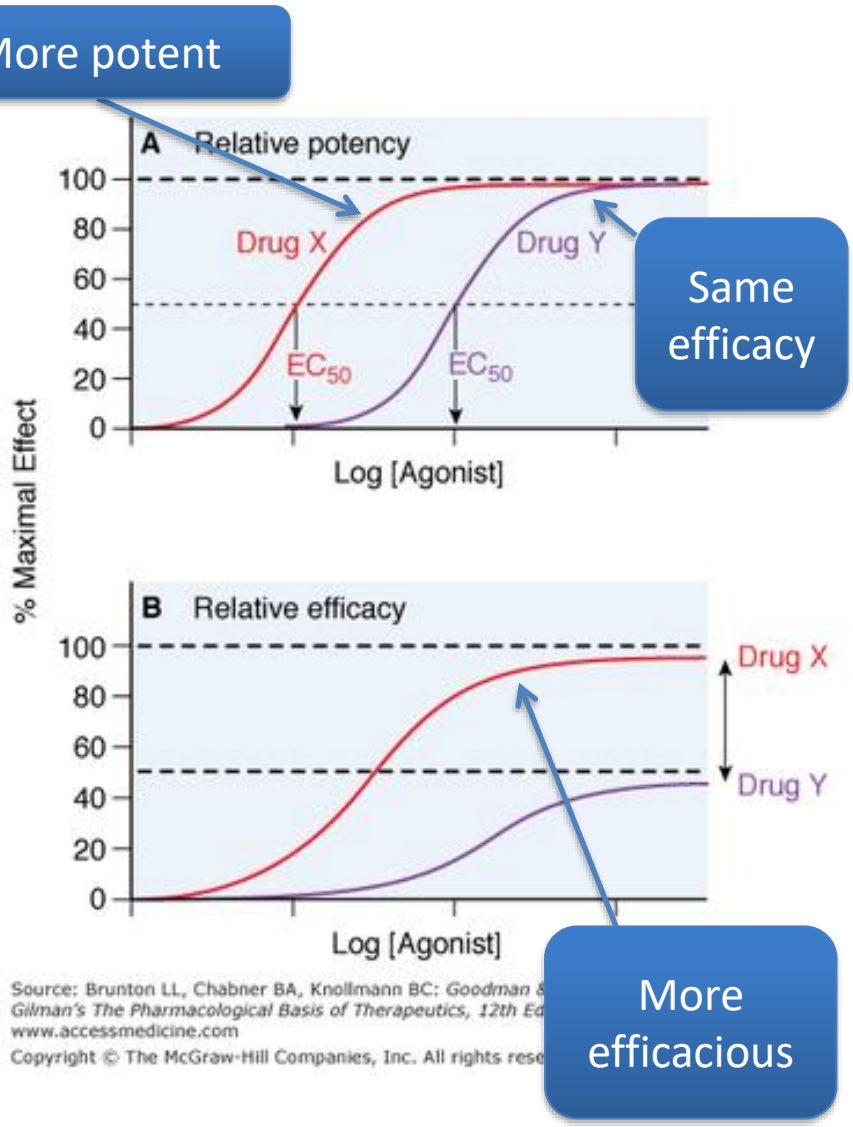
Pharmacology Terminology

- How to measure a drugs effects
  - Speed
    - fixed dose and time effect is measured
  - Potency
    - dose response curve
  - Efficacy
    - ability to cure or control an illness



Dose-Response Curve, Potency and Efficacy

- Dose on x axis and response on y axis
- Efficacy is the ability of a medication to product a clinical response
  - Efficacy more important clinically than potency
- Medication potency refers the relative amount of medication required to product the desired response
  - The potency of a drug is when the concentration of drug induces 50% of maximal response



Pharmacology Terminology

- Effective Dose 50 (ED_{50})
  - The dose that produces a quantal effect in 50% of the population
- Lethal Dose 50 (LD_{50})
  - The dose required to kill half the members of a tested population
  - LD_{50} figures are frequently used as a general indicator of a substance's acute toxicity

Pharmacodynamics

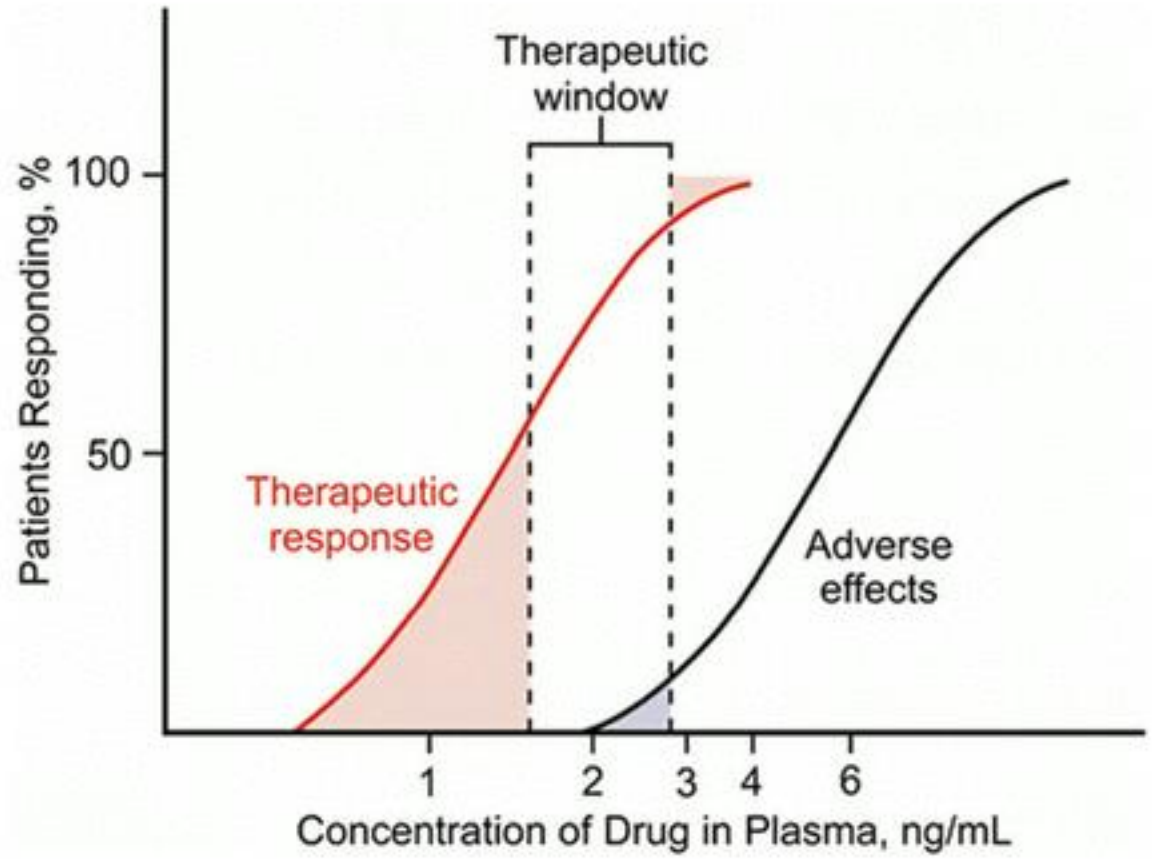
- Therapeutic Index (TI):

$$TI = LD50 / ED50$$

Lethal Dose (LD) in 50% of lab animals/Effective Dose (ED) in 50% of human trial subjects

- Measures the drugs safety, TI's close to 1 have a small margin of safety ie: digoxin

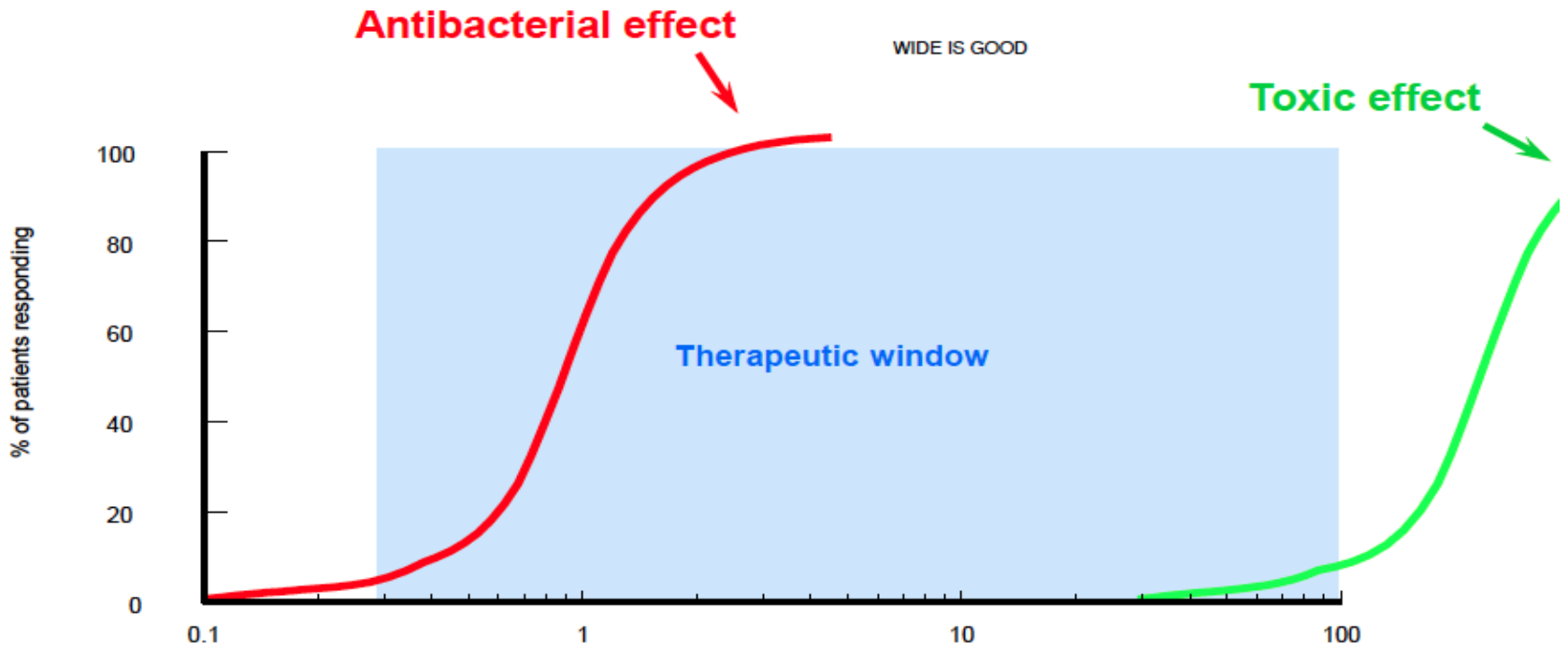
Therapeutic Window



- The relation of the therapeutic window of drug concentrations to the therapeutic and adverse effects in the population. The ordinate is linear; the abscissa is logarithmic.

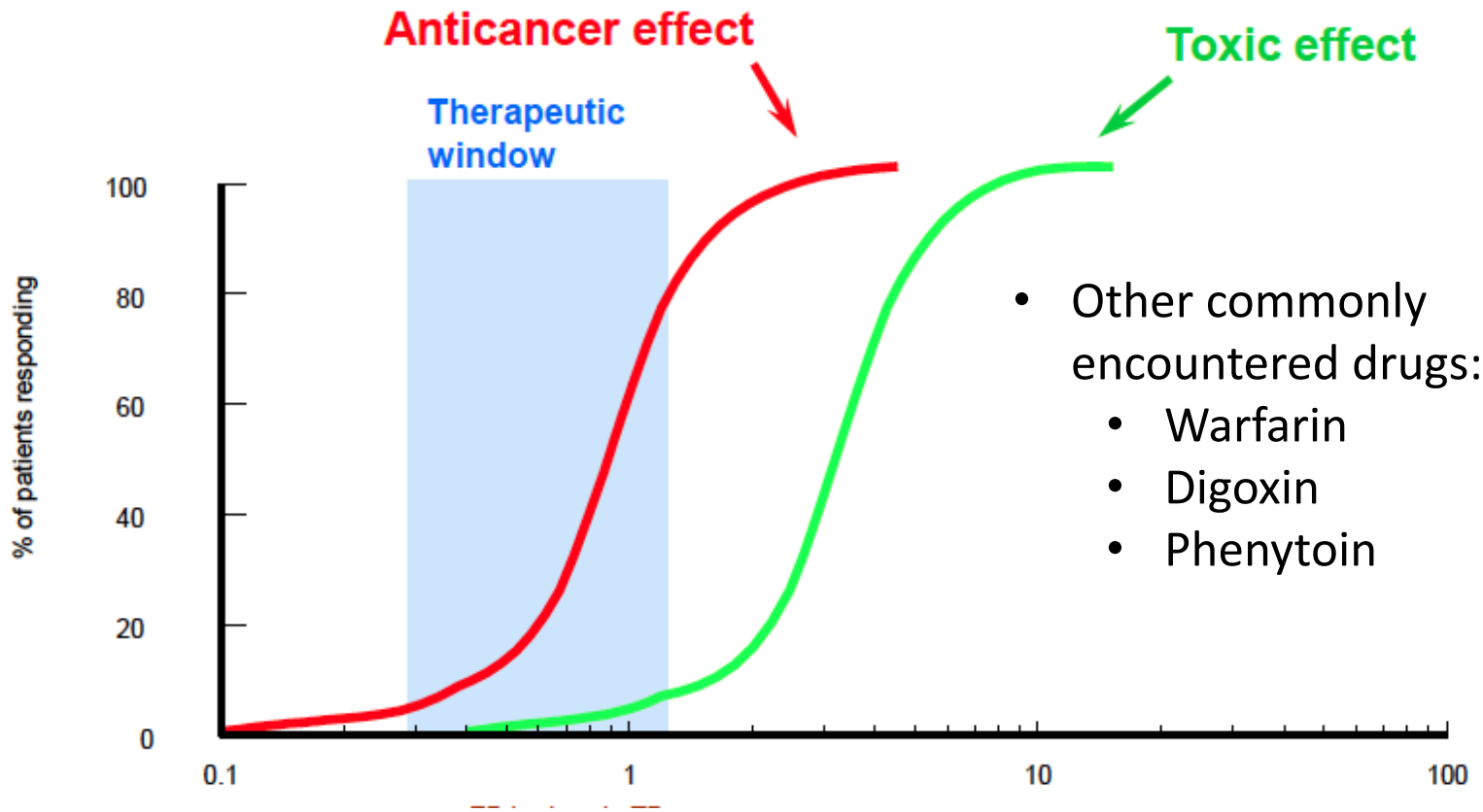
Wide Therapeutic Index

A penicillin (antimicrobial)



Narrow Therapeutic Index

An alkylating agent (anticancer)



- Other commonly encountered drugs:
  - Warfarin
  - Digoxin
  - Phenytoin

Factors Affecting Drug Response

- Age
- Body Mass
- Sex
- Environment
- Time of Administration
- Pathology
- Genetics
- Psychology

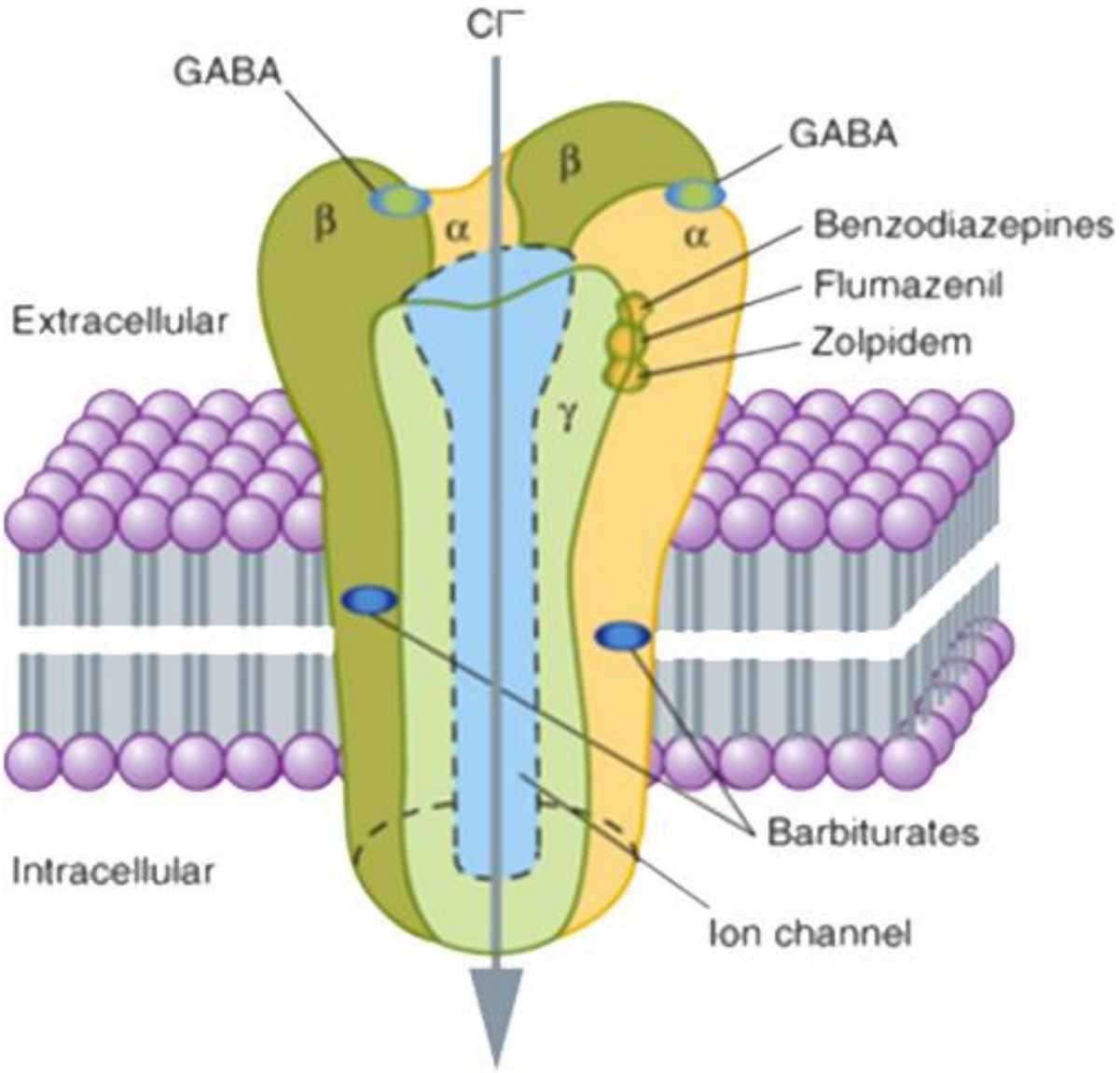
Pharmacology Terminology

- Side Effect
  - Unintended response to a drug
- Untoward Effect
  - A side effect that proves harmful
- Idiosyncrasy
  - Unusual or untoward effect unique to the patient
- Drug Allergy
  - An antibody/antigen complex
  - S/S skin rash, itching, wheezing

Pharmacology Terminology

- Drug dependence
  - Physical or psychological dependence
- Tolerance
  - Patient becomes accustomed to the drug's presence in his body
  - More and more drug required for same effect
- Cross Tolerance
  - Tolerance for a drug that develops after administration of a different drug (versed on valium addicts)
- Tachyphylaxis
  - Rapidly occurring tolerance to a drug

Cross Tolerance



Pharmacology Terminology

- Drug Interaction
  - Drug effects another drug that has already been given (may be good or bad)
- Antagonism
  - The opposition of one drug with another where the end result is less than each drug separately

Pharmacology Terminology

- Cumulative Effect
  - Increased effectiveness when a drug is given in several doses
- Potentiation
  - The effect of one drug is greatly increased by the intake of another drug (that in itself would not have great effect)
- Summation (Additive)
  - The combined action of two drugs (1+1=2)

Pharmacology Terminology

- Synergism
  - The combined action of two Rx's where the total effect is more than the sum of the individual effects (1+1=3)
- Interference
  - The direct biochemical interaction between two drugs; one drug affects the pharmacology of another drug (1+1=1)

Drug Interactions

- Drug interactions have the possibility to occur whenever two or more drugs are available in the same patient
- The interaction can increase, decrease, or have no effect on their combined actions.

Special Considerations

- Pregnant & Breast feeding Patients
- Pediatric Patients
- Geriatric Patients

Pregnant Patients

- Ask the patient if there is a possibility that she could be pregnant.
- *Teratogen* is a substance that has the potential under certain exposure conditions to cause abnormal development in the fetus
- Physiological changes in pregnant women:
  1. Increased cardiac output
  2. Increased HR
  3. Increased blood volume
  4. Decreased protein binding
  5. Decreased hepatic metabolism
  6. Increased renal excretion

Pregnant Patients

Breastfeeding

- Breast milk has been identified as the optimal source of nutrition for infants, but with benefits conferred to mothers, families, and societies.
- Passive of drug occurs through passive diffusion
  - Less likely with protein bound, large, water soluble drugs
  - Heparin, insulin – high molecular weight drug not likely to cross

Pregnancy categories

FDA Pharmaceutical Pregnancy Categories	
Category A	Adequate and well-controlled human studies demonstrate no risk.
Category B	Animal studies demonstrate no risk, but no human studies have been performed. OR Animal studies demonstrate a risk, but human studies have demonstrated no risk.
Category C	Animal studies demonstrate a risk, but no human studies have been performed. Potential benefits may outweigh the risks.
Category D	Human studies demonstrate a risk. Potential benefits may outweigh the risks.
Category X	Animal or human studies demonstrate a risk. The risks outweigh the potential benefits.

More data on older medications

Pregnant Patients

- New pregnancy categories
  - Dec. 2015 - “The U.S. Food and Drug Administration published a final rule today that sets standards for how information about using medicines during pregnancy and breastfeeding is presented in the labeling of prescription drugs and biological products. The new content and formatting requirements will provide a more consistent way to include relevant information about the risks and benefits of prescription drugs and biological products used during pregnancy and breastfeeding.”
  - “The final rule replaces the current product letter categories – A, B, C, D and X – used to classify the risks of using prescription drugs during pregnancy with three detailed subsections that describe risks within the real-world context of caring for pregnant women who may need medication”

Pediatrics

- Pediatric medication dosages are typically based on the child's body weight or body surface area (BSA)
- Important to ascertain pediatric patients weight or use a Broselow tape
- Absorption in altered and does not reach adult levels until several months
  - Stomach acid PH is higher meaning increased absorption of acid labile drugs
- Gastric emptying is delayed
  - Adult levels not reached until up to 8 months
- Decreased circulating plasma albumin, which leads to what?
- The development of liver metabolic enzyme function continues during the first years of life and does not appear to be at adult levels until after puberty
- Renal filtration, absorption, and secretion not fully functional until 1 year of age

Geriatric patients

- More apt to suffer from comorbidities
  - Growing segment of population
- Physiological effects of aging:
  1. Decreased cardiac output (decreased distribution)
  2. Decreased total body water, decrease lean body mass
     - Drugs that distribute into these tissues can result in higher levels (digoxin)
  3. Increase in total fat
     - Lipid soluble drugs such as diazepam can accumulate, and result in lower blood concentrations
  4. Decreased serum albumin (decreased distribution)
  5. Decreased renal function
     - Causes more adverse drug reactions than other physiological changes
     - Increases half life of drug
     - Greatest concern with drugs 100% renally cleared
  6. Decreased respiratory capacity
- As a general rule no change in absorption of drugs via GI tract

Drug Information, Components of a Drug Profile

- Name
- Classification
- Mechanism of Action
- Indications
- Pharmacokinetics
- Adverse drug reactions
- Routes of Administration
- Contraindications
- Dosage
- How Supplied
- Special Considerations

Sources of Drug Information

- Monographic resources
  - Compendium of Pharmaceuticals and Specialties (CPS), now electronic (e-CPS)
    - 6 sections
  - Lexicomp, Micromedex, Martindale
- Health Canada Drug Product Database
  - DIN, drug identification number
    - Gives manufacturer, routes of admin, schedule, strength
- Natural Health Products directorate
  - Now Non-prescription Health Products Directorate (NNHPD)

Sources of Drug Information

- Special patients
  - Pregnancy and lactation
    - Drugs in Pregnancy and Lactation: A Reference Guide to Fetal and Neonatal Risk by Briggs
    - Drugs During Pregnancy and Lactation: Treatment Options and Risk Assessment by Schaffer
    - Motherisk, from The Hospital for Sick Children, www.motherisk.org
    - Drugs and Lactation, LACTMED, http://toxnet.nlm.nih.gov/newtoxnet/lactmed.htm
- Compatibility of injectable drugs
  - Trissel's stability of compounded formulations, which can be accessed from lexicomp OR available as a hard copy by Lawrence A. Trissel
  - Kings Guide to parenteral admixtures, which can be accessed from micromedex
- Medication standards
  - United States Pharmacopeia (USP) and National Formulary (NF)
    - Electronic
  - British Pharmacopeia

Monographs

Drug Product Database

Health Canada Santé Canada

Canada

Health Canada
www.hc-sc.gc.ca

Français | Home | Contact Us | Help | Search | Canada.ca

Home > Drugs & Health Products > Drug Products

Drug Product Database (DPD)
Label Safety Assessment Update

Explore...
Main Menu
Healthy Canadians
Media Room
Site Map

Transparency
Regulatory Transparency and Openness
Completed Access to Information Requests
Proactive Disclosure

Drugs and Health Products

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Drug Product Database

What is the Drug Product Database (DPD)?

The DPD contains product specific information on drugs approved for use in Canada. The database is managed by Health Canada and includes human pharmaceutical and biological drugs, veterinary drugs, radiopharmaceutical drugs and disinfectant products. It contains approximately 47,000 products that are currently approved, marketed or cancelled.

Human, veterinary, disinfectants and Schedule C drugs (e.g. radiopharmaceutical products) approved products will be available in the DPD online at the time of authorization, with the exception of three monographed product groups under Division 1, Part C of the *Food and Drug Regulations*: sunscreen (sunscreens, lipstick making a SPF claim, cosmetic-like products with sunscreen claims, etc.), anti-dandruff shampoo, and hard surface disinfectants. For these products, applications filed after June 15, 2015, there may be a six month delay after approval for the inclusion in the DPD online.

Health Canada is the federal regulator of therapeutic products and **does not provide medical advice on the use of the products identified in this database.** For information related to treatment options, choices of medications and their uses, illnesses, side effects or drug interactions, please contact your health care professional. For information on where these products are sold, please contact the individual company directly.

Information Regarding the DPD Online Query

Access the Drug Product Database

Additional information regarding the DPD online query:

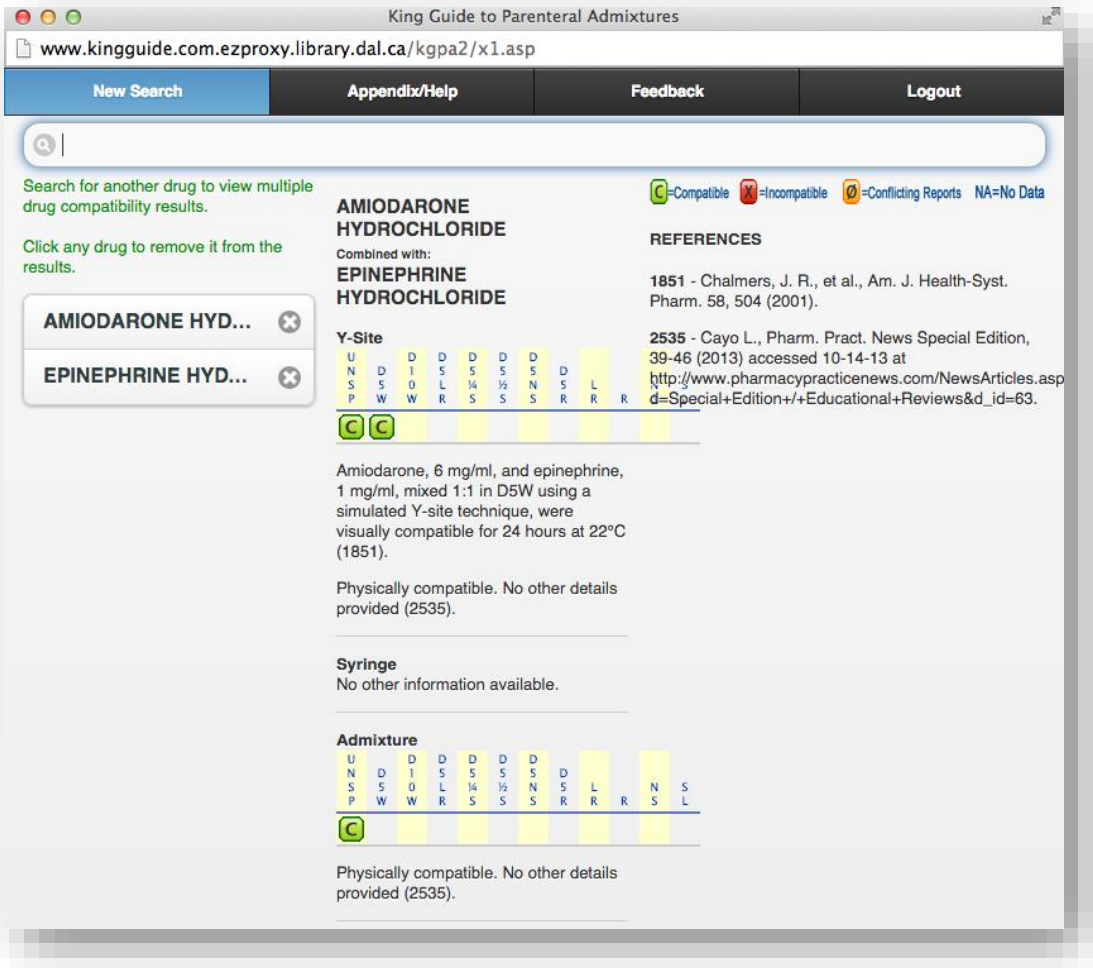
- the data found in the DPD online query is **updated nightly**;
- use the Search Tips to help navigate the database;
- use the Terminology to get an understanding of the words used in the DPD online

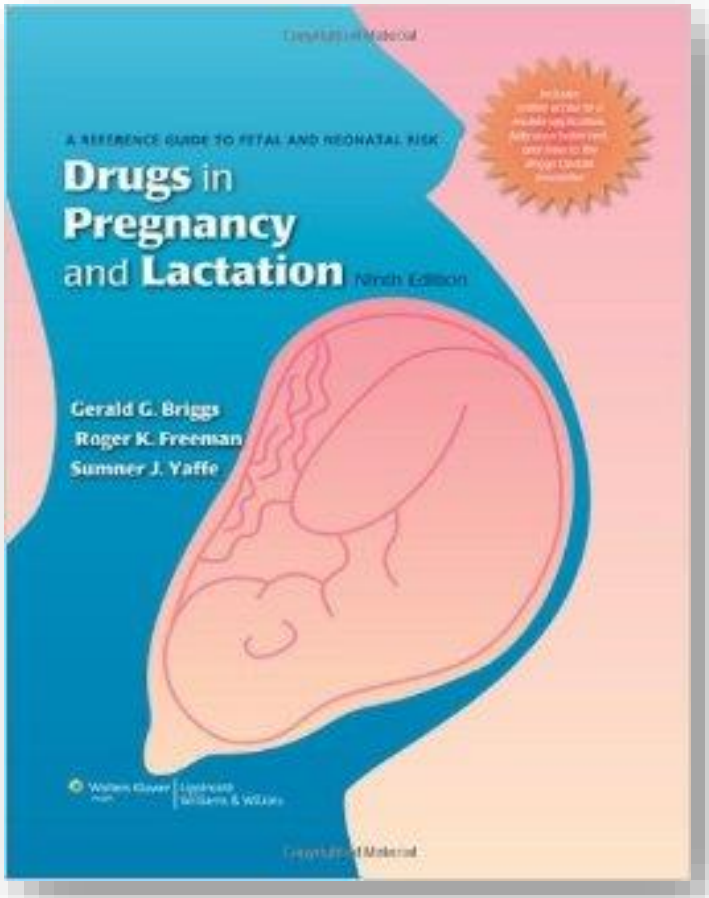
E-CPS

MEDAVIE HealthEd College of Paramedicine

ÉduSanté Collège de formation paramédicale

Sources of Drug Information





Vitamins & Natural Health Products

Science vs home remedies vs Facebook. More than meets the eye

DIGOXIN (Lanoxin) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Major Do not take this combination.
Severity = High • Occurrence = Likely • Level of Evidence = B
Concomitant use can reduce serum levels and the therapeutic effects of digoxin, requiring dosing adjustments when St. John's wort is started or stopped. St. John's wort extract 900 mg daily can reduce serum digoxin levels by 25% after 10 days in healthy people. St. John's wort is thought to affect the multidrug transporter, P-glycoprotein, which mediates the absorption and elimination of digoxin and other drugs (382,6473,7808,7810,9204).

FENFLURAMINE (Pondimin) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Major Do not take this combination.
Severity = High • Occurrence = Probable • Level of Evidence = B
Concomitant use with St. John's wort can increase the risk of serotonergic side effects and serotonin syndrome-like symptoms. St. John's wort 600 mg per day with fenfluramine can cause nausea, headache, and anxiety (3569).

FEXOFENADINE (Allegra) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Moderate Be cautious with this combination.
Severity = Mild • Occurrence = Probable • Level of Evidence = B
A single dose of St. John's wort can decrease the clearance of fexofenadine, resulting in increased plasma concentration of fexofenadine. However, with continued dosing, more than 2 weeks, St. John's wort does not appear to affect fexofenadine levels (9685). Patients taking fexofenadine and who start taking St. John's wort should be monitored for possible fexofenadine toxicity.

GLICLAZIDE (Diamicron, Dacadis, Nazdol, Zicron) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Moderate Be cautious with this combination.
Severity = Moderate • Occurrence = Probable • Level of Evidence = B
Taking St. John's wort decreases the half-life and increases clearance of gliclazide in healthy patients (22431). Theoretically, the blood sugar lowering effects of gliclazide in diabetic patients may be reduced. Advise patients not to take St. John's wort if they are taking gliclazide.

IMATINIB (Gleevec) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Major Do not take this combination.
Severity = High • Occurrence = Likely • Level of Evidence = A
Taking St. John's wort 900 mg/day decreases serum levels of imatinib by 30% in healthy volunteers. This is most likely due to St. John's wort's inducing effect on cytochrome P450 3A4 (CYP3A4) (11888). Advise patients not to take St. John's wort if they are taking imatinib.

IRINOTECAN (Camptosar) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Major Do not take this combination.
Severity = High • Occurrence = Likely • Level of Evidence = A
Concomitant use with St. John's wort can decrease serum levels of irinotecan by at least 50%. Clearance of the active metabolite of irinotecan, SN-38, is increased resulting in a 42% decrease in the area under the concentration curve (9206). St. John's wort is thought to lower drug levels by inducing cytochrome P450 3A4 (CYP3A4) (7092).

MEPERIDINE (Demerol) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Moderate Be cautious with this combination.
Severity = High • Occurrence = Possible • Level of Evidence = D
Theoretically, concurrent use with meperidine might cause additive serotonergic effects and increase the risk of serotonin syndrome (763,6427,8936). Also, concurrent use might theoretically cause cerebral vasoconstriction disorders such as Call-Fleming syndrome (8056).

MEPHENYTOIN (Mesantoin) <<interacts with>> ST. JOHN'S WORT
Interaction Rating = Major Do not take this combination.
Severity = High • Occurrence = Likely • Level of Evidence = B
Preliminary clinical research in healthy males shows that taking St. John's wort for 14 days induces cytochrome P450 2C19 (CYP2C19) and significantly increases metabolism of mephenytoin (Mesantoin). In patients with wild-genotype 2C19, metabolism was almost 4-fold greater in subjects who received St. John's wort compared to placebo. In contrast, patients with 2C19*2/*2 and *2/*3 genotypes did not demonstrate a similar increase in metabolism (17405).

Vitamin C for preventing and treating the common cold

Harri Hemilä[1,*], Elizabeth Chalker[2]

Database Title
The Cochrane Library

Editorial Group: Cochrane Acute Respiratory Infections Group

Published Online: 31 JAN 2013

Assessed as up-to-date: 29 NOV 2012

DOI: 10.1002/14651858.CD000980.pub4

"The failure of vitamin C supplementation to reduce the incidence of colds in the general population indicates that routine vitamin C supplementation is not justified, yet vitamin C may be useful for people exposed to brief periods of severe physical exercise."

Toxic upper limit of vitamin C is 2000mg/day

Safe and Effective Patient Care

- Know the precautions and contraindications for all medications you administer.
- Know how to observe and document drug effects.
- Maintain a current knowledge in pharmacology
- Establish and maintain professional relationships with other healthcare providers.
- Understand pharmacokinetics and pharmacodynamics
- Have current medication references available.

Safe and Effective Patient Care

- As a PCP you may be called upon by your ALS partner to administer medications under their supervision
- This will require you to have an understanding of medications outside of your scope
- Ensure you verify what you are doing with your ALS partner who is authorizing you to administer a medication out of your scope of practice
  - Closed loop communication
- Do not hesitant to ask questions or for partner to clarify

Safe and Effective Patient Care

- Take careful drug histories including:
  - Name, strength, dose of prescribed medications;
    - Ask about Abx used within last 3 month, excellent information to give hospital staff if patient has an infection
  - Over-the-counter drugs
    - Look at the active ingredients, you may be surprised
  - Vitamins
  - Herbal medications/folk remedies
  - Allergies
- Evaluate the patient's adherence, dosage, and adverse reactions.
- Consult with medical direction as needed.

Documentation

- The drugs you administer in the field do not stop affecting your patients when those patients enter the hospital.
- As a result, you must completely document all of your care, especially any drugs you have administered, so that long after you have left for your next call, other providers will know what drugs your patients has been administered
- Include the medication, time administered, dose, route, amount discarded, effect (therapeutic or adverse), sign/initial and include medic number