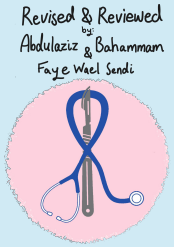


Mechanisms of Drug Action

Important
Main Text
Male slides
female slides
Extra information
Doctors notes

For any future corrections Editing File

If you didn't understand any part from this lecture Click here

Objectives

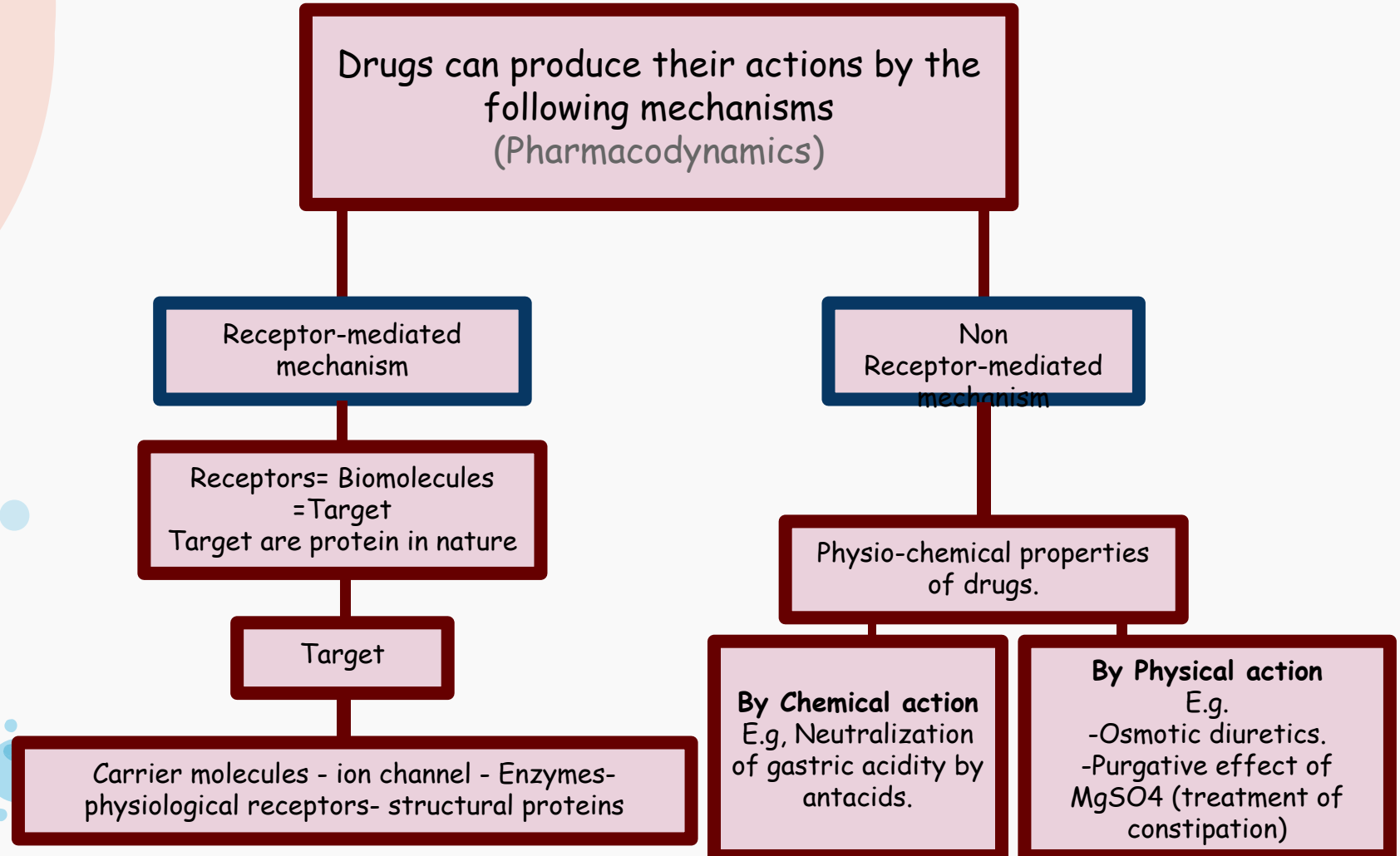
1. Identify different targets of drug action.

2. Differentiate between their patterns of action; agonism versus antagonism.

3. Elaborate on drug binding to receptors.

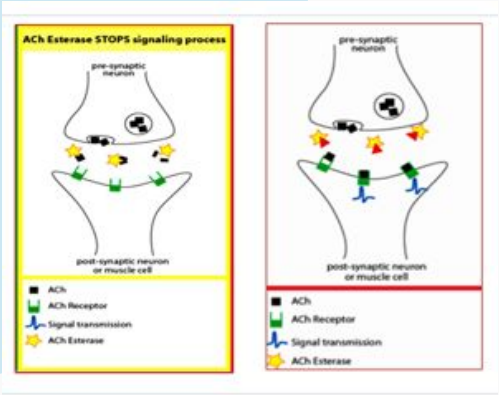
Pharmacodynamics:

Study of biochemical and physiological effects of drugs and their mechanism of action.

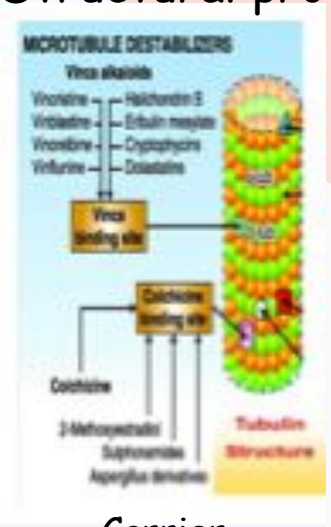

Drugs can produce their actions by the following mechanisms
(Pharmacodynamics)
Receptor-mediated mechanism
Non Receptor-mediated mechanism
Receptors= Biomolecules
=Target
Target are protein in nature
Target
Carrier molecules - ion channel - Enzymes- physiological receptors- structural proteins
Physio-chemical properties of drugs.
By Chemical action
E.g, Neutralization of gastric acidity by antacids.
By Physical action
E.g.
-Osmotic diuretics.
-Purgative effect of MgSO4 (treatment of constipation)

Protein	Structural	Tubulin is the target for drugs as anticancer drugs and antigout drugs and it is required for microtubules formation (cytoskeleton)	Target for	**Vincristine** : Anticancer drug that kills cancerous cells by Inhibiting microtubule formation and cell division. **Colchicine** : used in treatment of gout, it binds to tubulin and inhibits microtubule formation, preventing neutrophil motility and decreasing inflammation
	Regulatory	**Receptor** Is a special target macromolecule that binds the drug and mediates its pharmacological actions	**located in**	Cell membrane - Cytoplasm - Nucleus
		Enzymes The drug competes with the natural endogenous substrate for the enzyme. E.g. Anticholinesterases inhibit acetylcholinesterase thus producing cholinomimetic action.	Reversibly	Neostigmine reversibly compete with ACH for acetylcholinesterase enzymes at motor end plate (neuromuscular junction)
		Ion Channels -Responsible for influx or outflux of ions through cell membranes -They are activated by alteration in action potential. -Drugs bind to alter channel function (opening or blockade).	Local anesthetics	Act by blocking (Na^+) influx through Na channels in nerve fibers (Na Channel Blockers)
			Sulfonylurea drugs (Antidiabetic drugs)	Block potassium outflux via the K channel in pancreatic beta cells resulting in depolarization and opening of calcium channels and insulin secretion.
		Carrier Molecules -Responsible for transport of ions and small organic molecules between intracellular compartments, through cell membranes or in extracellular fluids. -Drugs bind to such molecules to alter their transport ability.	**Digoxin**	Blocks efflux of Na+ via **Na+/k+ pump** (Na+ / K+ -ATPase) used in the treatment of heart failure more Na+ in the cytosol less export of ca++ stronger heart muscle contraction
			Cocaine	-Blocks transport of reuptake of catecholamines mainly dopamine at synaptic cleft. -The dopamine transporter can't perform its reuptake function therefore dopamine accumulates in the synaptic cleft producing Euphoria

Enzymes



Structural proteins



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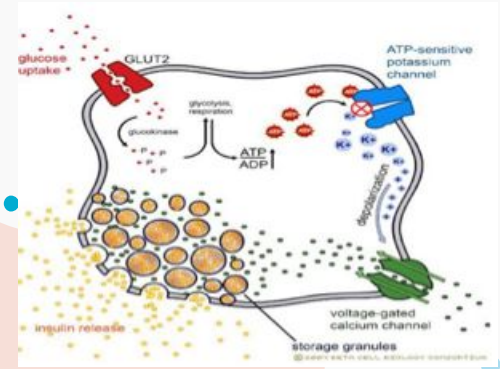
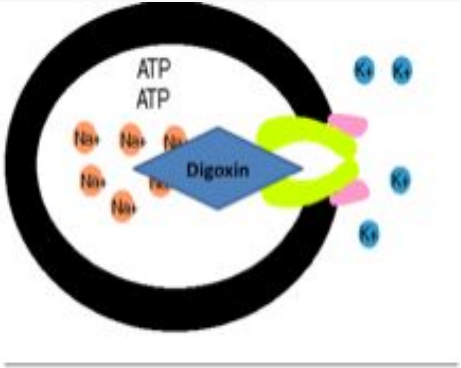
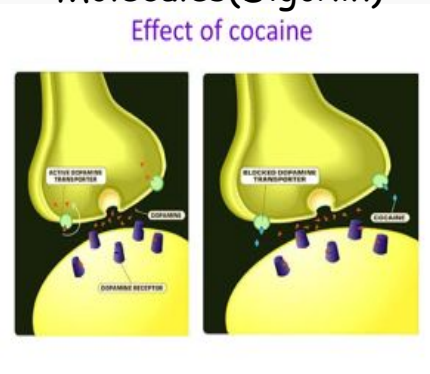
Ion Channels



Carrier Molecules(Digoxin)



Carrier Molecules(Digoxin)



binding Forces between drugs and receptors

Ionic bond – Van-Dar-Waal – Hydrogen bond – Covalent bond (the strongest)

Antagonist

Is a drug that combines with the receptor without producing a response (It blocks the action of agonist).

[e.g. Atropine]
Atropine block the action of Ach on muscarinic receptors.

It has a similar chemical structure to the Agonist

It has Affinity but No Efficacy or zero efficacy. (Blocks receptor)

Def

Def

01

02

Agonist

Definition: Is a drug that binds with a receptor and elicit a response.
It has Affinity and Efficacy

Ability of a drug to combine with the receptor.
[D + R 👉 D-R complex 👉 Effect]
[D= Drug , R= Reseptor]

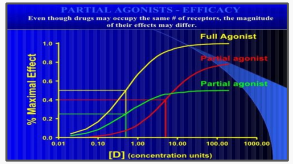
- Capacity of drug receptor complex to produce an action
- Is the maximal response produced by a drug (E-Max).

There are Two types:

Full Agonist

A drug that combines with its specific receptor to produce maximal effect by increasing its concentration (Affinity & High Efficacy).

e.g. Acetylcholine (ACH) acts upon muscarinic receptors



Partial Agonist

Combines with its receptor & evokes a response as a full agonist but produces submaximal effect regardless of concentration (Affinity & Partial efficacy). [e.g. Pindolol]

A beta blocker which is a partial agonist, produces less decrease in heart rate than pure antagonists such as propranolol.
Even though the drugs may combine with the same number of receptors, the magnitude they can produce may differ

Click Here for better understanding
(Youtube video)

Found Only in Female Slides-

Affinity	Is the capacity of drug to form a complex with receptor (D-R complex) [D= Drug , R= Reseptor]
Efficacy	(Intrinsic activity) The ability of the drug once bound to the receptor to trigger response
Full Agonist	Having a full affinity to the receptor and a maximal intrinsic activity (=1) [e.g. Acetylcholine]
Partial Agonist	Having a full affinity to the receptor but with low intrinsic activity (<1) [e.g. Pindolol]
Antagonist	Having full affinity to the receptor but no intrinsic activity (0) [e.g. Atropine]

The Value of intrinsic activity range from 0 to 1

Summary:

Drug	Mechanism of Action
Antacids	Neutralization of gastric acidity
Neostigmine (reversible cholinesterase inhibitor)	competes with ACh for acetylcholinesterase enzyme at motor end plate (neuromuscular junction).
Sulphonylurea (anti diabetic)	block K+ outflux via the K channels in pancreatic beta cells resulting in opening of calcium channels and insulin secretion.
Digoxine (drug of heart failure)	blocks Na efflux via Na/K pump
Cocaine	blocks transport or reuptake of catecholamines (dopamine) at synaptic cleft **causing euphoria**
Vincristine	**Anticancer agent**
Colchicine	**Drug for gout treatment**
Pindolol (Beta blocker)	a partial agonist, produces less decrease in heart rate than pure antagonists

Quiz

1. Efficacy = 1 when the drug is?

A.Full agonist

B.Antagonist

C.Partial Agonist

D.None

2. Receptors are?

A.macromolecules

B.micromolecules

C.both

D.none

3. Tublin is good target for?

A.anticancer drug

B.antiseptic drug

C.antigout drug

D.both A&C

4. Ability of a drug to combine with the receptor is?

A. Affinity

B. Efficacy

C. Agonist

4.A
3.D
2.A
1.A

Thank you

Team leaders

Lujain Alkhalaf - Salman Alotaibi

Female team members:

- Alanoud Albawardi
- Shaimaa Alqaoud
- Nada Alsaif
- Raneem Alanazi
- Ftoon Alenazi
- Areej Altamimi
- Sarah Alotaibi
- Rand Alshaya
- Rand Aldajani

Male team members:

- Anas Alharbi
- Abdulrahman Alghamdi
- Abdullah Alotaibi
- Abdulaziz Alqusiyer
- Bader Alshahrani
- Saad Alghadir
- Abdullah Alghamdi
- Mohammed Alsaqabi
- Abdulrahman Badghaish

Contact us on:

pharma411m@gmail.com

Reviewed and edited by: Abdulaziz Omar Bahammam