

**PLEASE FILL OUT OUR
SURVEY IF YOU ARE
ATTENDING 6+ TALKS**



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MINI MED SCHOOL

Talk 4: Common medications, how do they work?

JULIA DE PIERI, BSCHK, UBC MD CLASS OF 2024



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Medicine



University
of Victoria

let's talk  science

TERRITORIAL ACKNOWLEDGEMENT

I would like to begin by acknowledging that I am joining you from the unceded territory of the Coast Salish Peoples, including the territories of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), Stó:lō and Səl̓ílwətaʔ/Selilwitulh (Tsleil- Waututh) Nations.

I would also like to acknowledge the Lekwungen peoples on whose traditional territory the University of Victoria stands and the Songhees, Esquimalt and Wsanec peoples whose historical relationships with the land continue to this day.



DISCLOSURE

I am a medical student. These talks do not constitute or substitute for medical advice.



There are an infinite amount of medications and a variety of factors that will dictate which one you are prescribed. Our understanding and use of medication is constantly changing.

Please consult with your healthcare provider or pharmacist if you have questions about your specific health situation.

TOPICS

- **Over-the-counter medications**
- **Cardiovascular**
 - **Hypertension**
 - **Cholesterol**
- **Anticoagulants**
- **Diabetes**
- **Thyroid**
- **Proton-Pump inhibitors**
- **Anti-depressants**
- **Bisphosphonates**



OVER-THE-COUNTER MEDICATIONS

- Ibuprofen/naproxen (Motrin, Advil, Aleve etc.)
- Acetaminophen (Tylenol)
- Anti-histamines (Claritin, Benadryl)
- Anti-acids (TUMS)
- Laxatives
- Anti-diarrheal (Peptobismol, Imodium)
- Hydrocortisone



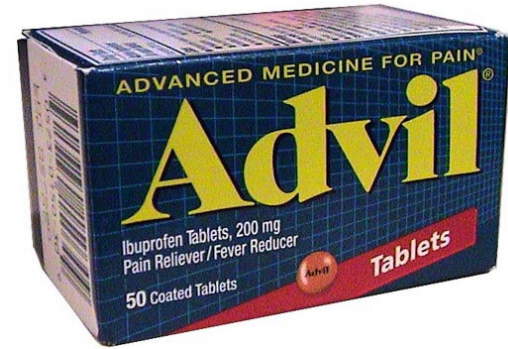
NON-STEROIDAL ANTI-INFLAMMATORIES (NSAIDS)



Examples: Ibuprofen (Motrin, Advil), Naproxen (Aleve),
ASA (Aspirin)

Indications: Headache, pain, aches, cramps, arthritis,
fever, inflammation etc.

Mechanism: Inhibits enzymes COX-1 and COX-2 →
Reduced prostaglandin production → Reduced pain,
inflammation, fever



ACETAMINOPHEN (TYLENOL, PARACETAMOL)



Indications: Fever, pain, headache

Mechanism: Not fully understood...

- Inhibits the COX pathway, but more in the central nervous system (ie. Brain) compared to NSAIDs
- Inhibits prostaglandins in the central nervous system
- Reduced pain, fever, headache



ANTI-HISTAMINES (1ST GENERATION)



Examples: Diphenhydramine (Benadryl)

Indications: Allergy symptoms, insomnia, common cold, tremors, nausea/vertigo

Mechanism: Blocks histamine receptors → Located in lungs, heart, GI tract, blood vessels, central nervous system and immune system → Reduced allergy symptoms and cough BUT causes severe drowsiness



Which of the following medications actually contains Benadryl?



A. Loratadine (Claritin)

B. Dimenhydrinate (Gravol)

C. Loperamide (Imodium)

D. A medication in a medication? Not possible

Which of the following medications actually contains Benadryl?



A. Loratadine (Claritin)

B. Dimenhydrinate (Gravol)

C. Loperamide (Imodium)

D. A medication in a medication? Not possible

ANTI-HISTAMINE (1ST GENERATION)



Examples: Dimenhydrinate (Gravol)

Indications: Motion sickness, nausea/vomiting, dizziness

Mechanism: Blocks histamine receptor in GI tract, blood vessels, respiratory tract + decreases stimulation of the vestibular system → Less dizzy, nauseous and reduced motion sickness



ANTI-HISTAMINES (2ND GENERATION)



Examples: Loratadine (Claritin), Cetirizine (Reactine, Zyrtec), Fexofenadine (Allegra)

Indications: Allergy symptoms

Mechanism: *Selective* histamine receptor blocker

→ Reduces allergy symptoms but doesn't cross blood brain barrier aka no drowsiness



ANTACIDS

Examples: Calcium carbonate (TUMS, Alka-Seltzer), Magnesium hydroxide (Milk of Magnesia), Gaviscon etc.

Indications: Heartburn/acid reflux, gastric ulcers, biliary reflux

Mechanism:

- Neutralize existing stomach acid by acting as a buffer.
- Stimulate movement of acid into stomach
- Create protective layer over stomach acid (Gaviscon)



ANTI-DIARRHEAL

Examples: Loperamide (Imodium), Bismuth subsalicylate (Pepto-Bismol)



Indications: Diarrhea, GI discomfort, H.pylori infection, stomach ulcers

Mechanism:

- Imodium: Bind opioid receptors → decrease peristalsis
- Pepto-bismol: antimicrobial, reduce prostaglandins → less inflammation and motility, more reabsorption of fluids



LAXATIVES

Examples: Fiber (Metamucil), Bisacodyl (Dulcolax), Senna Glycoside (Senokot)

Indications: Constipation

Mechanism:

- Metamucil: draw water back into GI tract to soften stool
- Dulcolax/Senokot: increase peristalsis by stimulating nerves of GI tract



HYDROCORTISONE CREAM



Indications: Multiple inflammatory skin conditions

Mechanism:

- Reduces inflammation by inhibiting proteins that trigger the inflammatory cascade, and prevents release of chemical mediators of inflammation



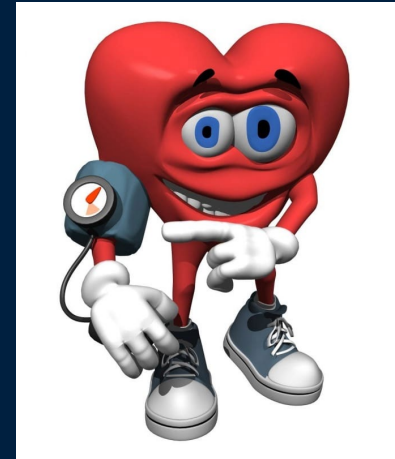
PRESCRIPTION MEDICATIONS

- **Cardiovascular**
 - **Hypertension**
 - **Cholesterol**
- **Anticoagulants**
- **Diabetes**
- **Thyroid**
- **Proton-Pump inhibitors**
- **Anti-depressants**
- **Bisphosphonates**



HYPERTENSION MEDICATIONS

- ACE-Inhibitors
- Angiotensin 2 Receptor Blockers (ARBs)
- Thiazide Diuretics
- Loop Diuretics
- Potassium Sparing Diuretics
- Beta Blockers
- Calcium Channel Blockers





BLOOD PRESSURE = CARDIAC OUTPUT X RESISTANCE

STROKE VOLUME X HEART RATE

ACE-INHIBITORS (-PRIL)

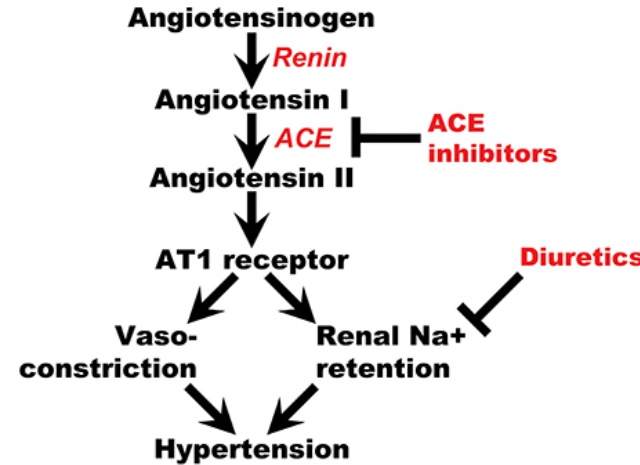
Examples: Captopril, Lisinopril, Ramipril etc.

Indications: Hypertension, heart failure, heart attack

Mechanism: Inhibit ACE

- Dilate blood vessels
- Reduce sodium reabsorption

Renin Angiotensin Aldosterone System (RAAS)



$$\text{BLOOD PRESSURE} = \text{CARDIAC OUTPUT} \times \text{RESISTANCE}$$
$$\downarrow \text{STROKE VOLUME} \times \text{HEART RATE}$$

ANGIOTENSIN 2 RECEPTOR BLOCKERS (-SARTAN)



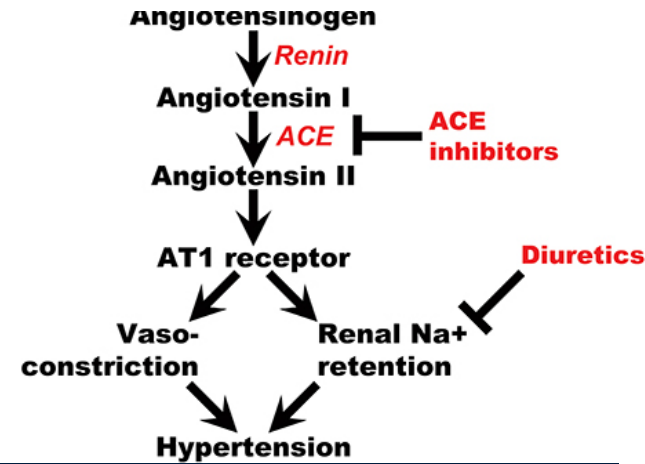
Examples: Irbesartan, Losartan, Valsartan etc.

Indications: Hypertension, heart failure, chronic kidney disease

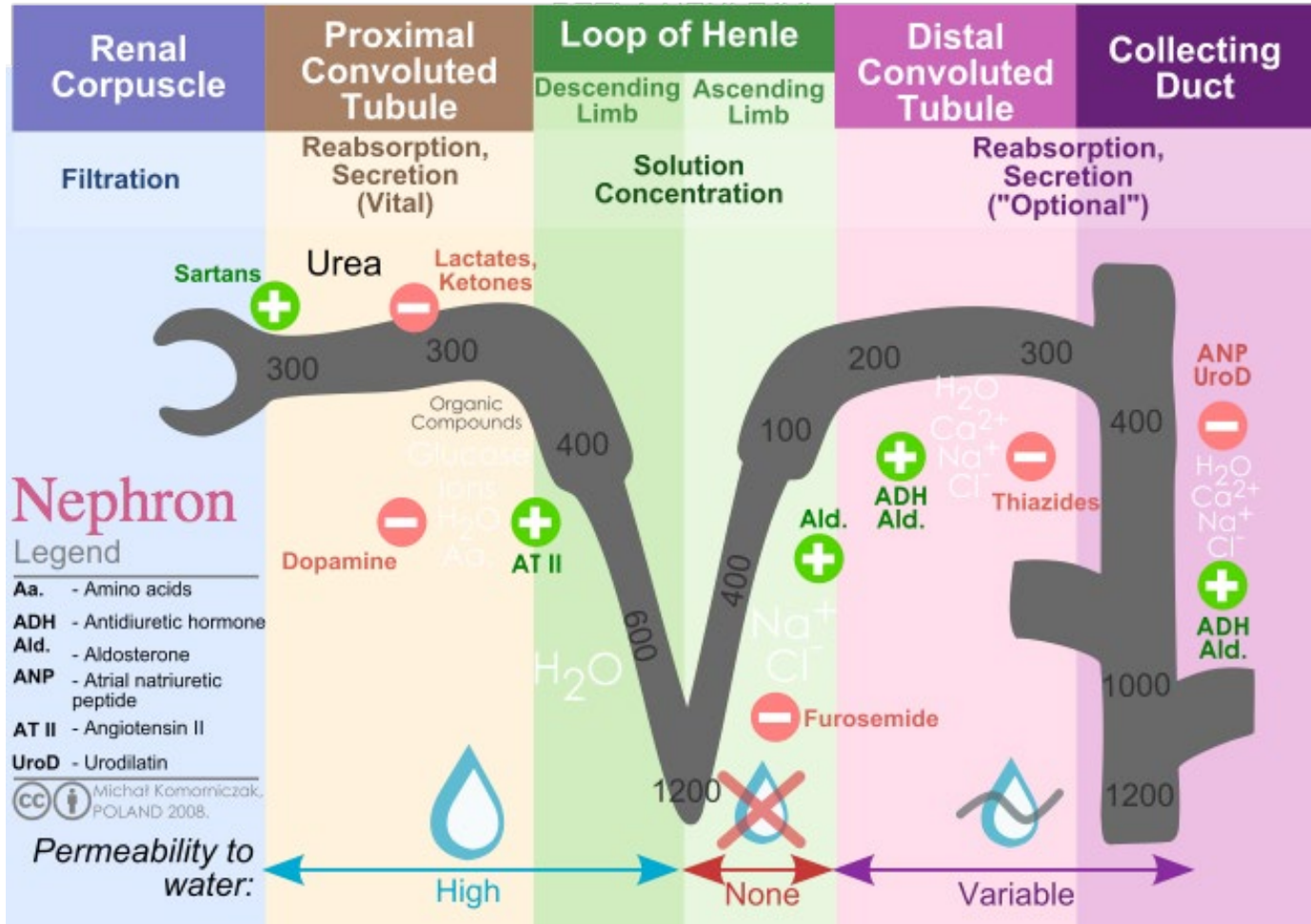
Mechanism: Inhibit Angiotensin 2

- Dilate blood vessels
- Reduce sodium reabsorption

Renin Angiotensin Aldosterone System (RAAS)



$$\text{BLOOD PRESSURE} = \text{CARDIAC OUTPUT} \times \text{RESISTANCE}$$
$$\text{RESISTANCE} \downarrow$$
$$\text{CARDIAC OUTPUT} = \text{STROKE VOLUME} \times \text{HEART RATE}$$
$$\text{STROKE VOLUME} \downarrow$$



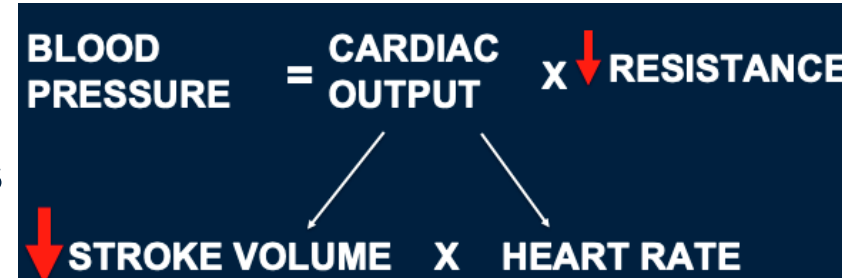
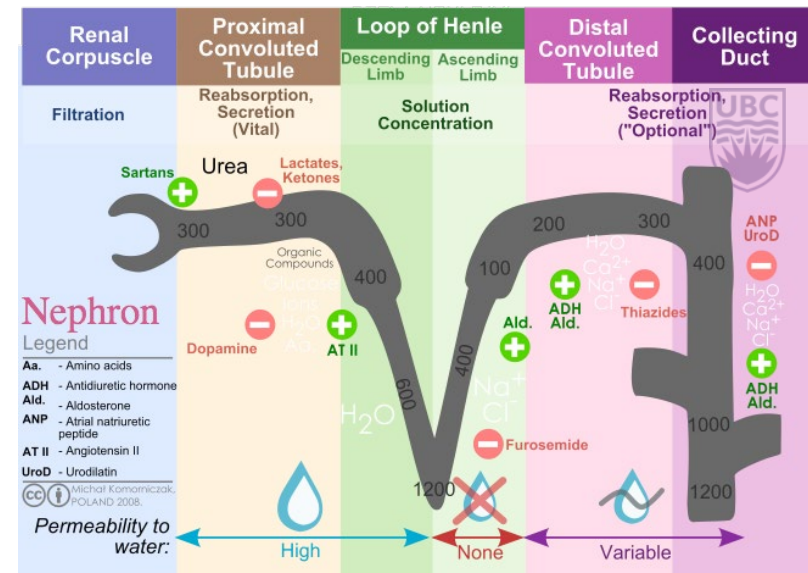
LOOP DIURETICS

Examples: Furosemide (Lasix)

Indications: Fluid overload (edema), severe heart failure, kidney disease, hypertension

Mechanism:

- Keeps salt in the urine → water follows → reduced blood volume
- Also dilates veins



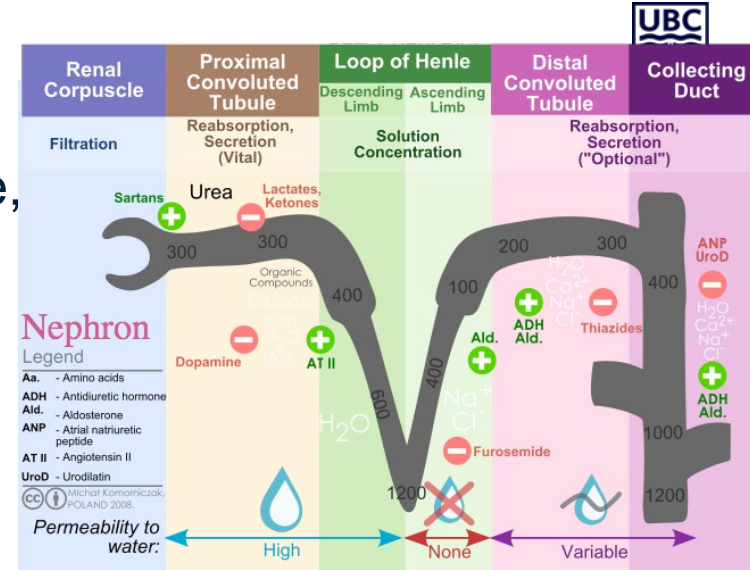
THIAZIDE DIURETICS

Examples: Hydrochlorothiazide, chlorothiazide, chlorthalidone

Indications: Hypertension, edema (fluid overload)

Mechanism:

- Keeps salt in the urine → water follows
- reduced blood volume
- Also dilates arterioles



$$\text{BLOOD PRESSURE} = \text{CARDIAC OUTPUT} \times \text{RESISTANCE}$$

$$\text{STROKE VOLUME} \times \text{HEART RATE}$$

↓ (Red arrow pointing down from RESISTANCE)

↓ (Red arrow pointing down from STROKE VOLUME)

POTASSIUM SPARING DIURETICS

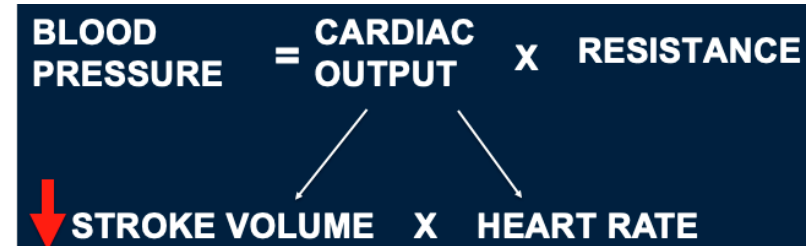
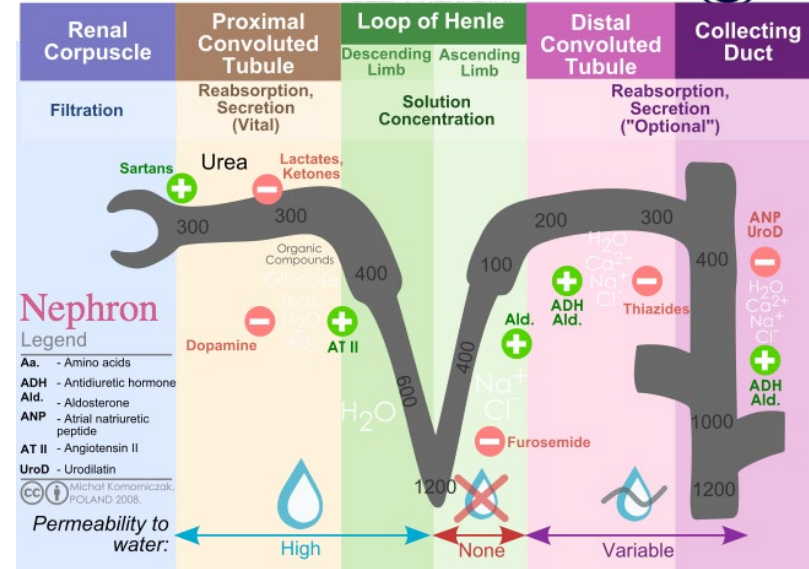


Examples: Spironolactone, eplerenone, amiloride

Indications: Hypertension, heart failure, edema, cirrhosis

Mechanism: Opposes aldosterone

- Keeps salt in the urine → water follows
- Potassium remains in the blood



CALCIUM CHANNEL BLOCKERS

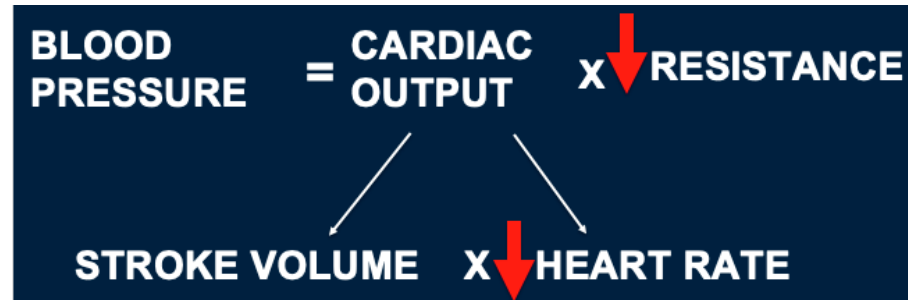


Examples: Verapamil, Diltiazem, Amlodipine, Nifedipine, Felodipine

Indications: Hypertension, angina, arrhythmias, pulmonary hypertension

Mechanism: Slow calcium movement into cells

- Verapamil/Diltiazem: slow electrical conduction and contractility
 - More helpful for heart issues
- Amlodipine/nifedipine: vasodilate
 - Better for blood pressure



BETA-BLOCKERS (-LOL)

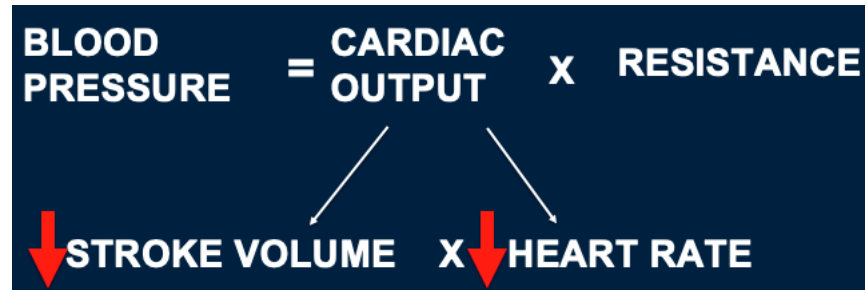


Examples: Propranolol, Labetalol, Metoprolol etc.

Indications: Hypertension, arrhythmias, heart failure, angina etc.

Mechanism: Block epinephrine/norepinephrine.

- Decreased heart rate (less contractility)
- Decreased renin release
(decreased blood pressure/stroke volume)



STATINS

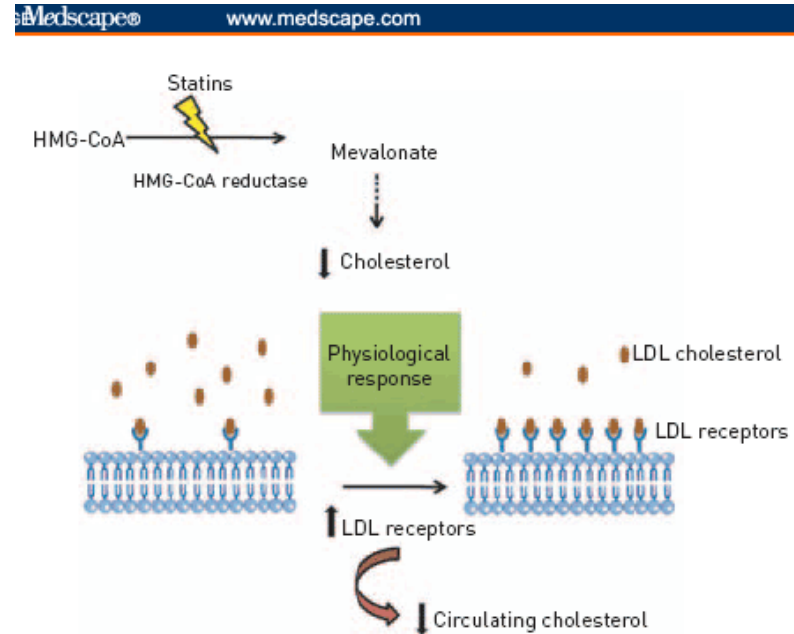


Examples: Atorvastatin (Lipitor), Rosuvastatin (Crestor)

Indications: High cholesterol/lipids, prevention of coronary artery disease, heart attack and stroke

Mechanism: Inhibit HMG-CoA reductase (liver enzyme)

- Increases low-density lipoprotein (LDL) receptors on liver cells → takes LDL from the blood → lowers blood cholesterol



Which medication was originally invented to treat hypertension, until they realized that it had useful side effects?



- A. Levothyroxine
- B. Sildenafil (Viagra)
- C. Benzodiazepines
- D. Bisphosphonates

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PDE5-INHIBITORS

Examples: Sildenafil (Viagra), Tadalafil (Cialis) etc.



Indications: Erectile dysfunction, pulmonary hypertension, prostate enlargement

Mechanism: Inhibits the enzyme PDE5

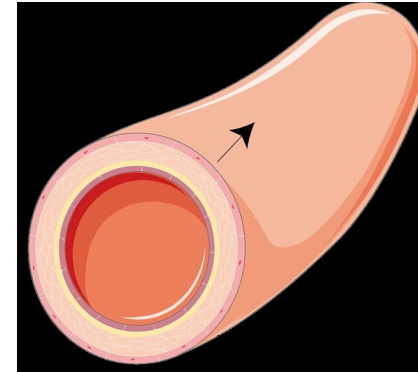
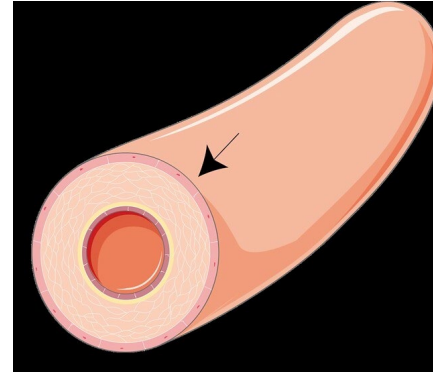
- Allows longer production of nitric oxide to widen the vessels
- Prevents breakdown of the end-product (cGMP) → longer erection

NITROGLYCERIN

Indications: Angina

Mechanism: Precursor to nitric oxide

- Nitric oxide helps dilate vessels by relaxing smooth muscle → reduce chest pain symptoms and reduce oxygen demand of the heart



**BREAK TIME FOR 10
MIN!**

**FILL OUT OUR
RESEARCH SURVEY IF
YOU HAVEN'T ALREADY!**

[HTTPS://UBC.CA1.QUALTRICS.COM/JFE/FORUM/SV_BQS3QCDSRTNZPEU](https://UBC.CA1.QUALTRICS.COM/JFE/FORUM/SV_BQS3QCDSRTNZPEU)



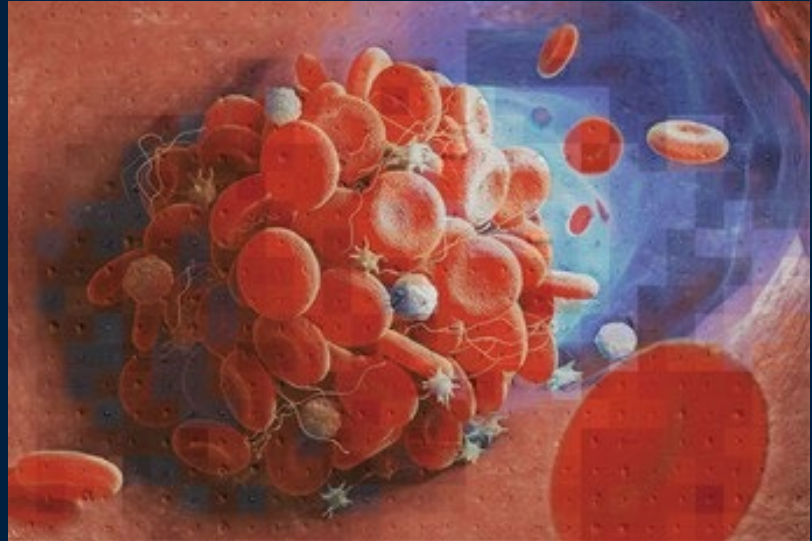
TOPICS

- ~~Over-the-counter medications~~
- ~~Cardiovascular~~
 - ~~Hypertension~~
 - ~~Cholesterol~~
- Blood thinners
- Diabetes
- Thyroid
- Proton-Pump inhibitors
- Anti-depressants
- Corticosteroids



BLOOD THINNERS

- Aspirin
- Anti-platelets
- Warfarin
- Direct Anticoagulants
- Heparin



ACETYLSALICYLIC ACID (ASPIRIN)

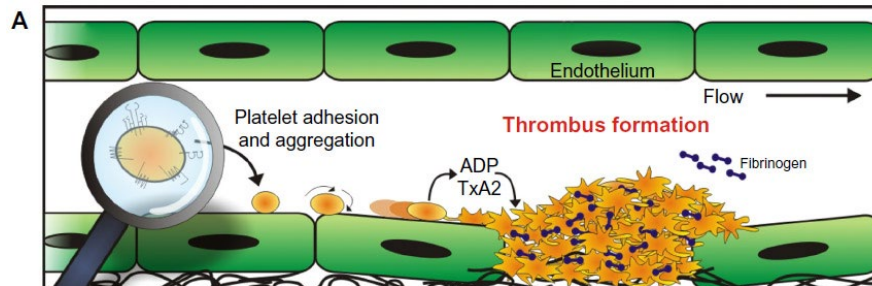


Indications: angina, fever, heart attack, arthritis, pain

Mechanism:



- Inhibits COX-1 and COX-2 → Reduce inflammation/pain/fever
- Blocks thromboxane A₂ on platelets → Prevents platelets from clotting

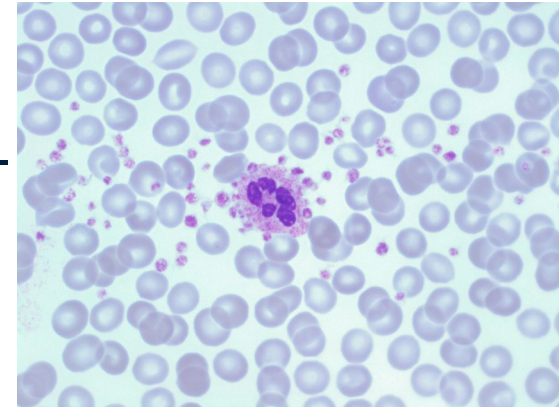
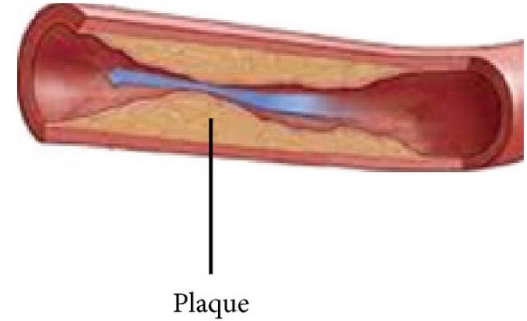


ANTI-PLATELETS

Examples: Clopidogrel (Plavix), Prasugrel (Effient), Ticagrelor (Brilinta)

Indications: Unstable angina, heart attacks, secondary prevention of heart attacks, strokes, post-stenting

Mechanism: Inhibit ADP receptor on platelets → platelets can't clump and form a clot.



DIRECT ORAL ANTICOAGULANTS (DOACs)

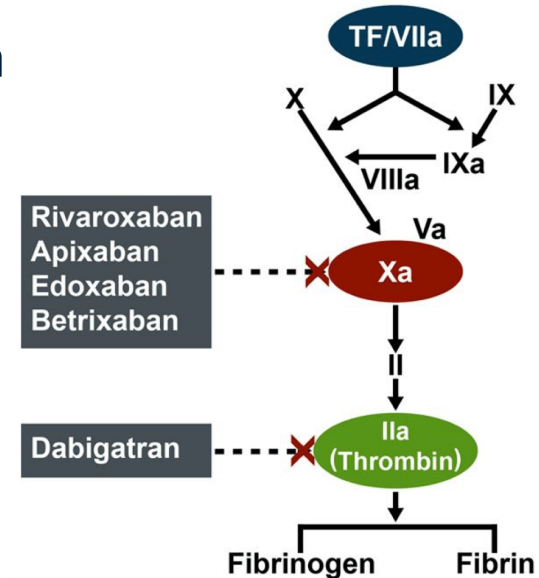


Examples: Rivaroxaban, Apixaban, Edoxaban, Dabigatran

Indications: Prophylactic prevention of clots post-surgery, atrial fibrillation, deep vein thrombosis/pulmonary embolism

Mechanism:

- Inhibit factor Xa
- Inhibit thrombin (dabigatran)



WARFARIN (COUMADIN)

Indications: Prophylaxis and treatment of deep vein thrombosis, pulmonary embolism, atrial fibrillation, recurrent heart attacks, strokes etc.

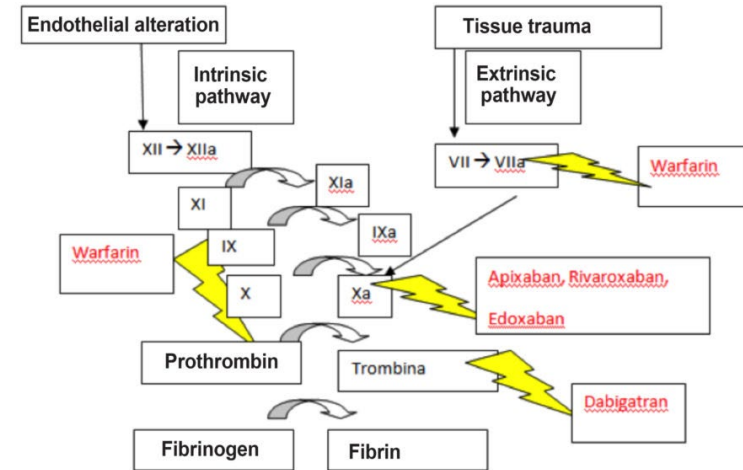
Mechanism: Inhibits vitamin K reductase

- Depletes factors 10, 9, 7, Thrombin (2)
- Prevents clots from forming



Pink	Lavender	Light Green	Tan	Blue	Peach	Teal	Yellow	White
1 mg	2 mg	2 1/2 mg	3 mg	4 mg	5 mg	6 mg	7 1/2 mg	10 mg

Coagulation cascade



HEPARIN

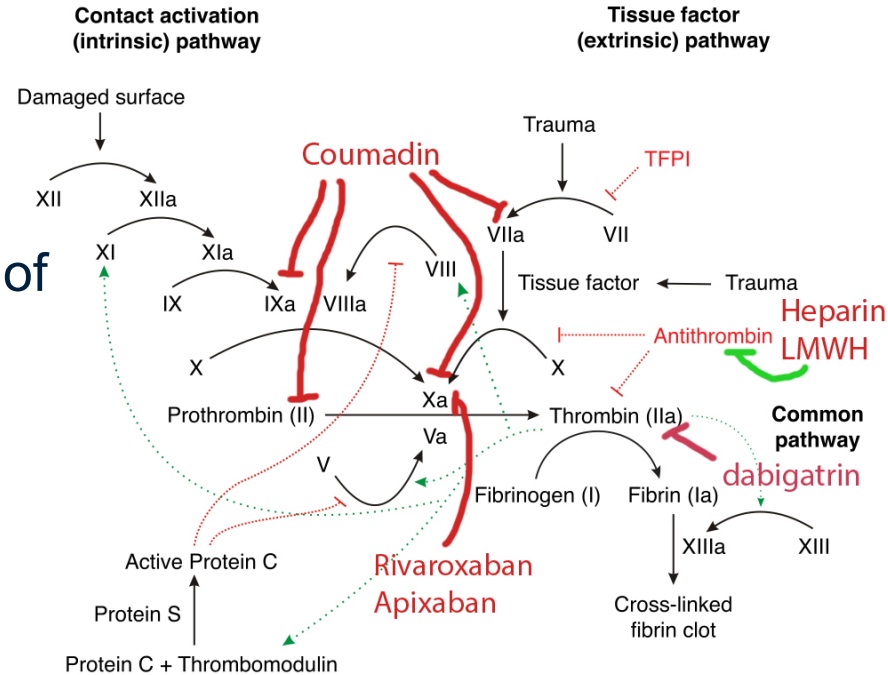


Examples: Dalteparin, Enoxaparin etc.

Indications: Prophylaxis and treatment of deep vein thrombosis, pulmonary embolism, unstable angina etc.

Mechanism: Inhibit antithrombin

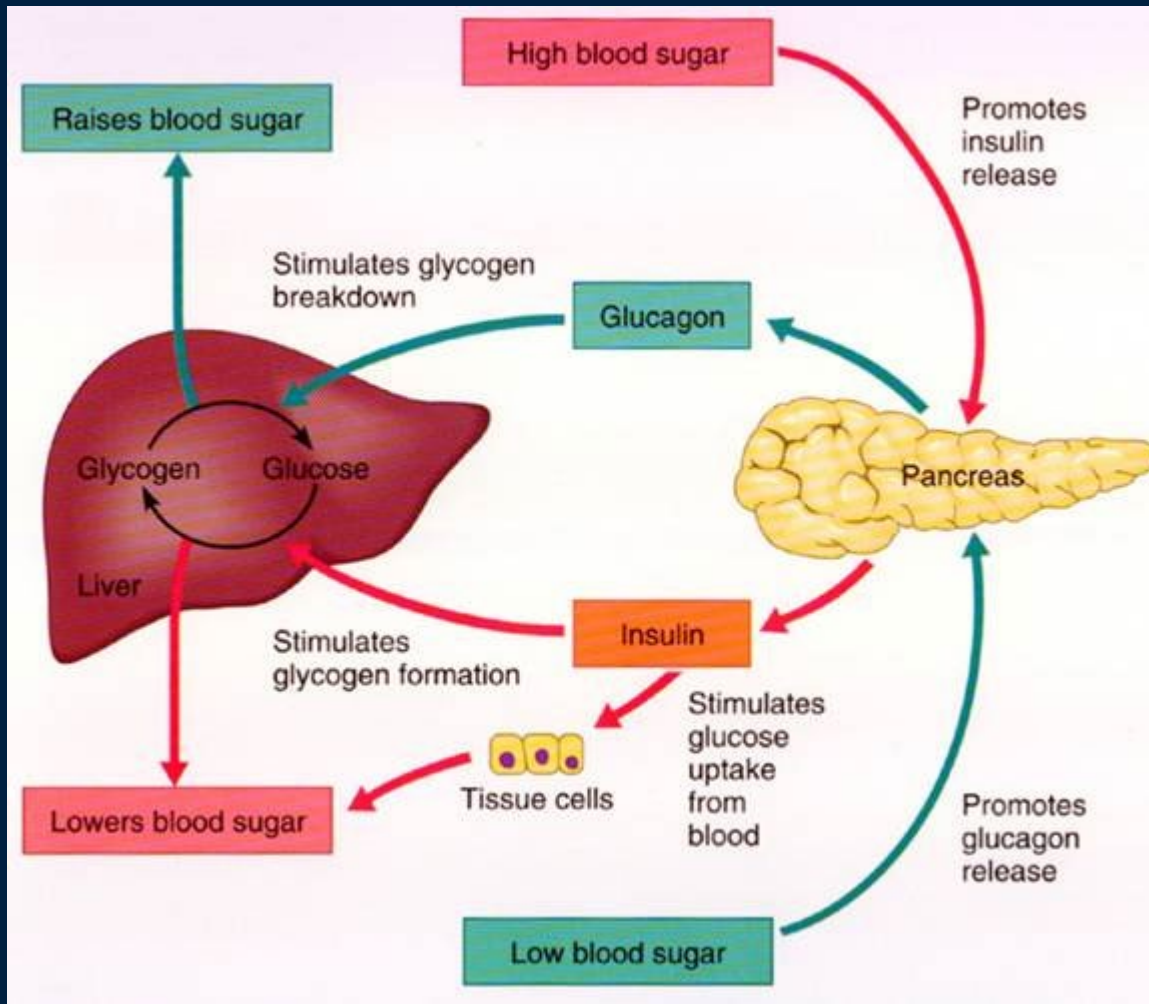
- Prevents activation of factor 10 and thrombin



DIABETES MEDICATIONS

- Insulin
- Biguanides (Metformin)
- GLP1 Receptor Agonists
- DPP-4 Inhibitors
- SGLT2 Inhibitors
- Sulfonylureas





Which of the following medications was discovered in Canada?



- A. SGLT2 Inhibitors (Canagliflozin)
- B. Insulin
- C. DPP-4 Inhibitors (Dulaglutide)
- D. We don't invent things in Canada

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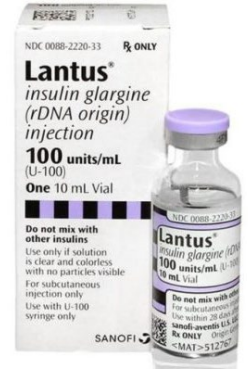
INSULIN

Examples: Short Acting (insulin lispro (Humalog), Long Acting (insulin glargine (Lantus) etc.)

Indications: Type 1 and 2 Diabetes

Mechanism: Acts like your own insulin (lowers blood sugar)

- Stimulate cells to take up glucose for energy storage
- Short acting: given before a meal
- Long acting: maintains blood sugar levels through the day



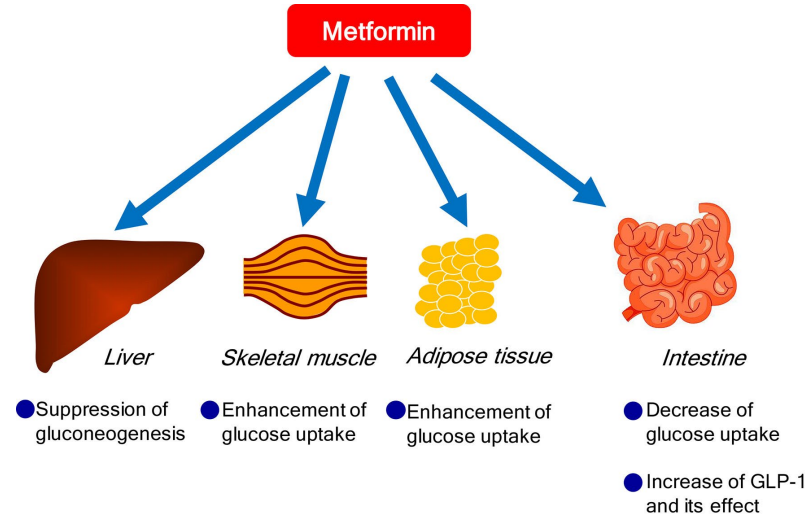
BIGUANIDES

Examples: Metformin

Indications: Type 2 diabetes, prediabetes, gestational diabetes, polycystic ovary syndrome (PCOS)

Mechanism: Reduces blood sugar by:

- Decreasing glucose production in the liver
- Decreasing glucose absorption from the intestine
- Increasing insulin sensitivity and glucose uptake in the tissues



GLP-1 RECEPTOR AGONISTS

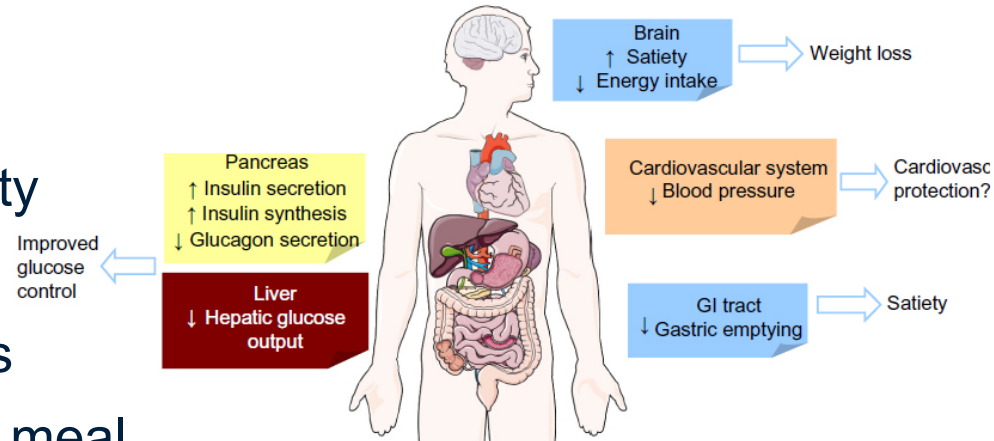


Examples: Dulaglutide (Trulicity), Liraglutide (Victoza), Semaglutide (Ozempic)

Indications: Type 2 Diabetes, obesity

Mechanism: Binds GLP-1 receptors

- Increases insulin release after a meal
- Inhibits glucagon release if blood sugar is high
- Prevent pancreatic beta cell death
- Slows stomach emptying



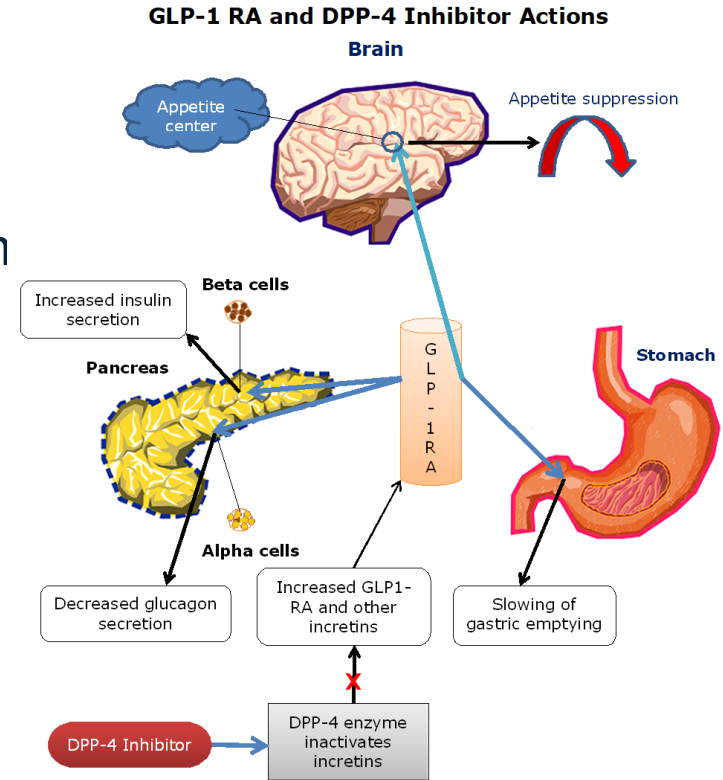
DPP-4 INHIBITORS

Examples: Linagliptin (Trajenta™), Saxagliptin
Sitagliptin (Januvia®)

Indications: Type 2 Diabetes

Mechanism: Inhibits DPP-4 enzyme

- Increases insulin release after a meal
- Inhibits glucagon release if blood sugar is high
- Prevent pancreatic beta cell death
- Slows stomach emptying

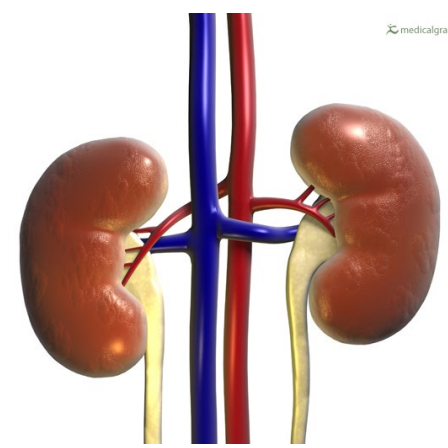


SGLT2 INHIBITORS

Examples: Canagliflozin, Dapagliflozin, Empagliflozin

Indications: Type 2 diabetes especially if concurrent cardiovascular disease or heart failure → protective benefit, lower mortality

Mechanism: Inhibits sodium-glucose channel in proximal tubules of the kidneys → Lose glucose and sodium in the urine “pee pills”
- Also lose water → Lower blood pressure



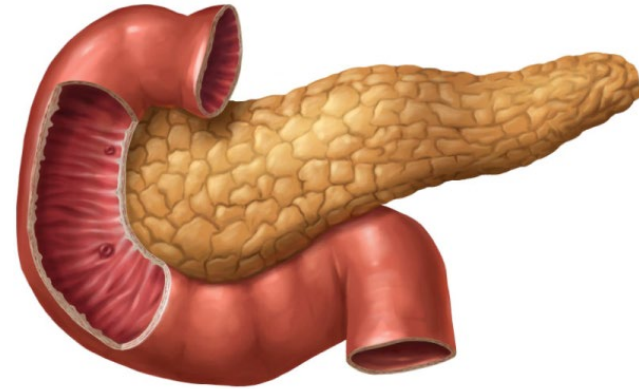
SULFONYLUREAS

Examples: Glimepiride, Glyburide, Glipizide

Indications: Type 2 Diabetes

Mechanism: Stimulate pancreas to make insulin by binding to beta cells → More insulin

- Decrease liver's ability to metabolize insulin → Prolonged effect
- Decrease glucagon secretion
- Increased sensitivity to insulin in the tissues



OTHERS

- Levothyroxine
- Proton Pump Inhibitors
- Antidepressants
- Bisphosphonates



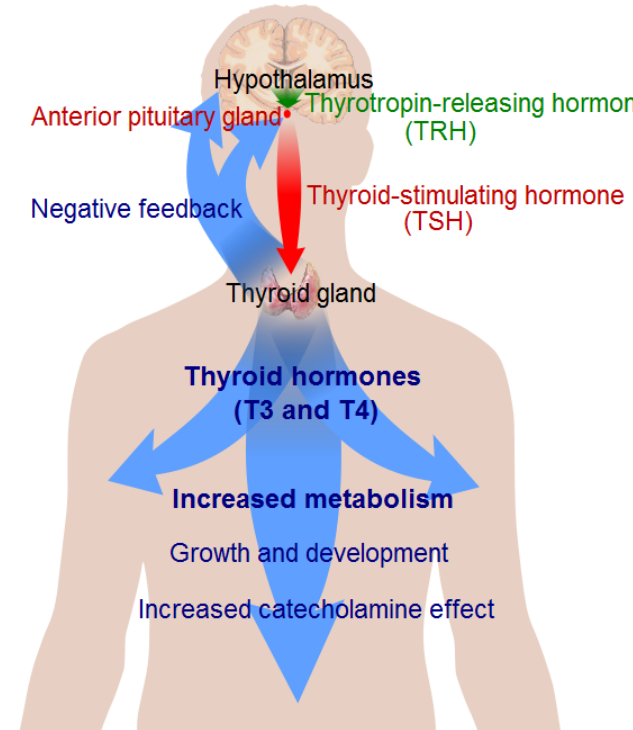
LEVOTHYROXINE (SYNTHROID)



Indications: Hypothyroidism (Low thyroid)

Mechanism: Replace thyroxine (T4)

Thyroid system



PROTON PUMP INHIBITORS

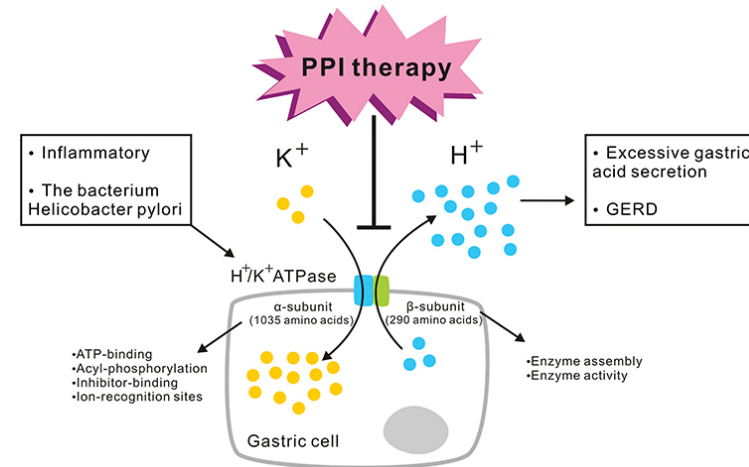


Examples: Omeprazole, Pantoprazole, Rabeprazole etc.

Indications: Peptic and duodenal ulcers, H.pylori infection, gastroesophageal reflux disease (GERD), heartburn

Mechanism: Decreases acid production

- Inhibits H⁺/K⁺ proton pump in the stomach



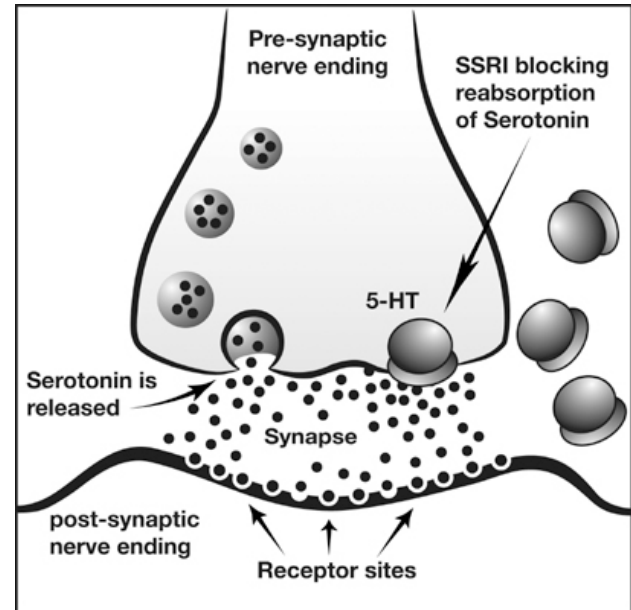
SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRI)



Examples: Citalopram (Celexa), Escitalopram (Lexapro), Fluoxetine (Prozac), Paroxetine (Paxil), Sertraline (Zoloft)

Indications: Major depressive disorder, several anxiety disorders

Mechanism: Inhibit the reuptake of serotonin
→ Allows serotonin to stay and exert effects for longer



SEROTONIN-NOREPINEPHRINE REUPTAKE INHIBITORS (SNRI)

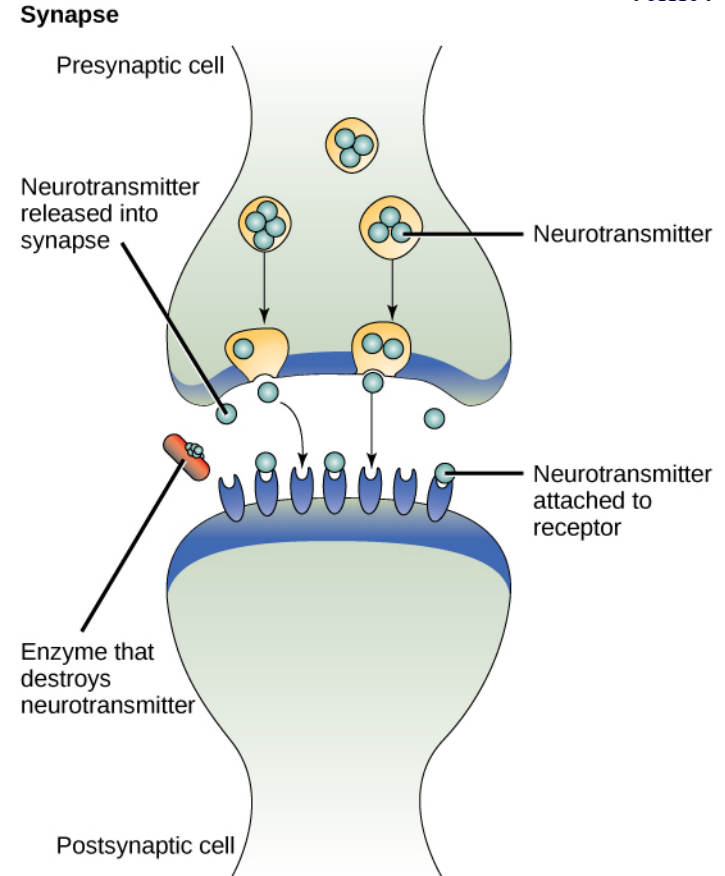


Examples: Desvenlafaxine, Duloxetine (Cymbalta), Venlafaxine

Indications: Major depressive disorder, anxiety disorders

Mechanism: Inhibits reuptake of serotonin and norepinephrine

→ Allows serotonin and norepinephrine to bind for longer

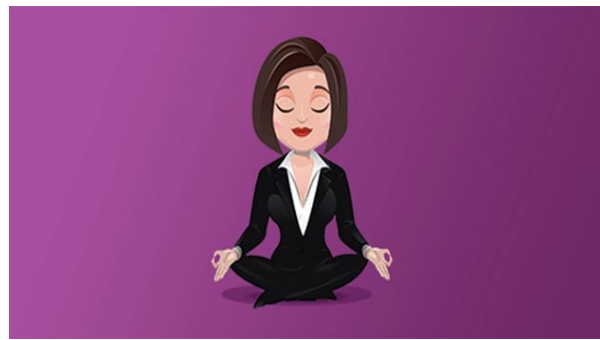


BENZODIAZEPINES

Examples: Alprazolam (Xanax), Diazepam (Valium), Lorazepam (Ativan)

Indications: Seizures, anxiety disorders, insomnia, agitation

Mechanism: Inhibits neurons by increasing the effect of GABA (an inhibitory neurotransmitter)



BISPHOSPHONATES

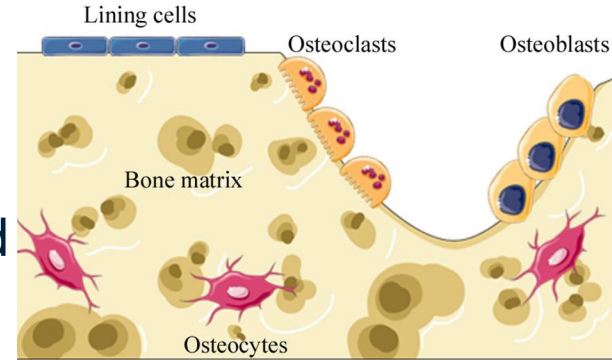


Examples: Risedronate, Alendronate, Zoledronic acid

Indications: Osteoporosis, Paget's disease

Mechanism: Binds hydroxyapatite binding sites and prevents osteoclasts from resorbing bone

- Also prevents osteoclasts from attaching to bone



HELPFUL RESOURCES

- Your healthcare provider or pharmacist!
- <https://www.heartandstroke.ca/heart-disease/treatments/medications>
- Health Link BC or 811
- Health Gateway
- MedScape
- StatPearls
- WebMD, Mayo Clinic, Cleveland Clinic etc.



FUTURE TALKS

- Sunday Jan 23: Popular diets
- Sunday Jan 30: The biology of stress

- Sunday Feb 6: Stress management
- Sunday Feb 13: How to avoid a drug interaction
- Sunday Feb 20: Supplements



We hope to see you there!



THE UNIVERSITY OF BRITISH COLUMBIA

Thank you!

Any questions?