



"Get rid of all the medical journals in the waiting room. They give my patients too many ideas."

Common OTC & Rx Drugs



OTC Confusion







Analgesics

- Analgesics are drugs which relieve pain without loss of consciousness.



Analgesics / Antipyretics

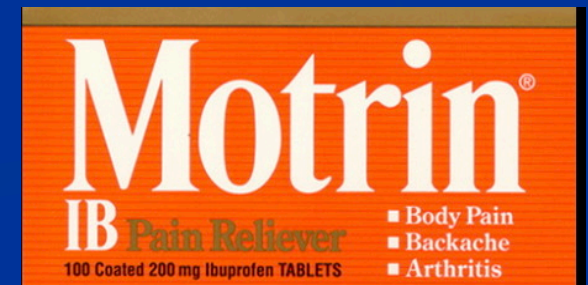
- Some analgesics are also antipyretics → reduce fever.

(1) Acetaminophen (Tylenol, APAP)

(2) Aspirin (ASA)

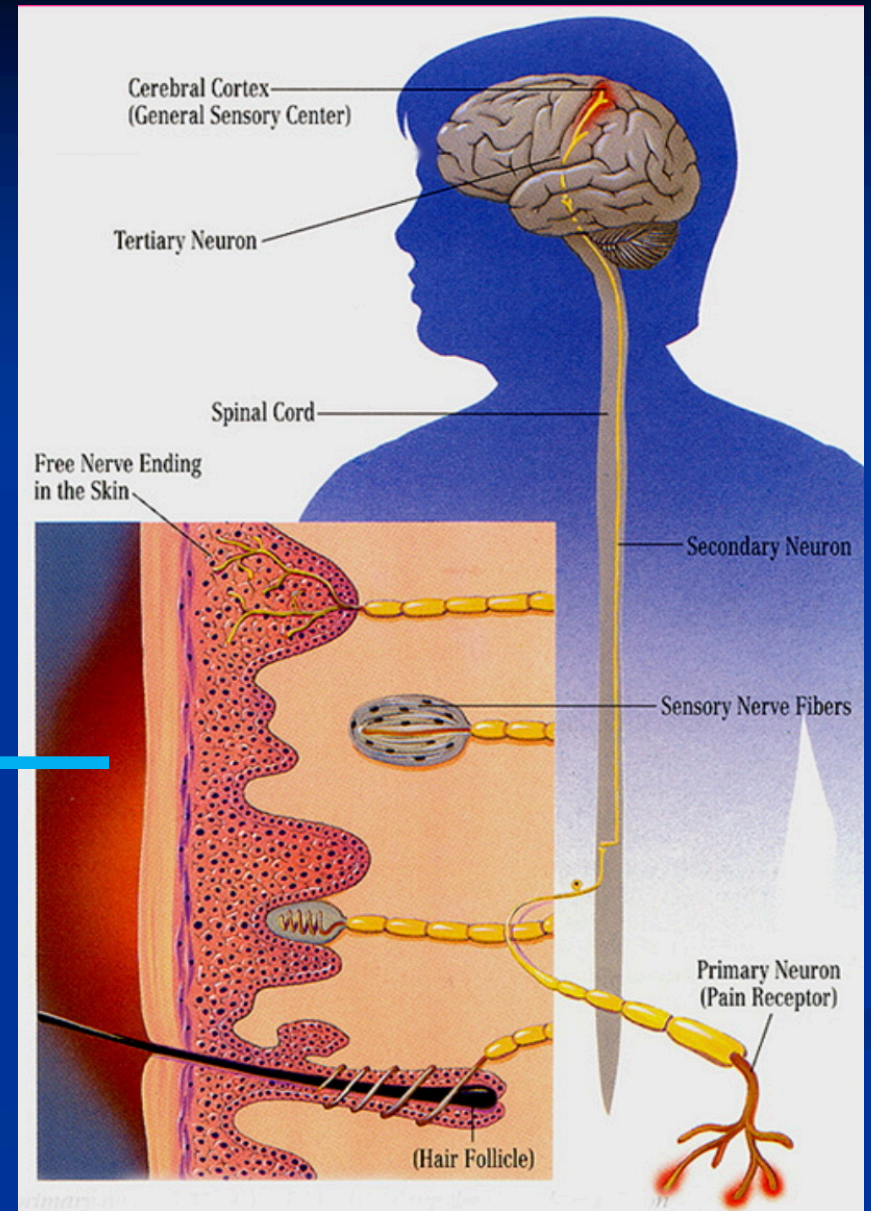
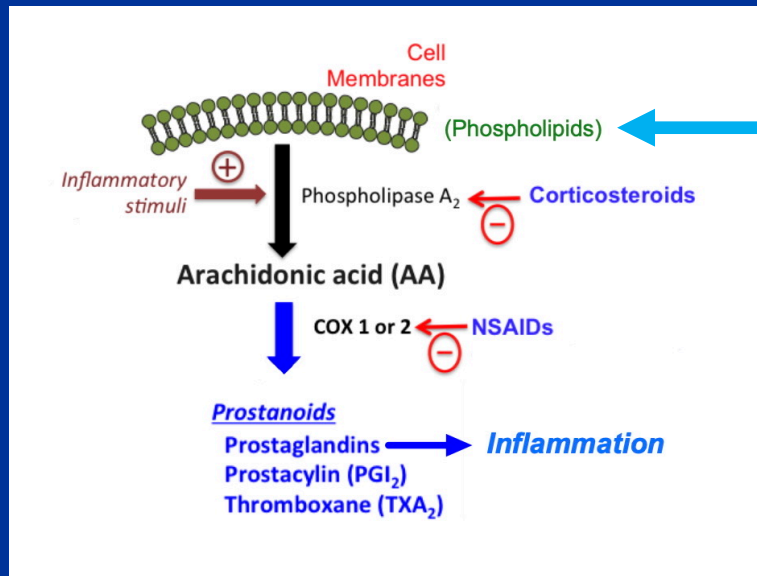
(3) NSAIDs

- Ibuprofen
(Motrin, Advil)
- Naproxen
(Aleve,
Naprosyn)



NSAIDs

- Mechanism of Action (MOA)
 - inhibit PG production
 - reduce inflammation
 - reduce pain



NSAIDs



inhibit
COX

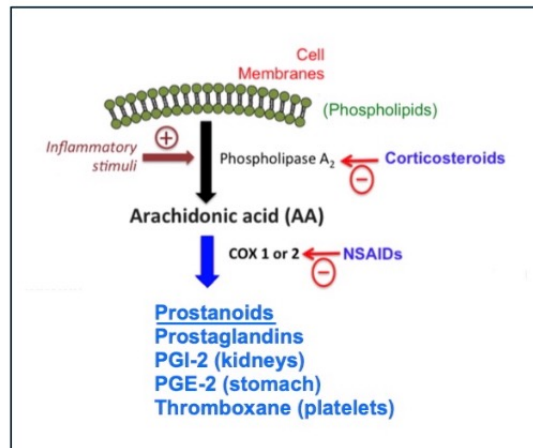
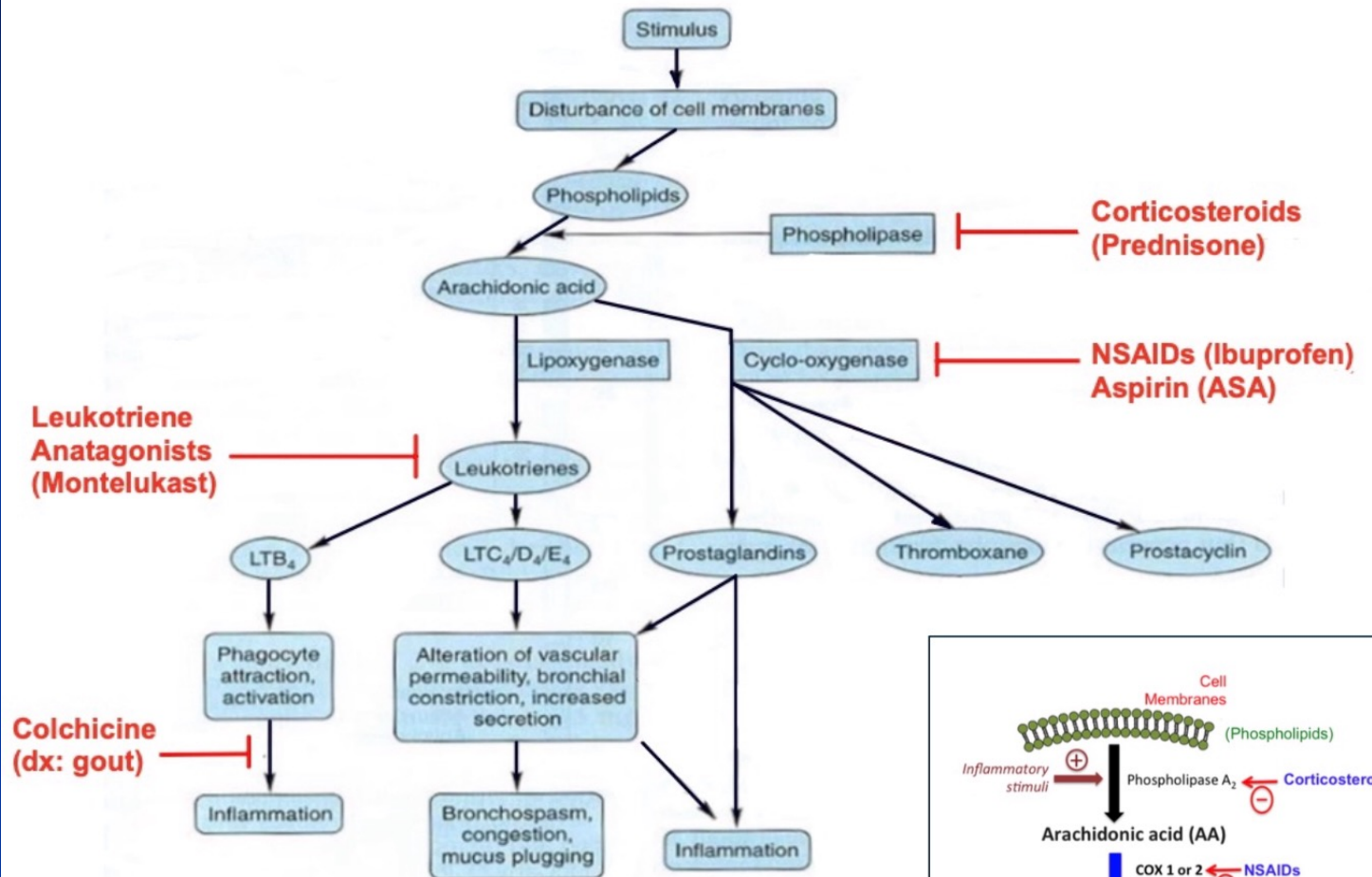


inhibit PG
production



reduce
inflammation
and pain

Cyclooxygenase (COX) Pathway

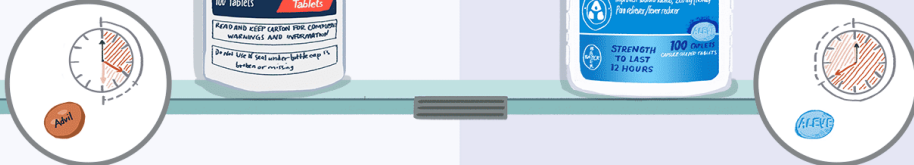


Naproxen (Aleve) versus Ibuprofen (Advil)

- Naproxen offers the convenience of twice daily (BID) dosing.

Advil vs. Aleve

Active ingredient: Ibuprofen		Active ingredient: Naproxen sodium
Dosing: One tablet every 4 to 6 hours		Dosing: One tablet every 8 to 12 hours



**A MORE COMPLETE
OTC ANALGESIC.**

ALEVE IS THE ONLY OTC ANALGESIC WITH:

THE **ENDURANCE**
OF 8-12 HOUR DOSING.

THE **TOLERABILITY**
THAT'S COMPARABLE TO IBUPROFEN
AND EVEN ACETAMINOPHEN.

AND THE **SPEED**
AND ACTIVITY OF NAPROXEN SODIUM.

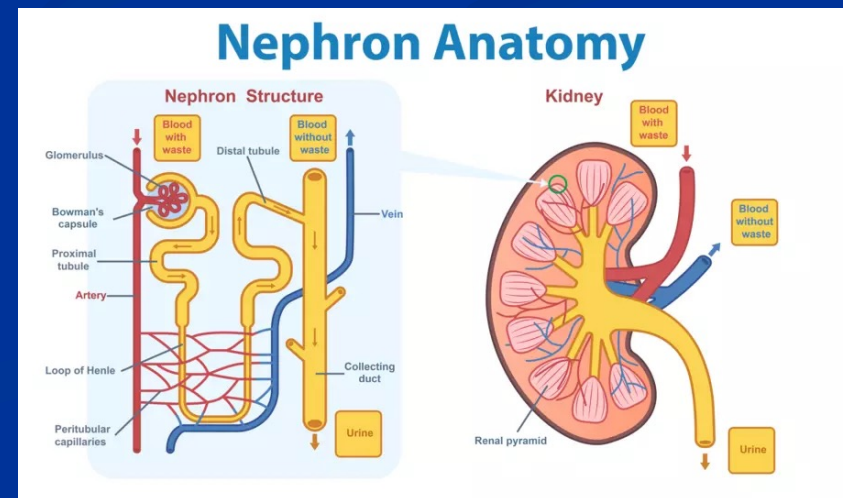
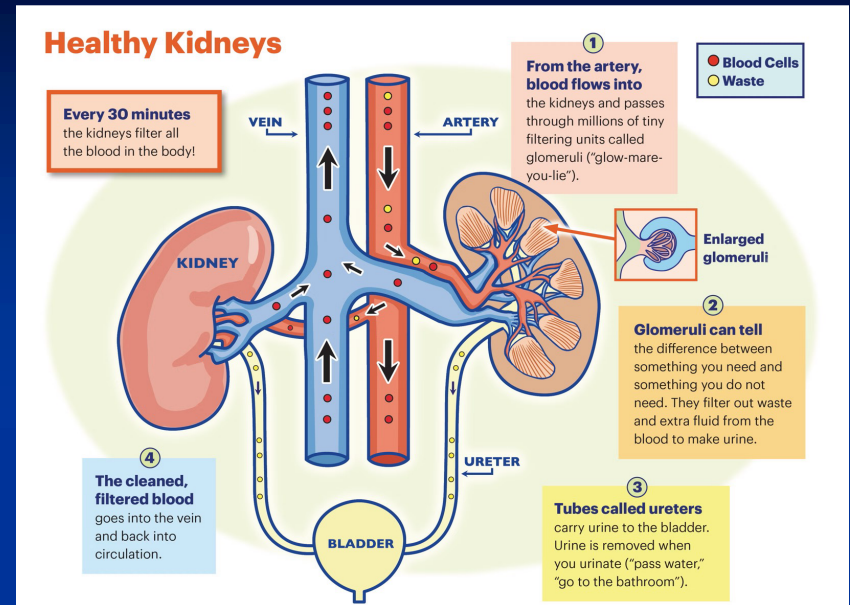
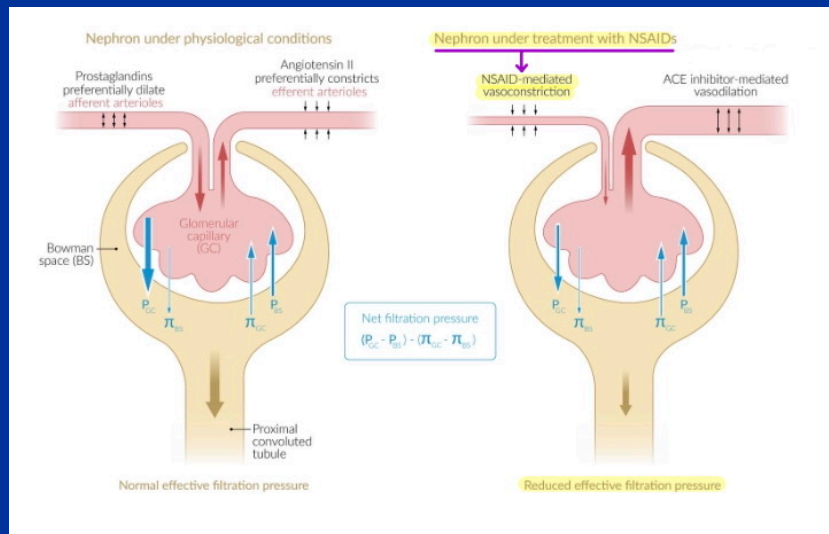
INSTEAD OF ADVIL OR TYLENOL
RECOMMEND
ALEVE
NAPROXEN SODIUM 220 MG
PAIN RELIEVER/FEVER REDUCER

A MORE COMPLETE
OTC ANALGESIC.

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NSAIDs & Kidney Function

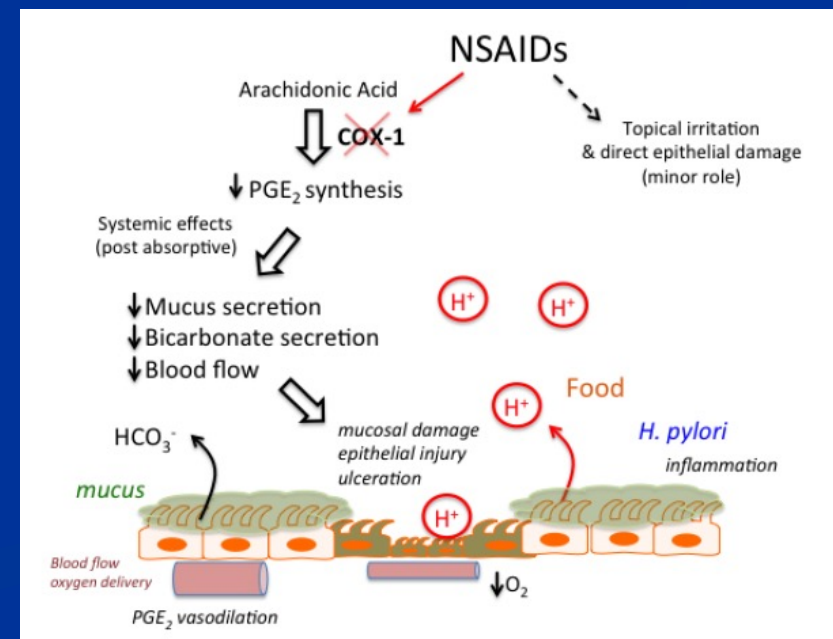
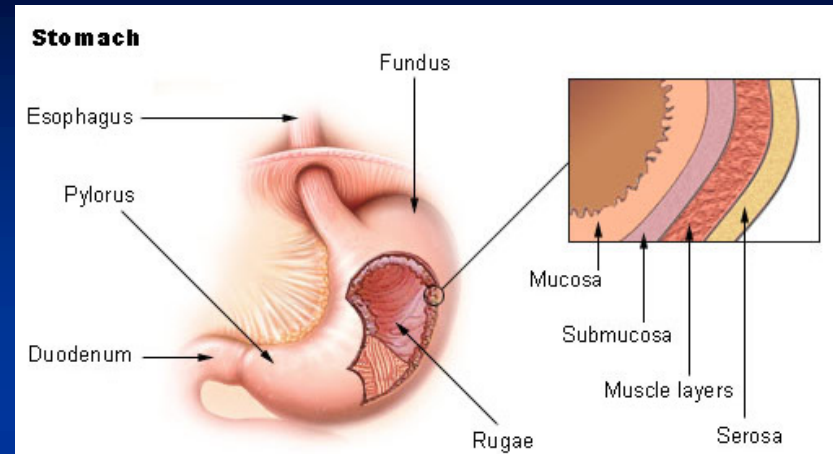
- NSAIDs inhibit renal prostaglandin (PGI_2)
- reduce kidney blood flow by constricting afferent arteriole of the nephron
- reduce glomerular filtration (GFR)
- increase sodium and water retention, especially in geriatric patients
- exacerbate hypertension (HTN), heart failure, and chronic kidney disease (CKD)



NSAIDs & GI Adverse Effects

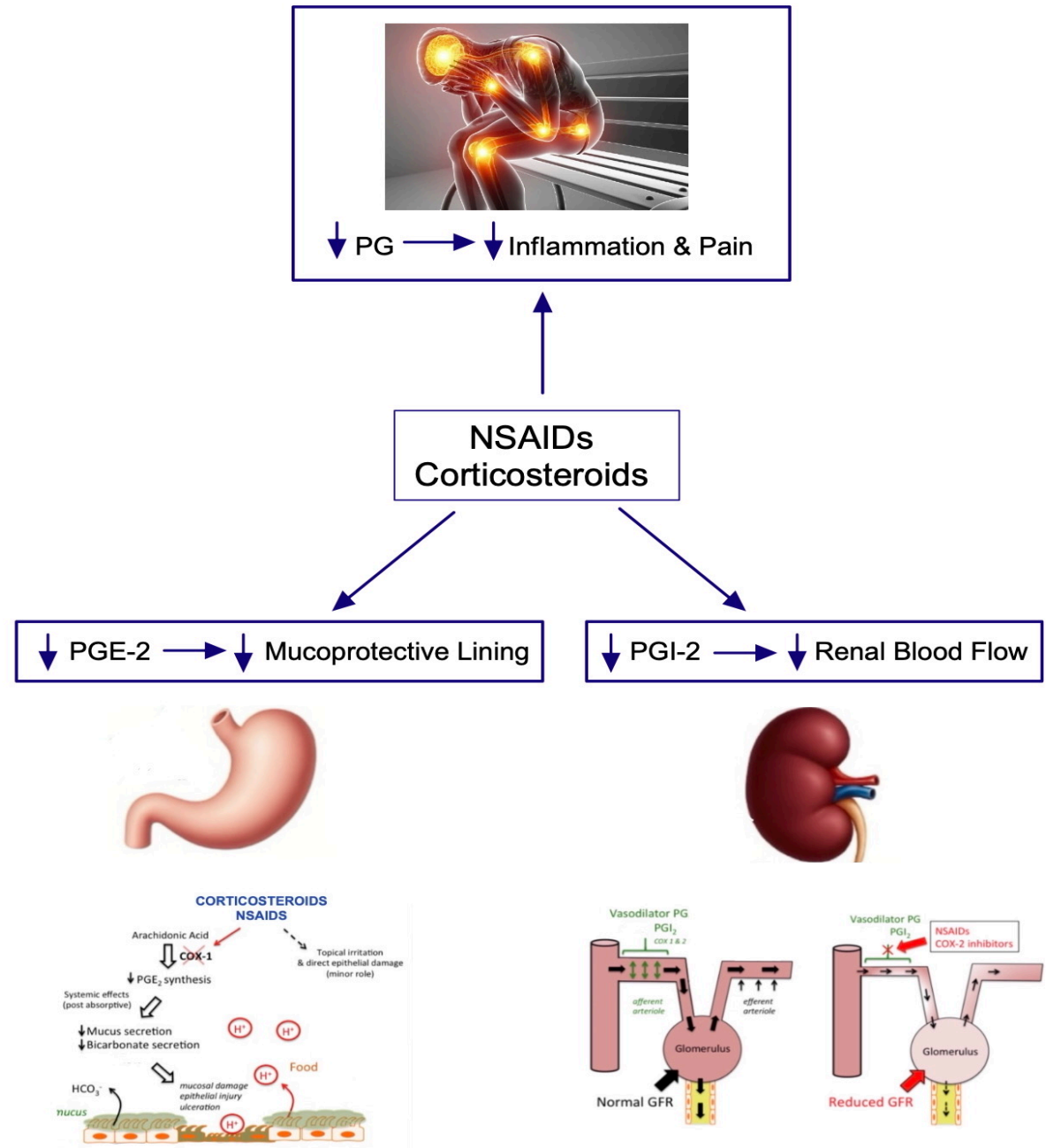
NSAIDs inhibit PGE_2 (stomach)

- decrease secretion of mucus and bicarbonate protective layers → thinning of mucoprotective lining of the stomach
- increase risk of gastric ulcers and GI bleeding



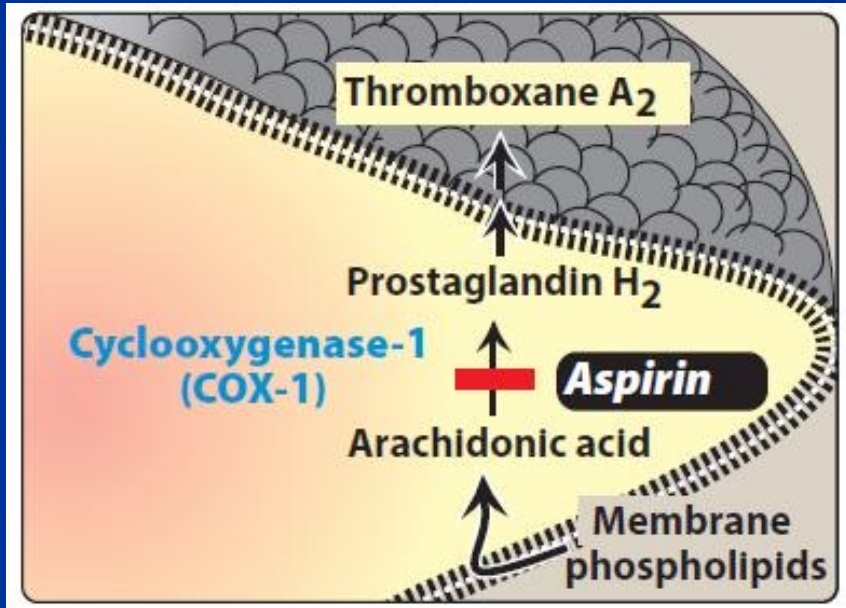
Summary of NSAID-Induced Adverse Effects in the GI Tract and Kidneys.

- NSAIDs & Corticosteroids inhibit $\text{PGE}_2 \rightarrow$ decrease muco-protective lining of the stomach $\rightarrow$ increase risk of gastritis and peptic ulcer disease (PUD).
- NSAIDs & Corticosteroids inhibit PGI_2 (prostacyclin) in kidneys $\rightarrow$ decrease renal blood flow $\rightarrow$ decrease GFR $\rightarrow$ increase $\text{Na}^+/\text{H}_2\text{O}$ retention $\rightarrow$ exacerbate hypertension (HTN), heart failure, and chronic kidney disease (CKD)



Aspirin (ASA)

- ASA (81 mg/day) irreversibly inhibits COX-1 in platelets.
 - inhibits platelet aggregation
 - prevents thromboembolic events (i.e., MI and stroke)



A Bold, New Look for Recurrent MI and Stroke Prevention

Aspirin Regimen BAYER[®]
(formerly BAYER[®] Enteric)

- New product name reinforces regular, regimen use
- Enteric "safety" coated for GI protection
- Available in 81mg and 325mg strengths to meet the dosing needs of your recurrent MI and stroke patients
- From a name your patients trust for quality

ASPIRIN REGIMEN BAYER[®]
ADULT **LOW 81_{mg} STRENGTH**
SAFETY COATED TABLETS
Doctor Recommended for Regular Use
ENTERIC COATED TABLETS DELAY RELEASE ASPIRIN

ORANGE FLAVORED BAYER[®] CHILDREN'S
Low Strength Chewable Aspirin
TABLETS 81mg

ASPIRIN REGIMEN BAYER[®]
REGULAR **325_{mg} STRENGTH**
SAFETY COATED CAPLETS
Doctor Recommended for Regular Use
ENTERIC COATED CAPLETS DELAY RELEASE ASPIRIN

CHERRY FLAVORED BAYER[®] CHILDREN'S
Low Strength Chewable Aspirin
TABLETS 81mg

GENUINE BAYER[®] ASPIRIN
Fast, Safe Pain Relief
COATED 325mg TABLETS

BAYER[®] Children's Chewable
ASPIRIN
• Low strength – 81mg: for adult regimen use
• Pleasant tasting – orange and cherry flavors

Genuine BAYER[®] Aspirin
• The original, pure aspirin standard

American Heart Association
Fighting Heart Disease and Stroke

Bayer Corporation is a proud contributor to the fight against America's No. 1 killer as a sponsor of the American Heart Association's educational programs.

© 1995 Bayer Corporation JA-PHIV

The advertisement features a large illustration of a human heart on the right side, showing its complex network of blood vessels. Below the heart, there is a profile of a human head with a transparent skull, revealing the brain and its intricate vascular system. The overall design uses a color palette of reds, oranges, and yellows, emphasizing the cardiovascular theme.

Aspirin (ASA)

- The properties of aspirin are dose-dependent.
- antiplatelet effect:
81-162 mg/day
- analgesic / antipyretic effect:
325-650 mg / dose
- anti-inflammatory effect:
1000 mg / dose

A Powerful, New Line-Up for Pain Relief
Combining Strength and Safety

The Extra Strength BAYER® Aspirin Family

- **Extra Strength BAYER® Aspirin**
The trusted, pain relieving power of BAYER Aspirin, 500mg strong
- **Extra Strength BAYER® Arthritis Pain Regimen Formula Aspirin**
Effective relief of arthritis pain and inflammation, enteric "safety" coated for GI protection

EXTRA STRENGTH BAYER® ASPIRIN
Fast, Safe Pain Relief

EXTRA STRENGTH BAYER® PLUS
Helps Protect Against Stomach Upset

EXTENDED-RELEASE BAYER® 8-hr ASPIRIN
Take Every 8 Hours For Fast Relief Starts Working in Minutes

GENUINE BAYER® ASPIRIN
Fast, Safe Pain Relief

• **Extra Strength BAYER® Plus Aspirin**
Buffered to help minimize stomach upset

• **Extended-Release BAYER® 8-hr. Aspirin**
The only 8-hour aspirin, for long-lasting pain relief

Genuine BAYER® Aspirin

- The original, pure aspirin standard

© 1995 Bayer Corporation JA-PH-94

Buffered Aspirin Products: Bufferin and Ascriptin

- buffered ASA products contain aspirin plus a dose of an antacid to prevent GI upset



Enteric-Coated Aspirin: Ecotrin

- Enteric-coated aspirin tablets dissolve and get absorbed in the alkaline environment of the small intestine.
- Enteric-coated aspirin reduces gastric irritation and ulcers, especially in patients requiring long-term aspirin therapy for cardiovascular prevention.



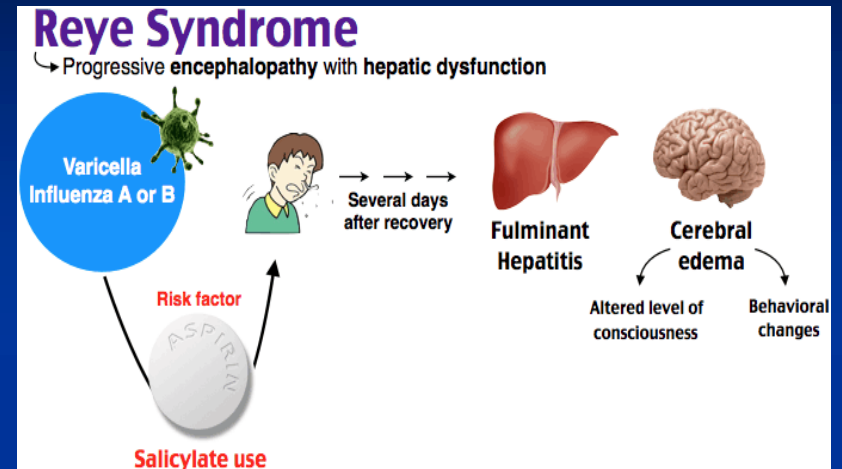
Aspirin & Pregnancy

Aspirin and NSAIDs increase bleed risk in both mother and fetus during pregnancy (due to antiplatelet effect), especially during the 3rd trimester.



Aspirin & Reye's Syndrome

Reye's Syndrome is a rare potentially fatal condition characterized by acute encephalopathy and liver dysfunction in children recovering from a viral illness (such as influenza or varicella / chickenpox), when treated with aspirin.



Pediatric patients should be treated with APAP (Tylenol) or ibuprofen (Motrin) for fever or cold & flu.



Acetaminophen (Tylenol, APAP)

- Advantage over NSAIDs and aspirin (ASA) → no GI upset
- Disadvantage: no peripheral anti-inflammatory properties in conditions such as gout, musculoskeletal injuries, osteoarthritis, etc ...



Property	Acetaminophen	NSAIDs (e.g., ibuprofen, aspirin)
Analgesic (pain relief)	✓ Yes	✓ Yes
Antipyretic (fever reduction)	✓ Yes	✓ Yes
Anti-inflammatory	✗ Minimal to none	✓ Strong
Mechanism	Weak COX inhibition in CNS	Strong COX-1/2 inhibition peripherally

Cold and flu time is

TYLENOL[®] TIME.

She's 38.
Has cold/flu symptoms.
And she's aching
for pain relief that won't
irritate her stomach.



- Fast and effective pain relief for colds and flu
- Unsurpassed efficacy versus OTC NSAIDs
- Won't irritate the stomach or exacerbate GI upset due to colds and flu



Sig: 1000 mg: 2 (500 mg) Capsules or Caplets q4 to 6h prn
Sig: 1300 mg: 2 (650 mg) Caplets q8h prn

TYLENOL. First choice in pain relief. First choice in safety.

Do not exceed eight capsules or caplets per 24-hour period. Do not take for pain for more than 10 days or for fever for more than 3 days unless directed by a physician. In case of accidental overdose, contact a physician or poison control center immediately. Prompt medical attention is critical for adults as well as for children even if you do not notice any signs or symptoms. Do not use with other products containing acetaminophen.

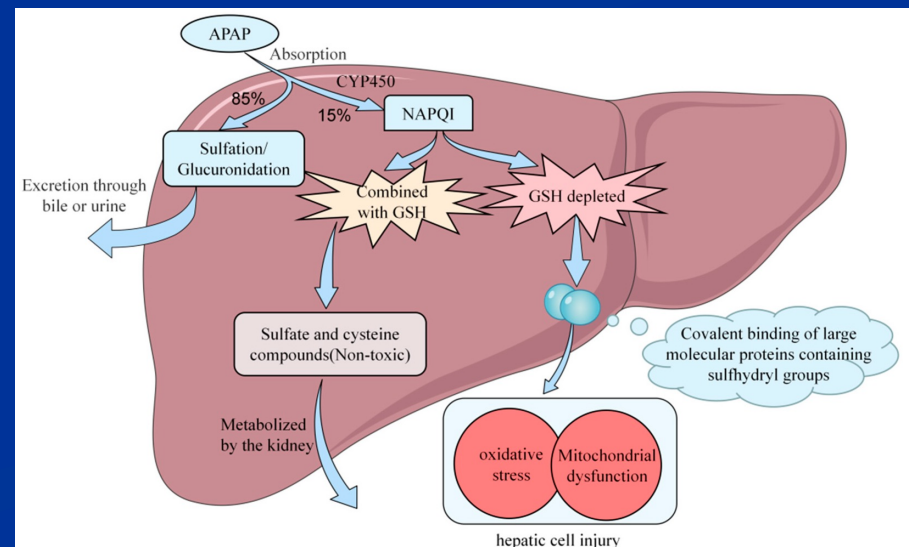
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Acetaminophen Overdose & Hepatotoxicity

- The liver breaks down most of the APAP using sulfation and glucuronidation to excrete APAP.
- 10-15% of APAP is metabolized by CYP2E1 into a toxic metabolite known as NAPQI, which is hepatotoxic.
- Glutathione is needed for the reactions that detoxify NAPQI.
- N-acetylcysteine (NAC), a treatment of APAP overdose, is a precursor for glutathione.

Stages of Acetaminophen Toxicity

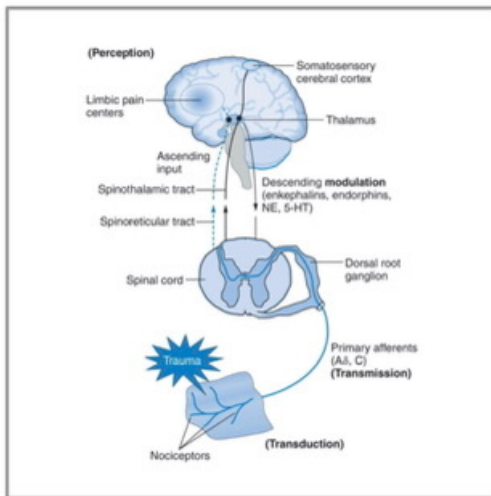
Stage	Signs & symptoms
Stage I (0.5 – 24 hours)	• Nausea, vomiting, diaphoresis, pallor, lethargy, & malaise • Some patients remain asymptomatic • Laboratory studies are usually normal
Stage II (24 – 72 hours)	• Initially, subclinical elevations of AST, ALT develop • patients develop right upper quadrant pain, with liver enlargement and tenderness. Elevations of prothrombin time (PT) and total bilirubin, oliguria, and renal function abnormalities may become evident
Stage III (72 – 96 hours)	• Liver function abnormalities peak • Symptoms of stage I reappear with jaundice, confusion (hepatic encephalopathy). • ALT and AST levels > 10,000 IU/L • Prolongation of the PT/INR, hypoglycemia, lactic acidosis, total bilirubin concentration above 4.0 mg/dL Death most commonly occurs in this stage
Stage IV (4 days – 2 weeks) Recovery	• Patients who survive stage III enter a recovery phase • Recovery can be slower in severely ill patients



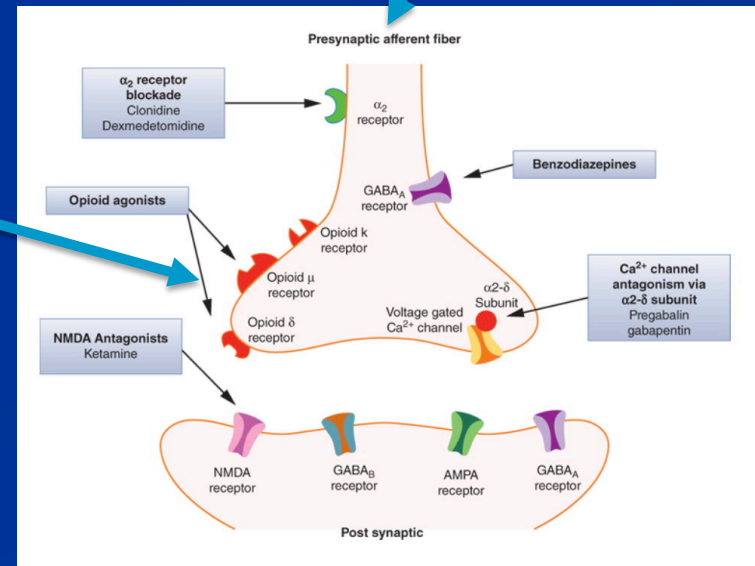
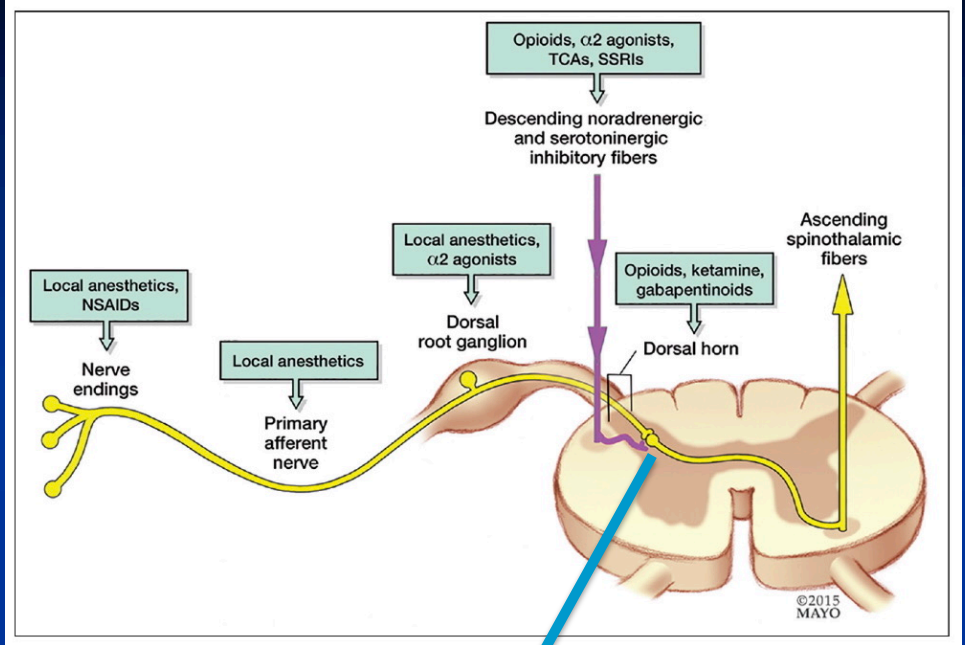
Narcotic Analgesics

- Opioids alleviate pain primarily by inhibiting neurotransmitter release at multiple levels of the pain pathway in the CNS, while collateral actions occur in the respiratory centers, GI tract, and reward circuitry to produce the adverse effects and abuse potential (i.e., euphoria).

Pain Transmission: Transduction, Transmission, Perception, & Modulation

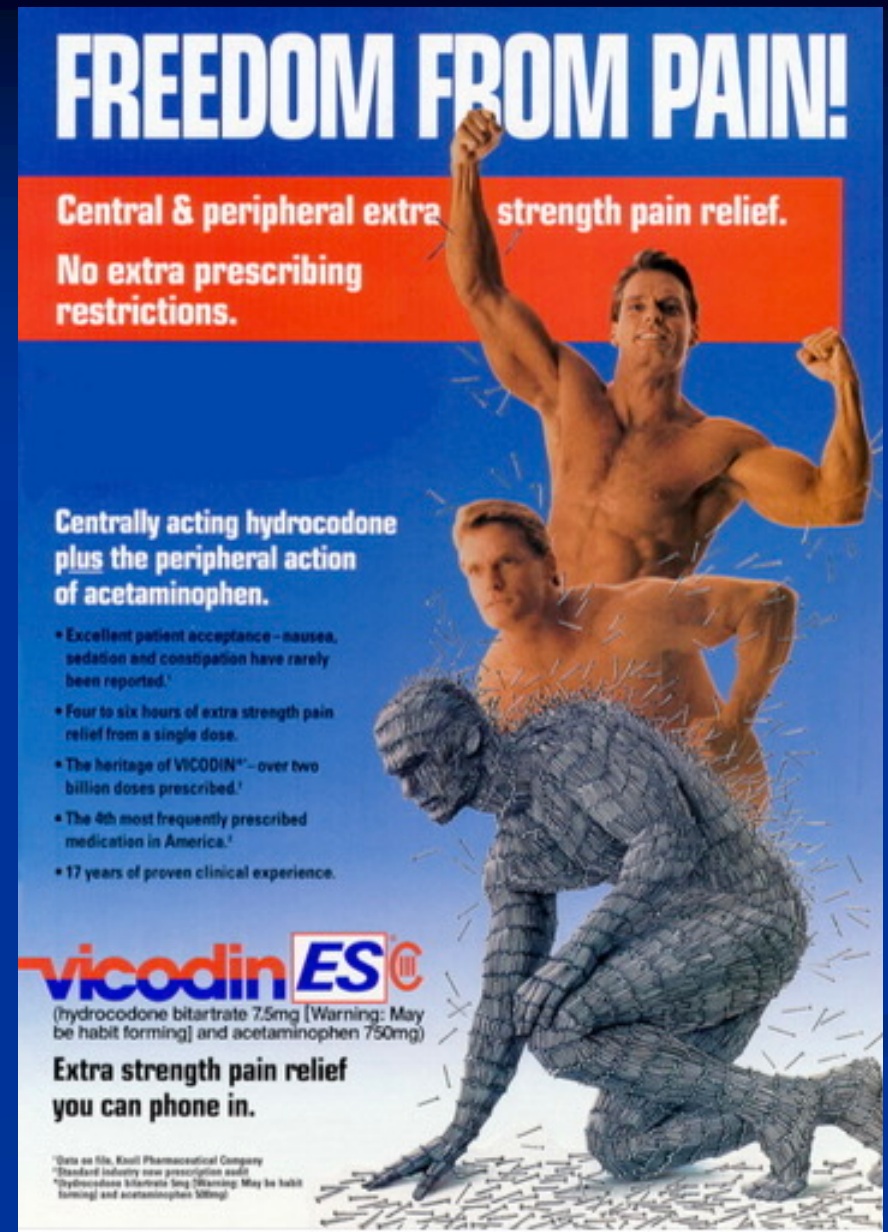


opioid receptors



Narcotic Analgesics

- Narcotics are very potent analgesics; however, they do not offer antipyretic and anti-inflammatory properties.
- Risks: drug tolerance, drug dependence, and potential for opioid addiction.

The advertisement features a muscular man in the background, shirtless and flexing his muscles, with a triumphant expression. In the foreground, a man is depicted inside a cage made of grey, pill-shaped capsules. The man in the cage is crouching, looking down with a somber expression. The background is a clear blue sky. The overall theme is the contrast between freedom from pain and the burden of pain.

FREEDOM FROM PAIN!

Central & peripheral extra strength pain relief.
No extra prescribing restrictions.

Centrally acting hydrocodone plus the peripheral action of acetaminophen.

- Excellent patient acceptance – nausea, sedation and constipation have rarely been reported.*
- Four to six hours of extra strength pain relief from a single dose.
- The heritage of VICODIN[®] – over two billion doses prescribed.[†]
- The 4th most frequently prescribed medication in America.[‡]
- 17 years of proven clinical experience.

vicodin ES[®]
(hydrocodone bitartrate 7.5mg [Warning: May be habit forming] and acetaminophen 750mg)

**Extra strength pain relief
you can phone in.**

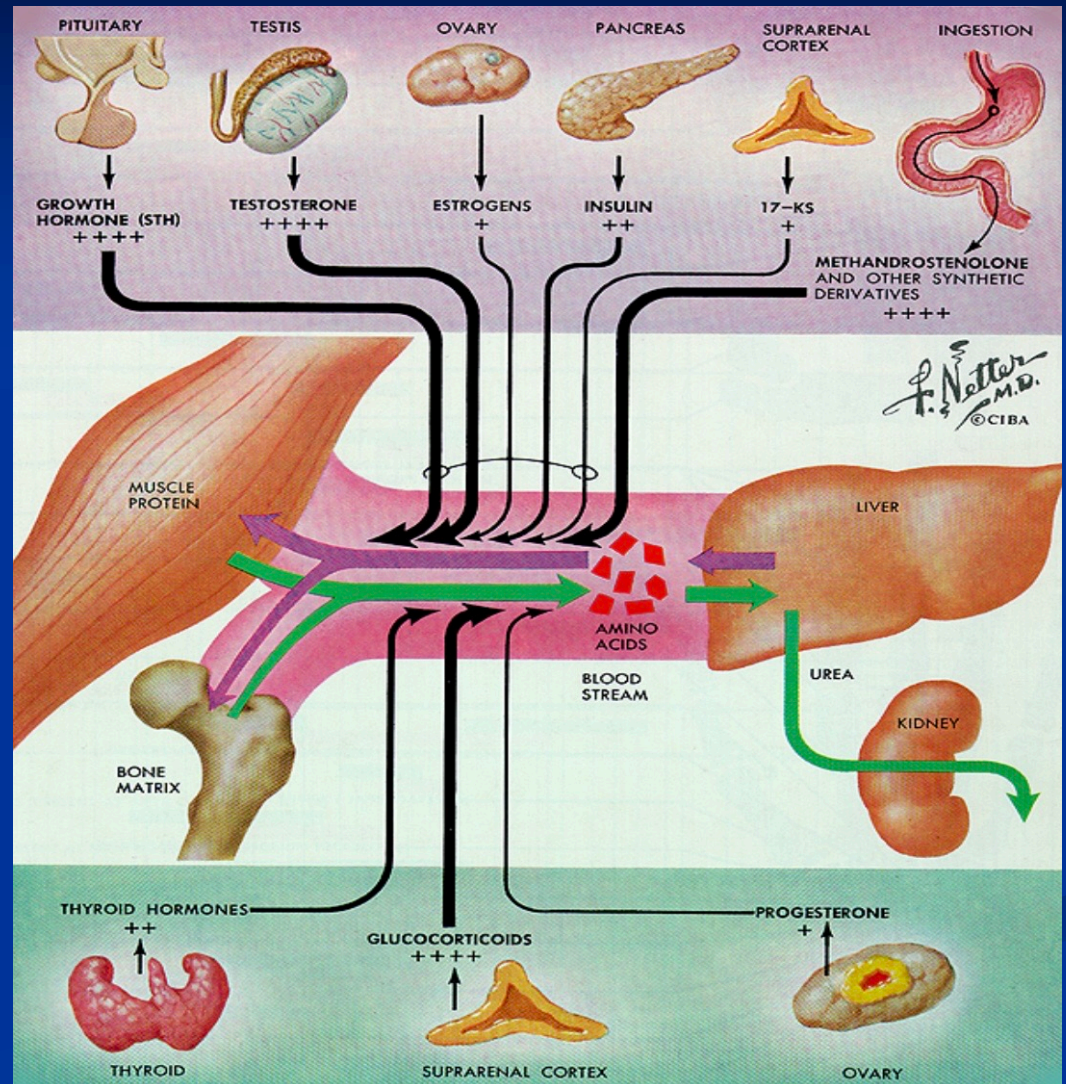
*Data on file, Knoll Pharmaceutical Company
†Standard industry new prescription audit
‡Hydrocodone bitartrate 5mg (Warning: May be habit forming) and acetaminophen 500mg

Treatment Options: NSAIDs, Muscle Relaxants, & Narcotic Analgesics

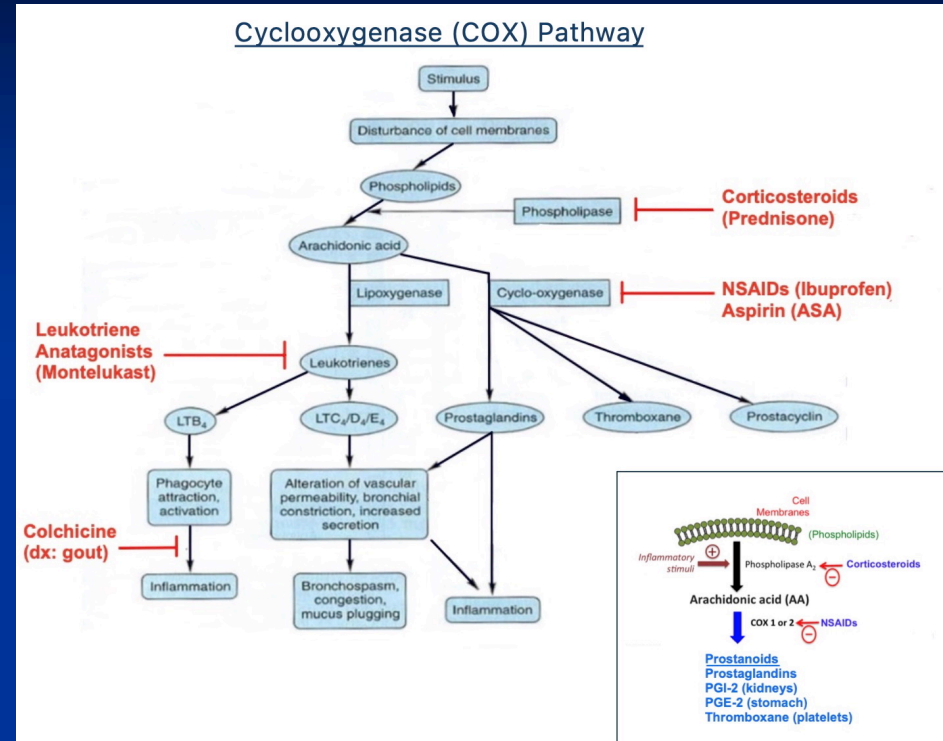


Corticosteroids

- Corticosteroids, also known as glucocorticoids, are potent anti-inflammatory agents.
- Disadvantages
 - PGE₂ inhibition → decreases mucoprotective lining (stomach) → GI upset / ulceration.
 - PGI₂ (prostacyclin) inhibition in kidneys → decreases renal blood flow → decreases GFR → increases Na⁺/H₂O retention → exacerbates HTN, heart failure, & CKD.
 - Systemic adverse effects (short-term and long-term): HPA-axis suppression, hypertension, hyperglycemia, cataract formation, immunosuppression, osteoporosis, myopathy, weight gain, etc...



Corticosteroids: Risks versus Benefits



Major Adverse Effects Associated with Systemic (PO/IV) Glucocorticoid Therapy

Metabolic & Endocrine Hyperglycemia Adrenal Insufficiency (i.e., HPA-Axis Suppression)	Neuropsychiatric Dysphoria/Depression Mania/Psychosis Euphoria Insomnia	Bone & Muscle Osteoporosis Myopathy
Immune System Immunosuppression (risk of infection)	Ophthalmologic Elevated Intraocular Pressure Cataract Formation Exophthalmos	Dermatologic & Appearance Cushingoid Appearance Facial Erythema Skin thinning Weight Gain Hirsutism Acne Striae
Hematologic Leukocytosis	Gastrointestinal Gastritis Peptic Ulcer Disease (PUD)	
Cardiovascular Fluid Retention Hypertension		

Summary Statements: ASA, Acetaminophen, NSAIDs, Glucocorticoids, and Opioids

Acetaminophen (Tylenol)

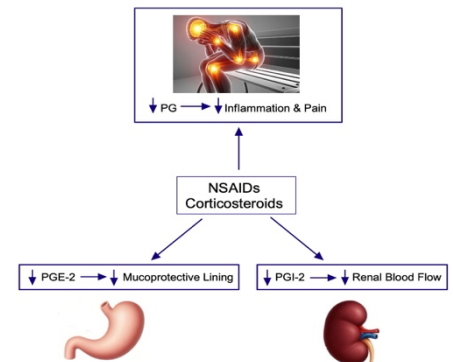
- Properties: antipyretic and analgesic
- Disadvantage: no anti-inflammatory properties
- Advantage: does not cause GI upset, gastritis, GI bleeding/ulcers
- Acetaminophen (APAP) does not exert antiplatelet effect
- APAP overdose --> hepatotoxicity

Aspirin (ASA)

- Pharmacologic effects are dose-dependent
 - ASA 81 mg/day --> antiplatelet effect --> reduces risk of recurrent thromboembolic events in post-stroke / post-MI patients.
 - ASA 325-500 mg/dose --> analgesic effect (e.g., headache)
 - ASA 1000 mg/dose --> anti-inflammatory effect
- Disadvantages
 - PGE₂ inhibition (stomach) --> decreases muco-protective lining --> GI upset, gastritis, GI bleeding / ulcers
 - PGI₂ (prostacyclin) inhibition --> decreases renal blood flow --> decreases GFR --> increases sodium/water retention --> exacerbates HTN / CHF

NSAIDs: Ibuprofen (Motrin, Advil) and Naproxen (Naprosyn)

- Properties: antipyretic, analgesic, and anti-inflammatory.
- Disadvantages
 - PGE₂ inhibition (stomach) --> decreases muco-protective lining --> GI upset, gastritis, GI bleeding / ulcers
 - PGI₂ (prostacyclin) inhibition (kidneys) --> decreases renal blood flow --> decrease GFR --> increases sodium/water retention --> exacerbates HTN/CHF
- Naproxen (Aleve is OTC, Naprosyn is Rx) is a more potent NSAID than ibuprofen (Advil, Motrin)
- Naproxen (BID dosing) has a longer duration of action than ibuprofen (TID-QID dosing).



Glucocorticoids = Corticosteroids = Anti-Inflammatory Steroids (Example: Prednisone)

- Properties: potent anti-inflammatory agents; no antipyretic effects.
- Disadvantages
 - PGE₂ inhibition --> decreases muco-protective lining (stomach) --> GI upset, gastritis, GI bleeding / ulcers
 - PGI₂ (prostacyclin) inhibition (kidneys) --> decreases renal blood flow --> decreases GFR --> increases sodium/water retention --> exacerbates HTN / CHF
 - Systemic adverse effects with short-term and long-term use: HPA-axis suppression, immunosuppression, cataract formation, osteoporosis, myopathy, weight gain, hypertension, hyperglycemia, etc ...

Opioids: Morphine, Codeine, Hydrocodone, etc...

- Properties: potent analgesic effects; no antipyretic effects and no anti-inflammatory properties.
- Disadvantages: drug tolerance, drug dependence, and potential for opioid addiction.

COLD & FLU



Treatment Considerations for Cold & Flu



Last night, he took his pharmacist's advice.



He didn't.

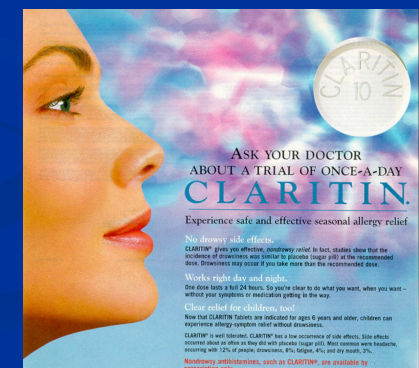
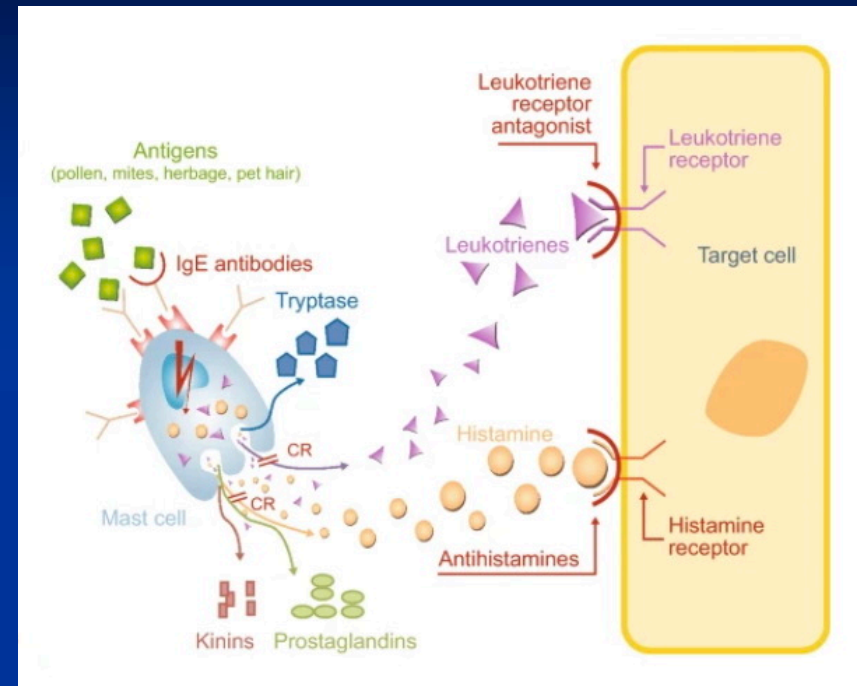
Cold & Flu Considerations

- What are the advantages and disadvantages of using multi-symptom combination products such as Nyquil?



Antihistamines

- MOA: Antihistamines have been reclassified as "inverse agonists," rather than H₁ receptor antagonists; therefore, antihistamines induce a conformational change in the structure of the H₁ receptor and prevent histamine from binding and activating it.
- Antihistamines are divided into 1st and 2nd generation agents.
 - 1st-generation antihistamines include: diphenhydramine (Benadryl), chlorpheniramine (Chlor-Trimeton), hydroxyzine (Atarax, Vistaril), promethazine (Phenergan).
 - 2nd generation (minimally-sedating) antihistamines include: cetirizine (Zyrtec), fexofenadine (Allegra), desloratadine (Claritin), loratadine (Claritin), levocetirizine (Xyzal).



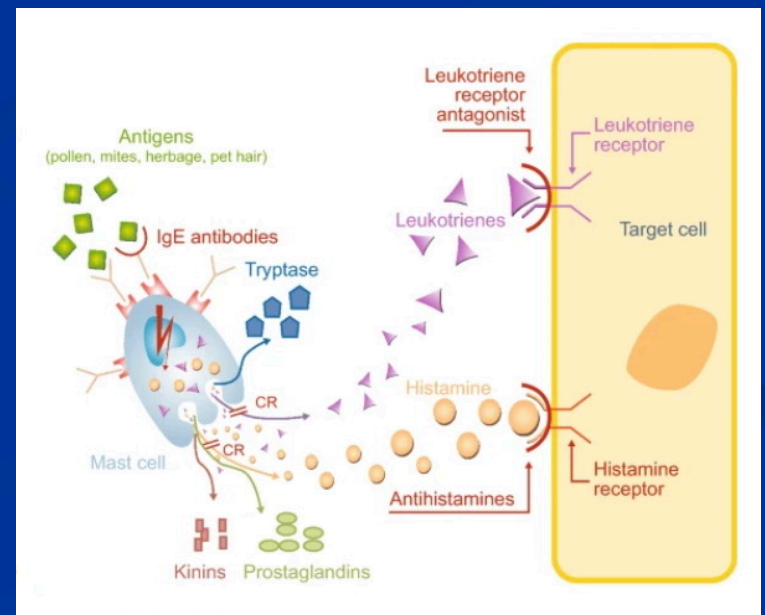
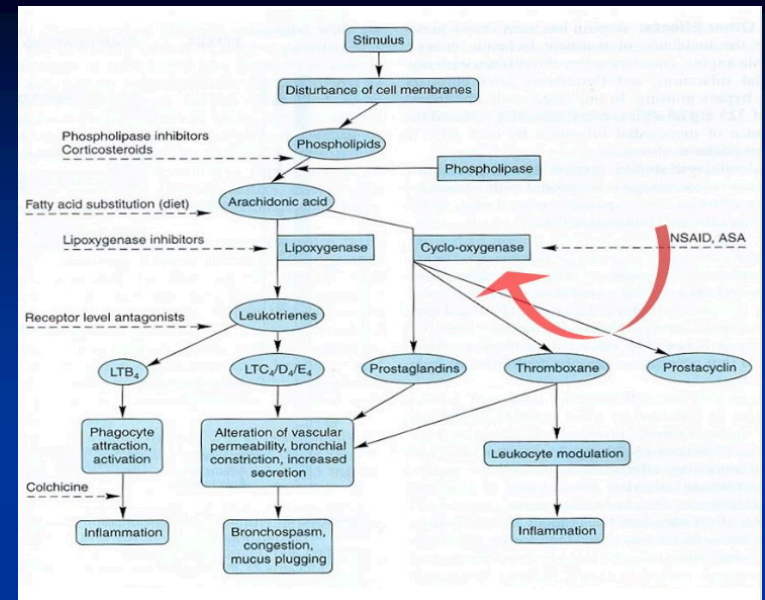
Decongestants

- MOA: Nasal decongestants are α_1 receptor agonists $\rightarrow$ vasoconstriction of nasal vessels $\rightarrow$ reduce mucus production and edema $\rightarrow$ decrease congestion.
- OTC nasal decongestant products include: phenylephrine (Neo-Synephrine) and oxymetazoline (Afrin).
- Caution: Nasal decongestants sprays can cause *rhinitis medicamentosa* (i.e., rebound congestion) after 5-7 days of continuous use.



Glucocorticoid Nasal Sprays

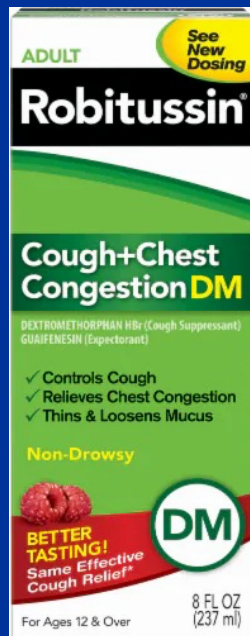
- MOA: Inhaled glucocorticoids are non-specific suppressors of inflammation: Glucocorticoids inhibit arachidonic acid metabolism, resulting in the decreased production of leukotrienes (LT) and prostaglandins (PG).
- Glucocorticoid nasal sprays, such as fluticasone (Flonase), are the most effective pharmacologic agents for allergic rhinitis and are recommended for moderate-severe allergic rhinitis.



Antitussives

- Antitussives, known as cough suppressants, relieve coughing by acting on the cough center in the brain to suppress the cough reflex.

Dextromethorphan
(Robitussin DM)



Codeine Syrup
(Robitussin AC)



Diphenhydramine
(Benlyn)



Expectorants

- Guaifenesin is the most common OTC expectorant in products such as Robitussin (Plain) Syrup and Mucinex.
- Expectorants thin and loosen mucus and airway secretions, making it easier to cough up and expel.



Combination Cold/Flu Products Considerations

MAXIMUM STRENGTH NDC 63824-237-21

Mucinex[®]

FAST-MAX[®]

COLD, FLU & SORE THROAT

Acetaminophen – Pain Reliever/Fever Reducer
Dextromethorphan HBr – Cough Suppressant
Guaifenesin – Expectorant
Phenylephrine HCl – Nasal Decongestant

- ✓ Relieves Headache, Fever & Sore Throat
- ✓ Controls Cough
- ✓ Relieves Nasal & Chest Congestion
- ✓ Thins & Loosens Mucus

Actual Size

20 CAPLETS FOR AGES 12+

POWERFUL RELIEF **VICKS** **DAY & NIGHT PACK**

DayQuil

COLD & FLU

Acetaminophen, Phenylephrine HCl, Dextromethorphan HBr

Headache, Fever, Sore Throat, Minor Aches & Pains
Nasal Congestion, Sinus Pressure
Cough

NyQuil

COLD & FLU

Acetaminophen, Doxylamine Succinate, Dextromethorphan HBr

Headache, Fever, Sore Throat, Minor Aches & Pains
Sneezing, Runny Nose
Cough

Tablets

Advil[®]

Cold & Sinus

IBUPROFEN/PSEUDOEPHEDRINE HCl
Pain Reliever/Fever Reducer/Nasal Decongestant

advanced formula for cold & sinus relief™

for relief of nasal congestion, sinus pain, and fever without drowsiness

PACKAGE NOT CHILD RESISTANT **20 COATED TABLETS**

MULTI-ACTION

ACTIFED

12 TABLETS

CONTENTS

Each tablet contains:
Triprolidine hydrochloride 2.5 mg
Pseudoephedrine hydrochloride 60 mg
Other ingredients include: lactose
Please read the enclosed leaflet.

USES

Multi-Action Actifed Tablets contain a decongestant to relieve nasal congestion as well as blocked sinuses and catarrh. They also contain an ingredient which works in two ways: an antihistamine action to relieve the symptoms of allergies, such as sneezing and a drying action to relieve other symptoms of colds, flu and hayfever such as runny noses and watery eyes.

DOSE

Adults and children over 12 years:
One tablet every 4-6 hours
up to 4 times a day.
Do not exceed the stated dose.
Keep out of reach and sight of children.

WARNING

May cause drowsiness. If affected, do not drive or operate machinery. Avoid alcoholic drink.

If you are pregnant or currently taking any other medicine, consult your doctor or pharmacist before taking this product. If symptoms persist consult your doctor.

PL 15513/0014
Product Licence holder:
McNeil Products Ltd,
Maidenhead, Berkshire, SL6 3UG, UK.

Actifed is a trade mark.

McNeil
Products Ltd

Hypnotics

- Sedatives are used to reduce anxiety symptoms; whereas hypnotics are used to treat insomnia by inducing sleep.



Diphenhydramine 25 mg softgels

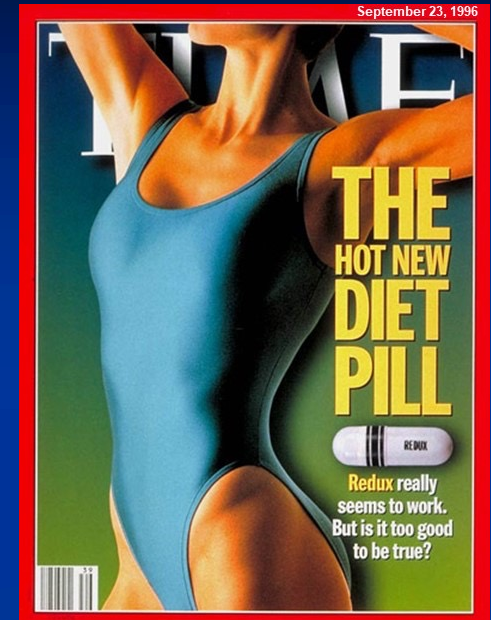


APAP 500 mg + Diphenhydramine 25 mg caps

Appetite Suppressants



- Phen-Fen, a popular combination appetite suppressant regimen during the 1990s, consisted of Fastin (phentermine) plus Pondimin (fenfluramine).
- Redux (Dexfenfluramine), an isomer of fenfluramine, was also a popular appetite suppressant marketed during the Phen-Fen fad.



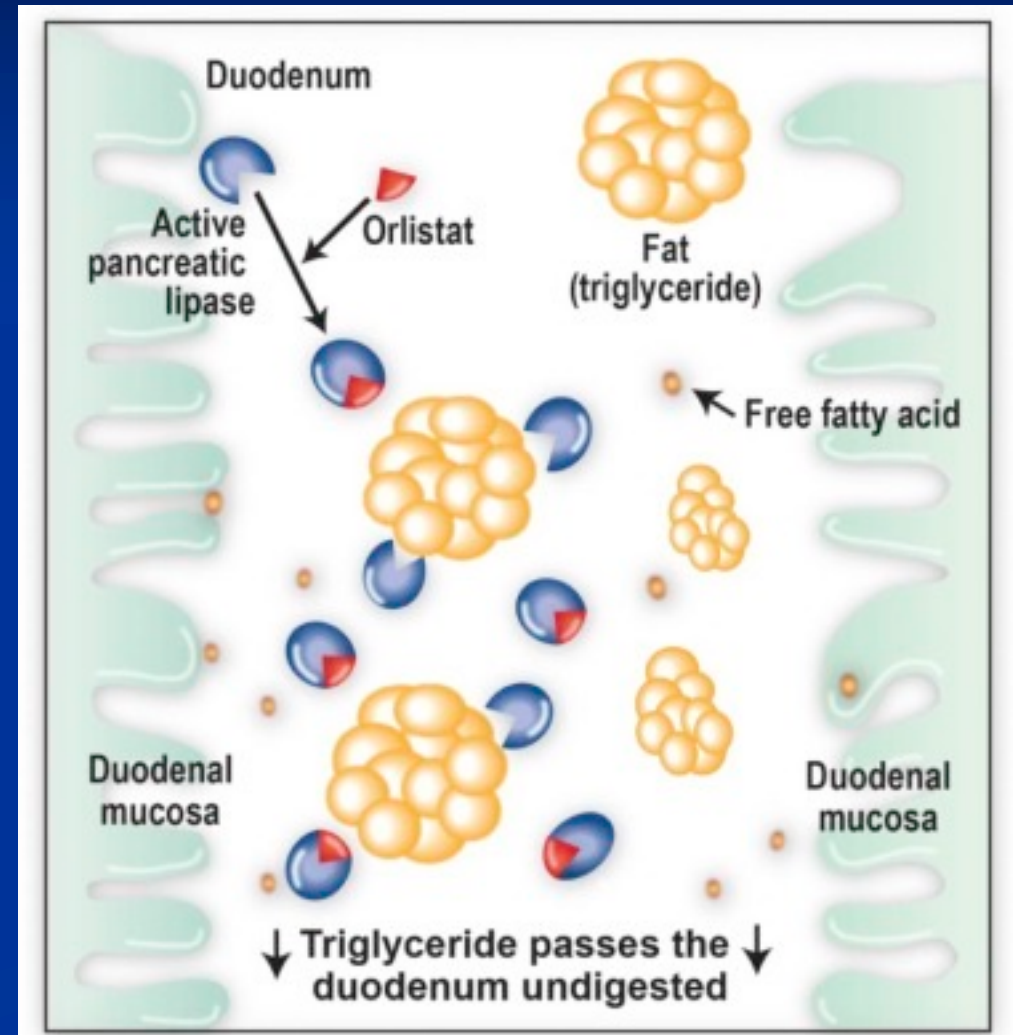
Phen-Fen Diet → Key Points ...

- Phen-Fen consisted of phentermine (Fastin) plus fenfluramine (Pondimin), a potent synergistic combination product.
- Phentermine increases norepinephrine (NE) in appetite center of the brain → reduces appetite.
- Fenfluramine increases serotonin in appetite center → reduces appetite.
- High doses of fenfluramine (Pondimin) and dexfenfluramine (Redux) results in pulmonary hypertension.



Xenical (Orlistat)

- MOA: orlistat inhibits pancreatic lipases → inhibits breakdown of fats into fatty acids + glycerol → reduces absorption of fatty acids (9 kcal/gm) → reduces body weight.
- Side Effects: steatorrhea, fluid and electrolyte depletion, and fat-soluble vitamin deficiencies (i.e., vitamins A, D, E, K).



Appetite Suppressants

GLP-1
Receptor
Agonists



Increase Insulin
Release

+

Decrease Glucagon
Release

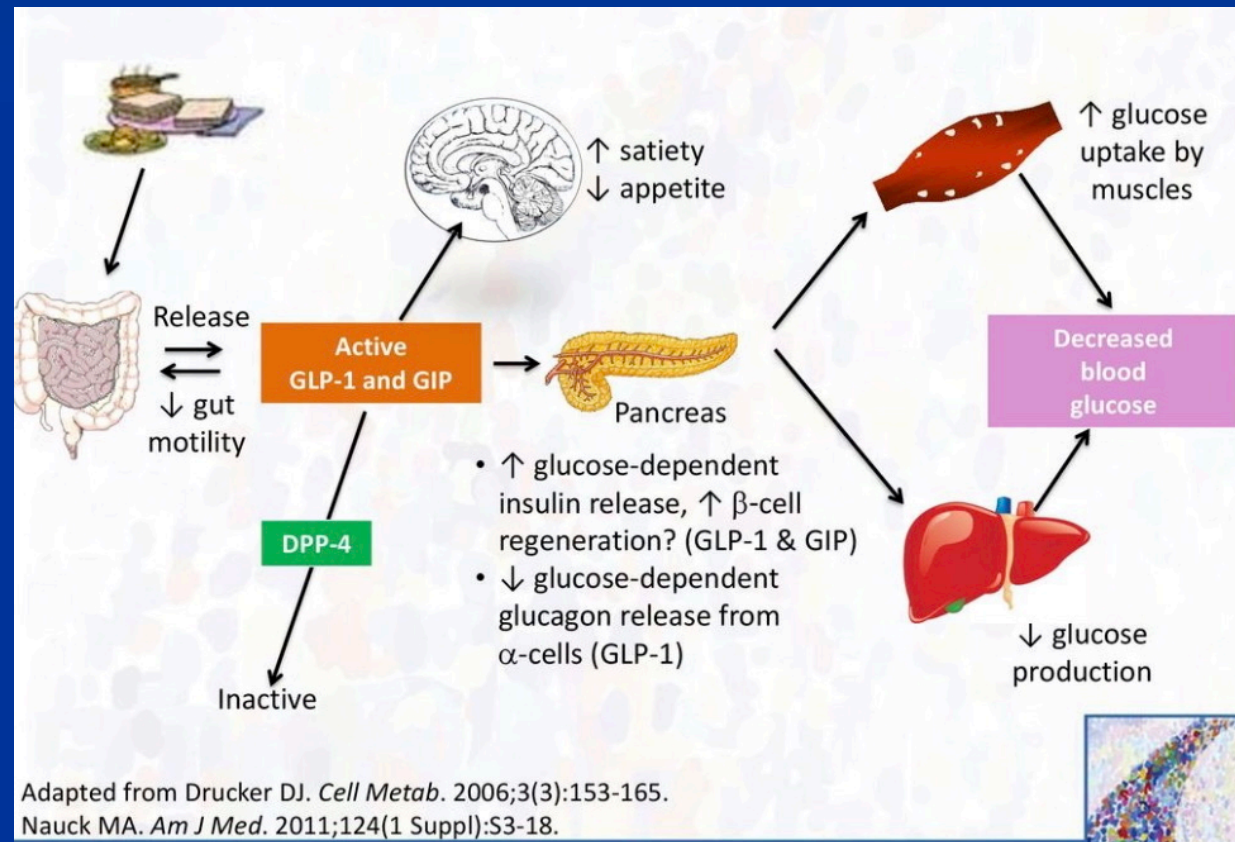
+

Increase Satiety

+

Delay Gastric
Emptying Time

Semaglutide (Ozempic, Wegovy)
Tirzepatide (Zepbound, Mounjaro)
Dulaglutide (Trulicity)
Liraglutide (Victoza)



Lifestyle Modifications

Dietary Considerations & Exercise

Sample Caloric Requirement (BEE) Calculation for Stressed Patients

Female: $655 + (9.6 \times \text{wt. in kg}) + (1.85 \times \text{ht. in cm}) - (4.7 \times \text{age})$

Male: $66 + (13.7 \times \text{wt. in kg}) + (5.00 \times \text{ht. in cm}) - (6.8 \times \text{age})$

Sample Calculation (based on patient-specific parameters: ht, wt, age, and disease state)

S.Y. is a 64 year-old female patient with major sepsis. Calculate her caloric requirement based on her pathologic condition. Her height is 5'4" and body weight is 140 pounds.

Conversion Factors:

- body weight from pounds to kg. : $140 \text{ lbs} / 2.2 = 63.64 \text{ kg}$
- height from inches to cm. : $5'4" = 64 \text{ inches} \times 2.54 = 162.56 \text{ cm}$

$$\text{BEE} = 655 + (9.6 \times 63.64) + (1.85 \times 162.56) - (4.7 \times 64)$$

$$= (655 + 610.94 + 300.74) - (300.8)$$

$$= 1265.88 \text{ kcal / day}$$

Multiply the BEE value by the appropriate "disease stress factor", which provides additional calories to account for the degree of physiologic stress (based on increased metabolic requirement during pathologic condition – i.e., major sepsis).

$$\text{BEE for major sepsis} = 1.5 \times 1265.88$$

$$\text{Answer} \rightarrow 1898.82 \text{ kcal / day}$$



Gastrointestinal Disorders



Antacids: Maalox / Mylanta

MOA: Neutralize Gastric Acidity

Active Ingredients
(neutralizing agents)

(1) magnesium
(SE: osmotic diarrhea)

(2) aluminum
(SE: constipation)

* SE = Side Effect(s)



Antacids (cont.)

Milk of Magnesia (magnesium)

- magnesium → neutralizes hyperacidity
- magnesium → treats constipation

Amphojel (aluminum hydroxide)

- aluminum → neutralizes hyperacidity
- neutralizing agent → treats diarrhea



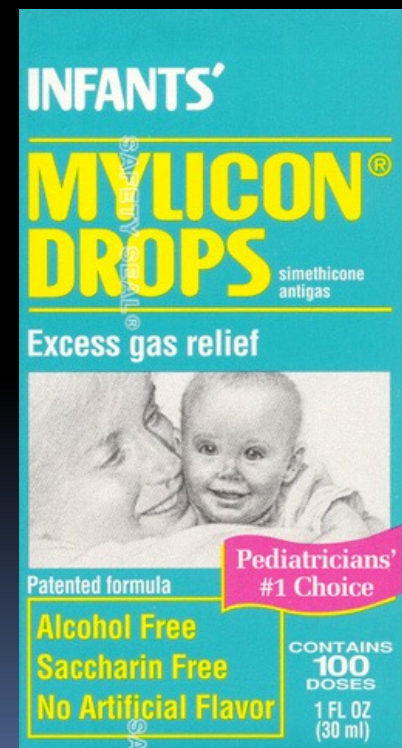
Antacids (Maalox, Mylanta)

- Onset: immediate (minutes)
- Duration: 30 minutes on an empty stomach, but 3 hours when taken within 1 hour of meals
- Alginic acid may be added to antacids → forms a viscous solution that floats on top of gastric contents → protects the esophageal mucosa from acid reflux
- Simethicone (surfactant) may be added to antacids → "breaks up" gas bubbles → relieves gas
- Caution: small amounts of aluminum and magnesium are absorbed and can accumulate in renal insufficiency → toxicity
 - Magnesium: avoid in patients with $\text{CrCl} < 30 \text{ ml/min}$
 - Aluminum: avoid in patients with renal failure ($\text{CrCl} < 15 \text{ ml/min}$)

Antacids (cont.)

Simethicone (Mylicon)

Simethicone (surfactant) → decreases surface tension of gas bubbles
→ breaks up gas bubbles → relieves gas



Antacids (cont.)

Calcium Carbonate (TUMS)

- moderate neutralizing capacity, compared to Maalox/Mylanta
- $\text{CaCO}_3 \rightarrow$ gas formation
 $\rightarrow$ burping / flatulence
- high-doses (4-8 grams/day)
 $\rightarrow$ hypercalcemia / metabolic alkalosis
“milk-alkali syndrome” $\rightarrow$ kidney failure



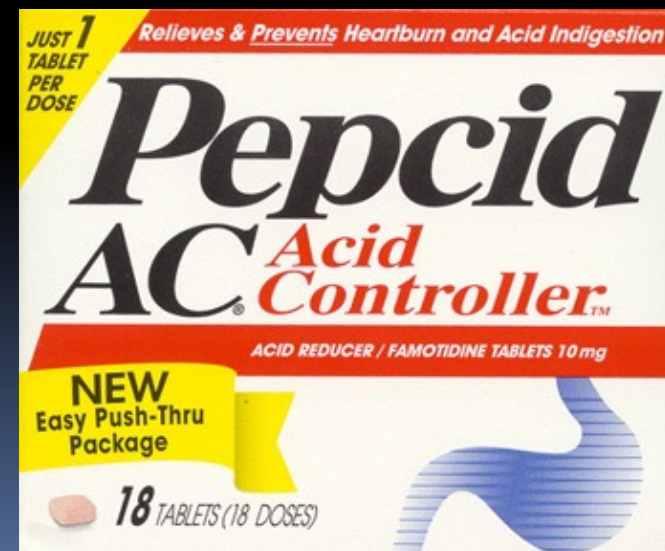
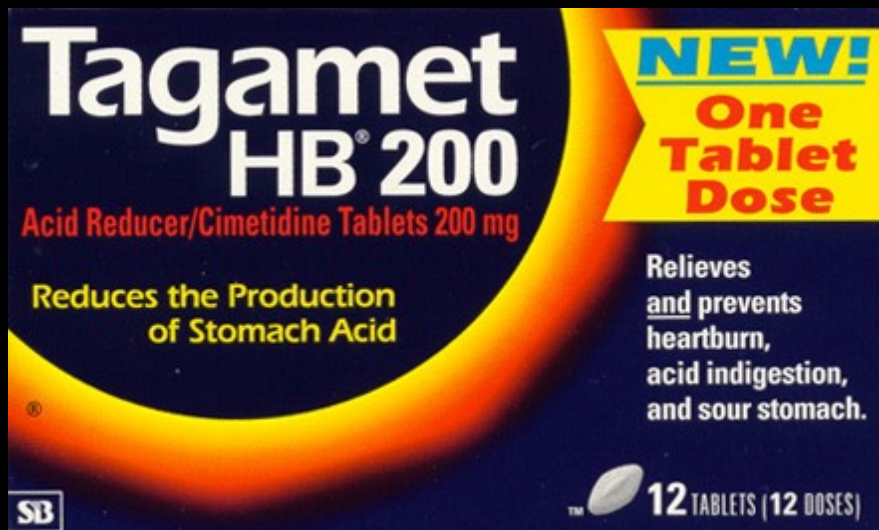
Antacids (cont.)

Sodium Bicarbonate (Alka-Seltzer)

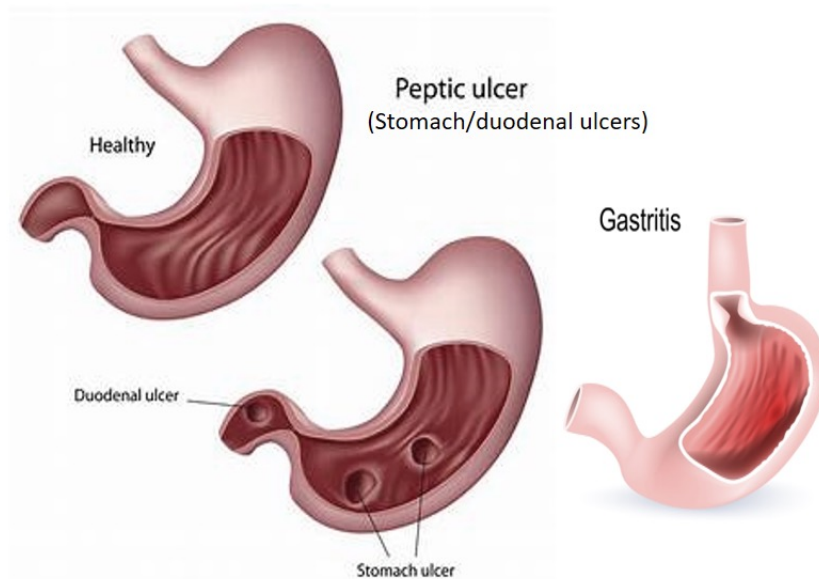
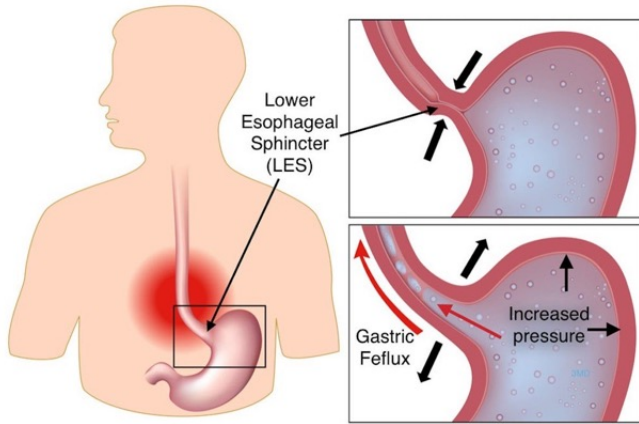
High sodium content (567 mg per tablet) → $\text{Na}^+/\text{H}_2\text{O}$ retention
→ exacerbates hypertension, heart failure, chronic kidney disease



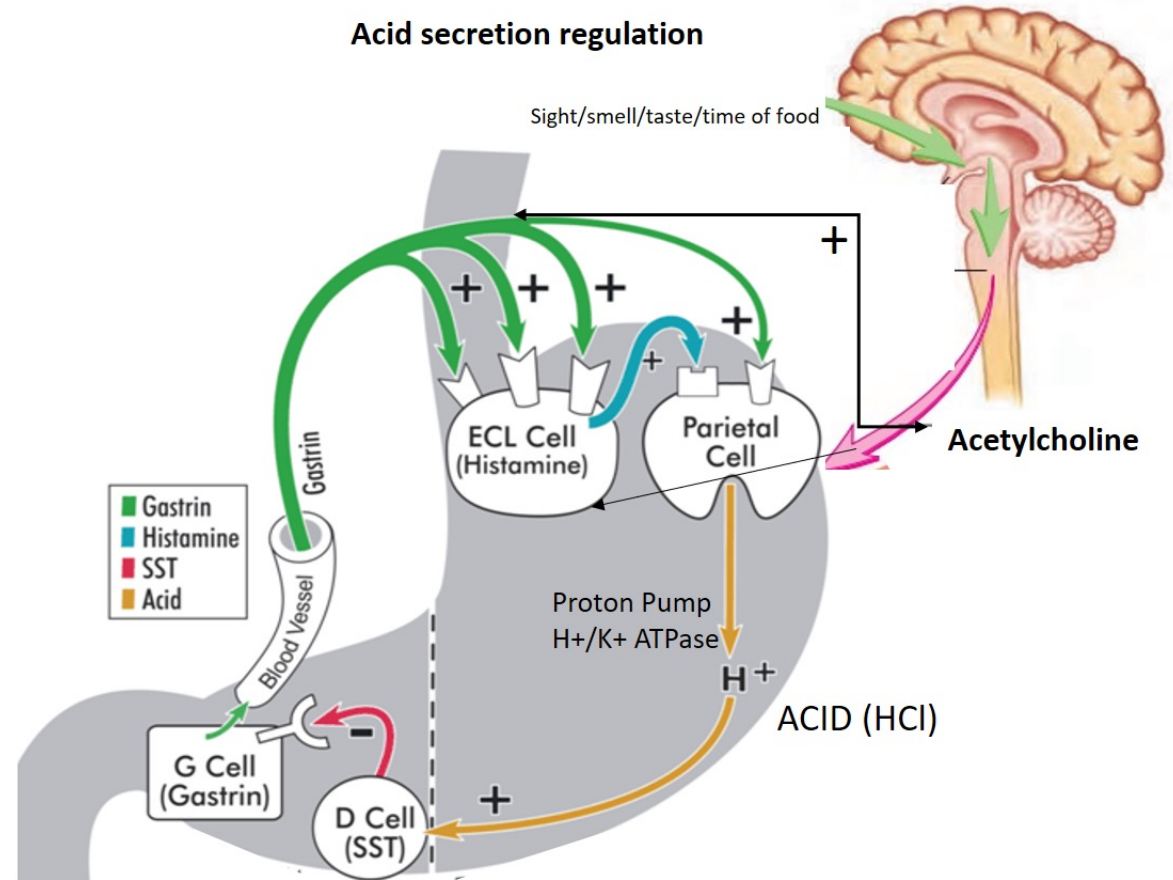
H₂ Receptor Antagonists (H₂RAs)



Gastroesophageal Reflux Disease (GERD)

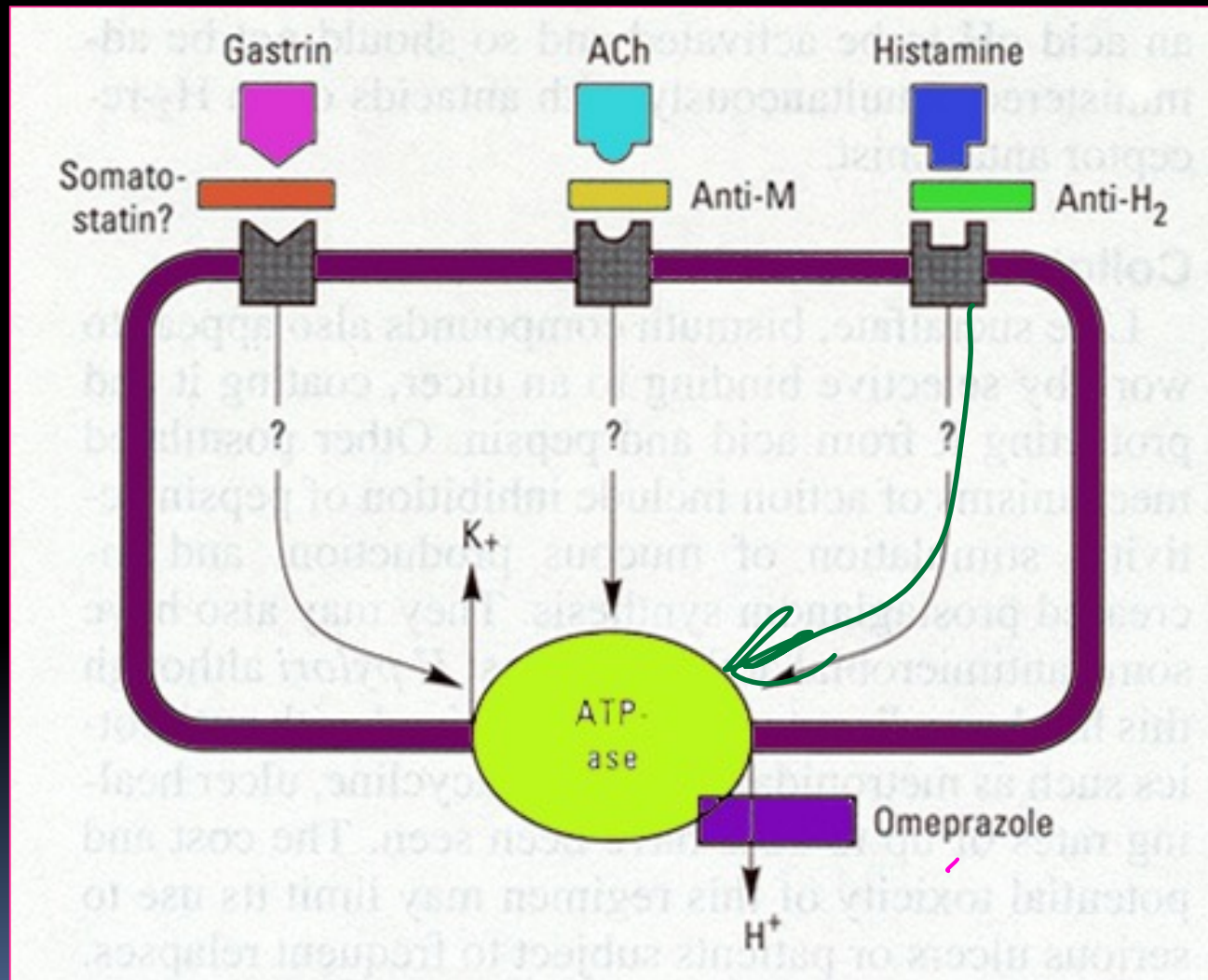


Acid secretion regulation



G-cells (antrum) → produce gastrin. D-cells protect stomach from overproduction of gastric acid by releasing somatostatin (SST) → inhibits production of gastrin. ACh and gastrin → increase release of histamine-2 from enterochromaffin-like (ECL) cells. Gastrin, Histamine-2, ACh (acetylcholine) → bind to receptors on parietal cells → gastric acid secretion

H₂ Receptor Antagonists (H₂RAs)



Histamine-2 Receptor Antagonists (H₂RA)

- H₂RAs are remarkably safe
- Oral absorption is rapid → peak serum drug concentration: 1-3 hours
- Side Effects (SEs)
 - GI Discomfort: diarrhea, constipation
 - CNS Effects: headache, dizziness, drowsiness, lethargy
 - Dermatologic Effects: rash
 - Hematologic Effect: thrombocytopenia (1%) is reversible upon discontinuation of H₂RA
- Cimetidine (Tagamet) has the greatest potential for drug-drug interactions → inhibits hepatic cytochrome P-450 isoenzymes
→ inhibits metabolism of theophylline, phenytoin, warfarin
→ drug toxicities

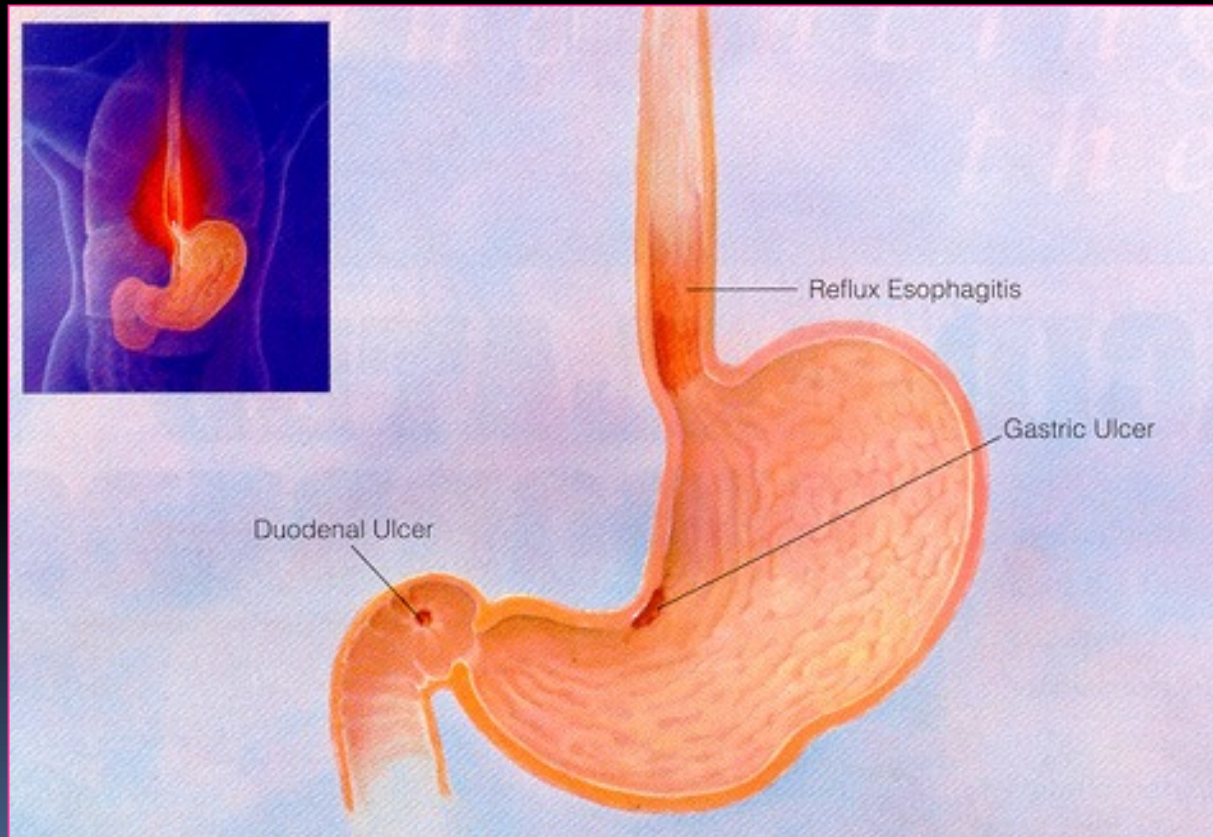
Histamine-2 Receptor Antagonists (H₂RA)

- Tachyphylaxis or tolerance may develop after 2-6 weeks of H₂RA therapy due to upregulation of H₂ receptor sites.
- Development of tachyphylaxis limits the use of H₂RAs in management of GERD and other conditions requiring long-term therapy.

Sucralfate (Carafate)

(cytoprotective agent)

MOA: binds to gastric ulcer forming a protective barrier



Sucralfate (Carafate)

- Sucralfate may also have protective affect by stimulating release of mucosal prostaglandins (PGE)
- SE: constipation (1-3%) due to aluminum content
- Caution: aluminum content may accumulate in patients with renal insufficiency → “aluminum encephalopathy” (i.e., dementia), and anemia
- Aluminum binds dietary phosphate (GI tract) → hypophosphatemia
- Sucralfate tablets are large and may be difficult for geriatrics to swallow → use liquid formulation



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Misoprostol (Cytotec)

MOA: synthetic prostaglandin (PG) analog

- stimulates the production of mucus and bicarbonate (“mucoprotective shield”)
- improves mucosal blood flow
- reduces mucosal cell turnover
- mildly inhibits gastric acid secretion (less than H₂RAs)

SE: diarrhea (up to 30%), abdominal cramping

- take with food and reduce daily dose to minimize incidence of diarrhea

Caution: misoprostol is contraindicated in pregnancy.

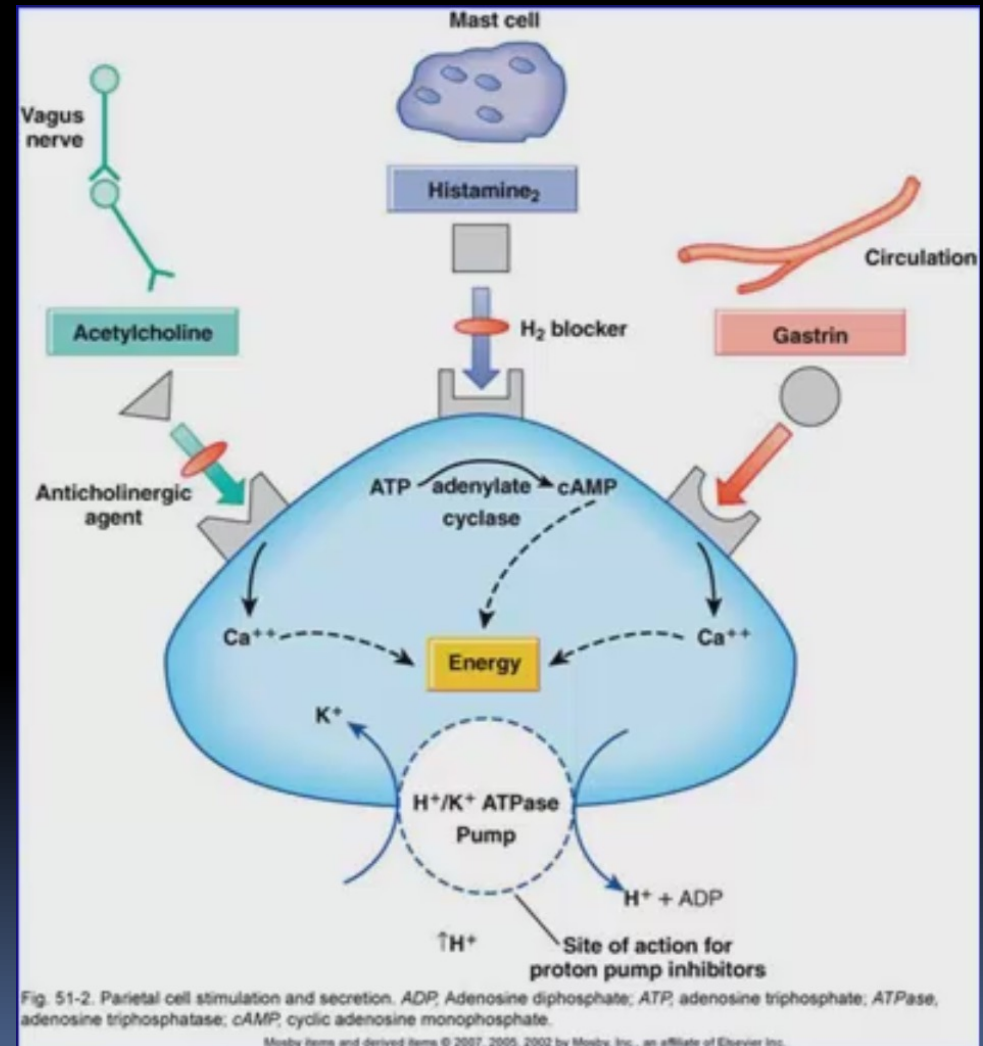
- use in women in childbearing years requires negative serum pregnancy test and adequate contraception



Proton Pump Inhibitors (PPIs)

MOA:

- PPIs irreversibly bind to the proton pump and inhibit gastric acid secretion
- PPIs are the most potent inhibitors of gastric acid secretion (superior to H₂RAs)
- PPIs are indicated for patients who experienced tx failure with maximum doses of H₂RA
- Dosage reduction of PPIs is not required in renal insufficiency



Proton Pump Inhibitors (PPIs)

Table 1. Availability, Formulations, and Dosages for Proton Pump Inhibitors in Adults

<i>Drug</i>	<i>Availability</i>	<i>Route of administration</i>	<i>Starting dosage*</i>	<i>Cost of generic (brand)†</i>
Dexlansoprazole (Dexilant)	Prescription	Oral	30 mg per day	NA (\$153)
Esomeprazole (Nexium)	Prescription	Oral or IV	Oral: 20 mg per day IV: 20 mg per day for 10 days	Oral: NA (\$201) IV: NA (\$381)‡
Lansoprazole (Prevacid)	Prescription	Oral	15 mg per day	\$106 (\$196)
Lansoprazole (Prevacid 24H)	Over-the-counter	Oral	15 mg per day for 14 days§	NA (\$13)
Omeprazole (Prilosec, Zegerid)	Prescription	Oral	20 mg per day	\$33 (\$196)
Omeprazole (Prilosec OTC, Zegerid OTC)	Over-the-counter	Oral	20.6 mg (Prilosec OTC) or 20 mg (Zegerid OTC) per day for 14 days§	\$7 (\$13)
Pantoprazole (Protonix)	Prescription	Oral or IV	Oral: 40 mg per day IV: 40 mg per day for 7 to 10 days	Oral: \$16 (\$186) IV: \$42 (\$42)‡
Rabeprazole (Aciphex)	Prescription	Oral	20 mg per day	NA (\$250)

IV = intravenous; NA = not available.

**—Number of weeks of recommended treatment varies.*

†—Estimated retail price of one month's treatment (unless otherwise specified) based on information obtained at <http://www.drugstore.com> (accessed January 31, 2012) or at a national retail chain.

‡—Estimated wholesale price based on information obtained at Red Book online. Micromedex 2.0. Micromedex Healthcare Series [Internet database]. Greenwood Village, Colo.: Thomson Reuters (accessed January 31, 2012).

§—Patients should not take more often than 14 days per month every four months.

Proton Pump Inhibitors (PPIs)

Short-Term SEs of PPIs (infrequent and comparable to H₂RAs)

- GI discomfort: nausea, diarrhea, abdominal pain
- CNS: headache, dizziness

Long-Term SEs of PPIs (usually with high doses)

- Atrophic gastritis has been “rarely” associated with patients on long-term therapy PPIs for *Helicobacter pylori*.
- Risk of *C. difficile* and other enteric infections has been observed due to ability of pathogens to survive in a less acidic GI environment; however the overall risk is low.
- Vit B₁₂ deficiency, since gastric acid is required to extract Vit B₁₂ from dietary sources. Monitor Vit B12 levels in PPI patients.

Long-Term SEs of PPIs

- Hypomagnesemia may occur with long-term use of PPIs due to reduced intestinal absorption. Monitoring serum magnesium levels is recommended in patients on long-term PPI therapy.
- Hypocalcemia and increase risk of fractures is associated with reduced calcium absorption due to hypochlorhydria. Since calcium citrate does not require acid for absorption, it is the recommended calcium supplement in patients on long-term PPI therapy.
- Iron malabsorption secondary to long-term gastric acid suppression with PPIs, however this does not appear to be of clinical significance unless a patient requires oral iron supplementation. Higher doses and longer duration of iron supplementation are recommended in these patients.

Guidelines for Self-Medication

- (1) read the label carefully
- (2) follow the directions for use
- (3) if symptoms persist, seek professional advice
- (4) OTC drugs do not cure illness
- (5) don't use expired or old medications
- (6) store medications properly
- (7) avoid OTC products with identical medications

Guidelines for Self-Medication (cont.)

- (8) consult a pharmacist or a physician assistant for information on OTC drugs
- (9) select an economical generic OTC product when available (generic vs brand)

