SCOREBUILDERS

SPOTLIGHT *Series*

Cardiovascular and Pulmonary Pharmacology for Dummies

Presented by
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Objectives

By the end of the presentation the learner will be able to:

- Recall the action of medications administered to patients with cardiovascular and/or pulmonary dysfunction
- Recall indications and contraindications to participation in physical therapy with patients who are prescribed select cardiovascular and pulmonary medications
- Discuss the effects of select cardiovascular and pulmonary medications on exercise tolerance and vital sign response
- Discuss the importance of precise exercise prescription with patients who are prescribed select cardiovascular and/or pulmonary medications

"In your lifetime, Mr. Johnson, approximately how much secondhand smoke have you been exposed to?"


CLOSE TO HOME
BY JOHN McPHERSON
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1-18
SO, TAKING THE FIRST THREE LETTERS OF EVERYBODY'S DOG'S NAME...
VINALLPHALEX
VINNY ⇒ VIN
ALLAGASH ⇒ ALL
PHARAOH ⇒ PHA
LEXY ⇒ LEX
RAYCOM PHARMACEUTICA
HOW NEW MEDICATIONS ARE NAMED.
McPHERSON

Pulmonary Medication Classes

- Adrenergic Agonists
- Cholinergic Antagonists
- Antibiotics
- Antiviral Agents
- Adrenocortical Hormones (Steroids)
- Histamines/Antihistamines
- Immunosuppressive
- Others

Agonists and Antagonists

Agonists - Drugs that occupy receptors and activate them.

Antagonists - Drugs that occupy receptors but do not activate them
Antagonists block receptor activation by agonists.

Anticholinergics/Cholinergic Antagonists		
Medication	**Effects**	**Side Effects**
Tiotropium (Spiriva)		Dry Throat/Mouth
Ipratropium Bromide (Atrovent)		
Atropine (mostly used for dysrhythmias)		Blurred Vision
	Long acting (24 hour) anticholinergic bronchodilators	
		Tachycardia
		Constipation

Short Acting β2 Adrenergic Agonists		
Medication	**Effects**	**Side Effects**
		Tremor
		Palpitations
Albuterol	Rescue or quick relief medication. Provides fast and temporary relief of bronchoconstrictive flare-up	Headache
Levalbuterol		Nervousness
Pributerol	Acts within 3-5 minutes, lasts 4-6 hours	Dizziness
		Nausea
		HTN
		May cause (+) inotropic and/or chronotripic effects

Long Acting β2 Adrenergic Agonists		
Medication	**Effects**	**Side Effects**
	NOT intended for immediate and rapid bronchodilation	Tremor
		Palpitations
Salmeterol	Commonly taken 2x day with anti inflammatory medication	Headache
Formoterol		Nervousness
	Especially helpful to maintain airways open during sleeping hours	Dizziness
		Nausea
		HTN
	Can relieve airway restriction up to 12 hours	May cause (+) inotropic and/or chronotripic effects

Other Selective Adrenergic Agonists

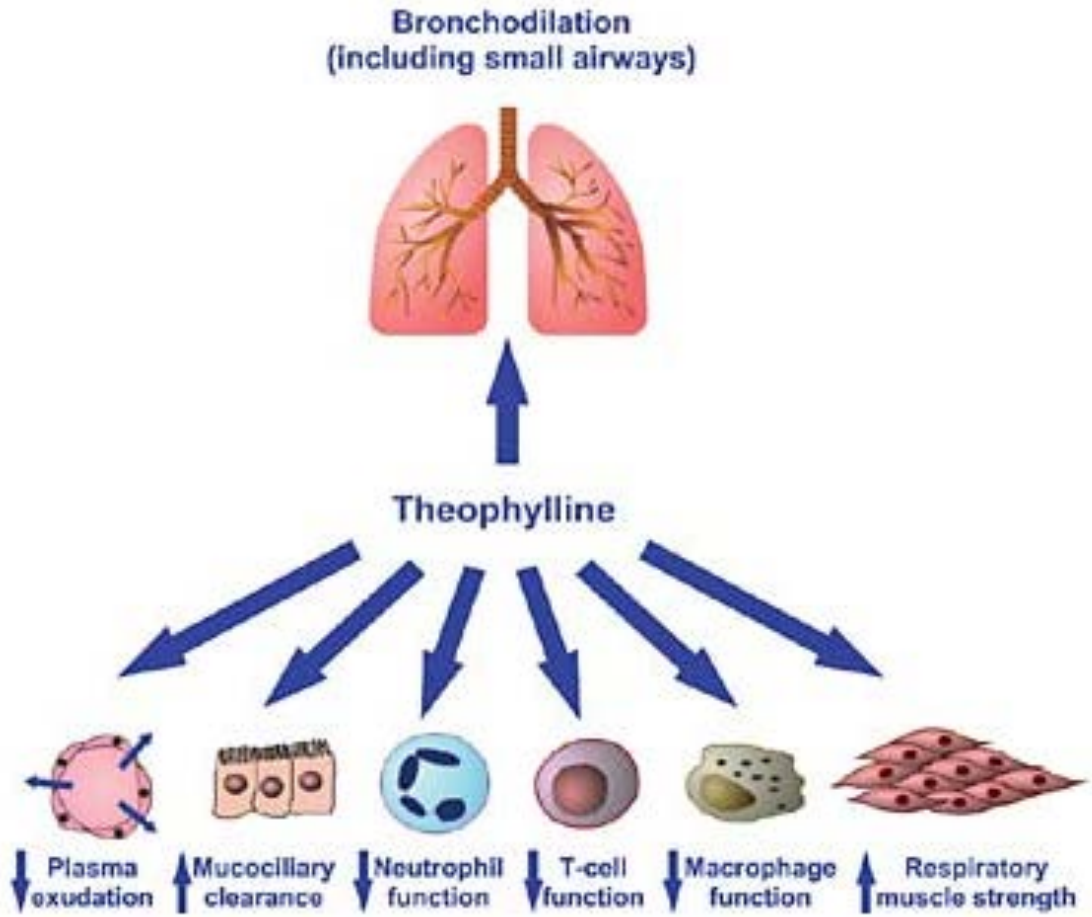
- α_1
  - Phenylephrine
    - Decongestant
    - Used 2/2 pseudoephedrine restrictions
  - Naphazoline
    - Nasal spray
    - Vasoconstrictive properties
      - Rebound effects
- β_1, β_2
  - Isoproterenol
    - Asthma and emphysema (rare)
    - Primary use is for heart blocks

Non Selective Adrenergic Agonists

- **Epinephrine**
  - Activates α_1, β_1, β_2
  - Alleviates severe bronchoconstriction

- **Norepinephrine**
  - Not as effective bronchodilator as epinephrine
  - Activates α_1, β_1
  - Used more in cardiac patients

Methylxanthines		
Medication	**Effects**	**Side Effects**
		Nausea/Vomiting
		Diarrhea
		Headache
Theophylline	Long acting bronchodilator effects. Prevents asthma and COPD exacerbations	Tachycardia/Dysrhythmias
Aminophylline		Muscle Cramps
		GERD
		“Jittery” Feelings


Bronchodilation
(including small airways)
Theophylline
Plasma exudation
Mucociliary clearance
Neutrophil function
T-cell function
Macrophage function
Respiratory muscle strength

Corticosteroids		
Medication	**Effects**	**Side Effects**
Triamcinolone (Azmacort)		Increase risk of infection
Prednisone	Reduce inflammatory response	GI Disturbances
Prednisolone		Muscle Weakness (proximal > distal)
Budesonide (Pulmicort)	Decrease mucosal swelling Bronchodilate	“Moon Face”
Flunisolide		Insomnia
Fluticasone (Flovent)		Glaucoma
	No immediate relief. Help with long term control	

Leukotriene Inhibitors		
Medication	**Effects**	**Side Effects**
Zileuton	Smooth muscle relaxation (Bronchodilation)	Headaches
Montelukast (singulair)		Liver damage
Zafirlukast	Inhibition of leukotriene synthesis	Fatigue
		Nausea/Vomiting

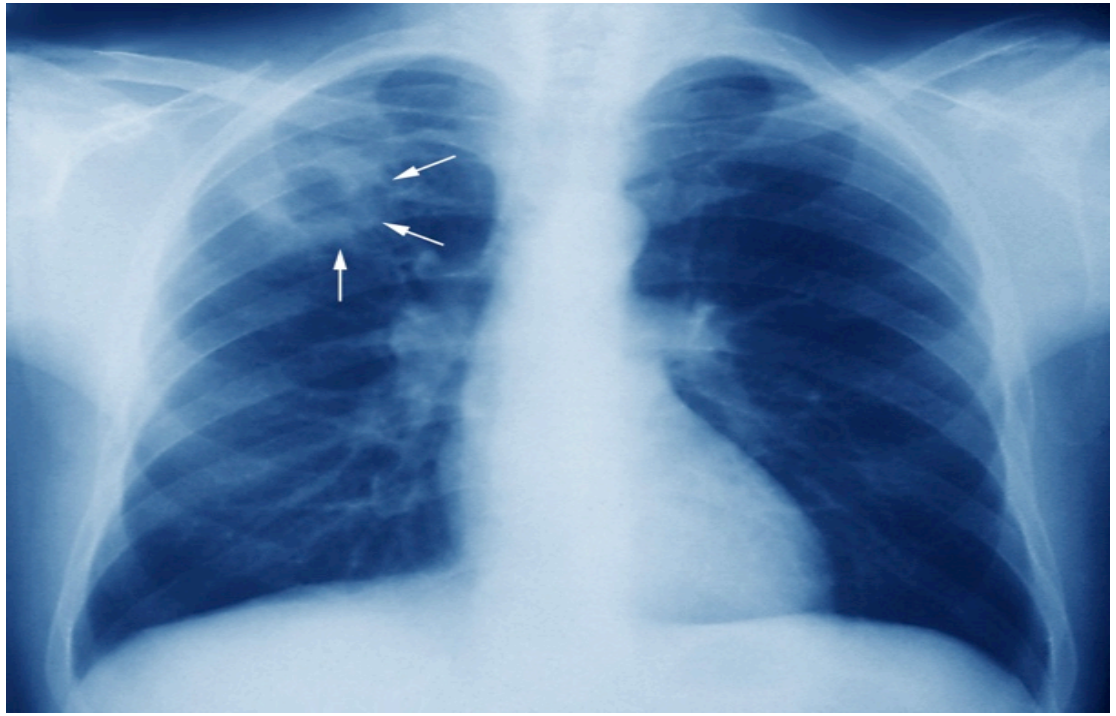
Nonsteroidal Anti-Inflammatory Agents		
Medication	**Effects**	**Side Effects**
Cromolyn Sodium	Bronchodilation	
Nedocromil Sodium		Dry Mouth
	Prevention of late-stage asthma bronchoconstriction − impairs release of bronchoconstrictive mediators (histamine)	Dry Throat
		Airway Irritation

Administration of Inhaled Agents

- Medication administration – RT or RN
  - Clear secretions
  - Decrease inflammations
  - Reduction of side effects
  - Localized medication delivery
- Aerosol Therapy
  - Inhalers
  - Nebulizers
- Relevance
  - Pre PT – may enhance pt performance
  - Increase clearance of secretions
  - Decrease SOB and/or WOB

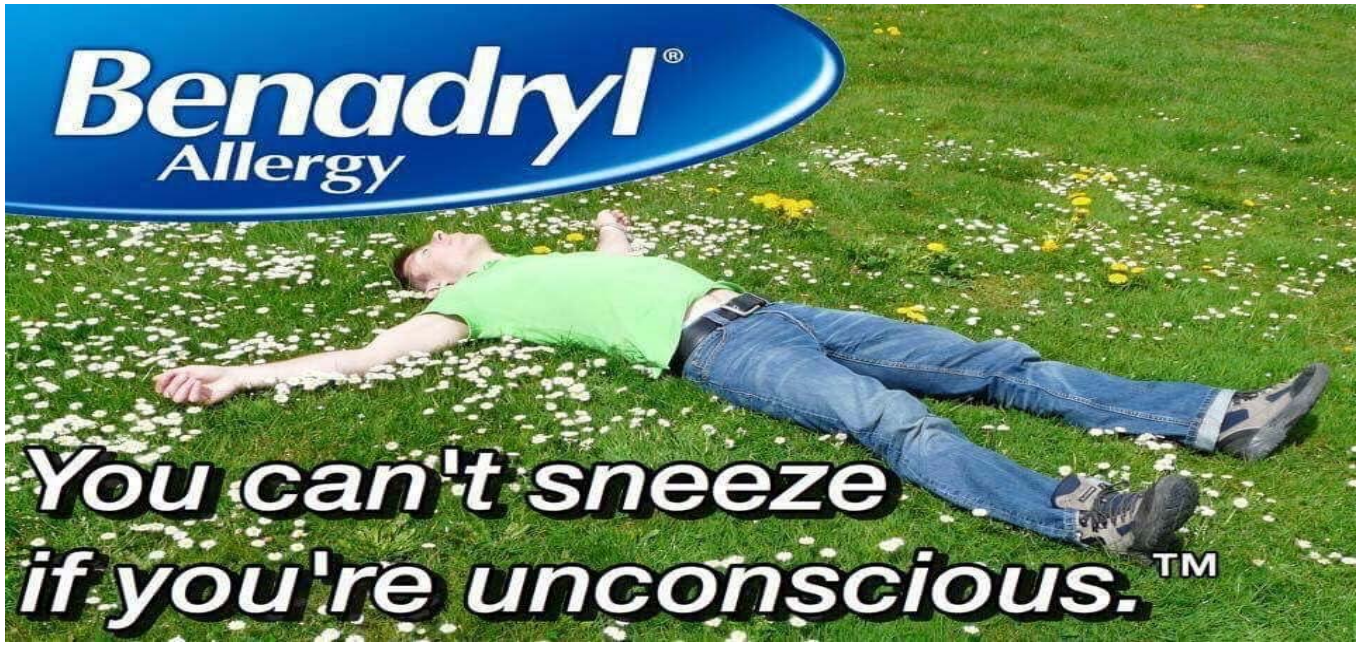
Antibiotics

- **Pneumonia**
  - Azithromycin (Zithromax)
  - Clarithromycin (Biaxin)
  - Fluoroquinolones (Ciproflaxin)
- **Tuberculosis**
  - Rifampin and Isoniazid combinations
- **Side effects**
  - Hyperglycemia
  - N/V/D
  - Rash
  - QT elongation on ECG



Antihistamines

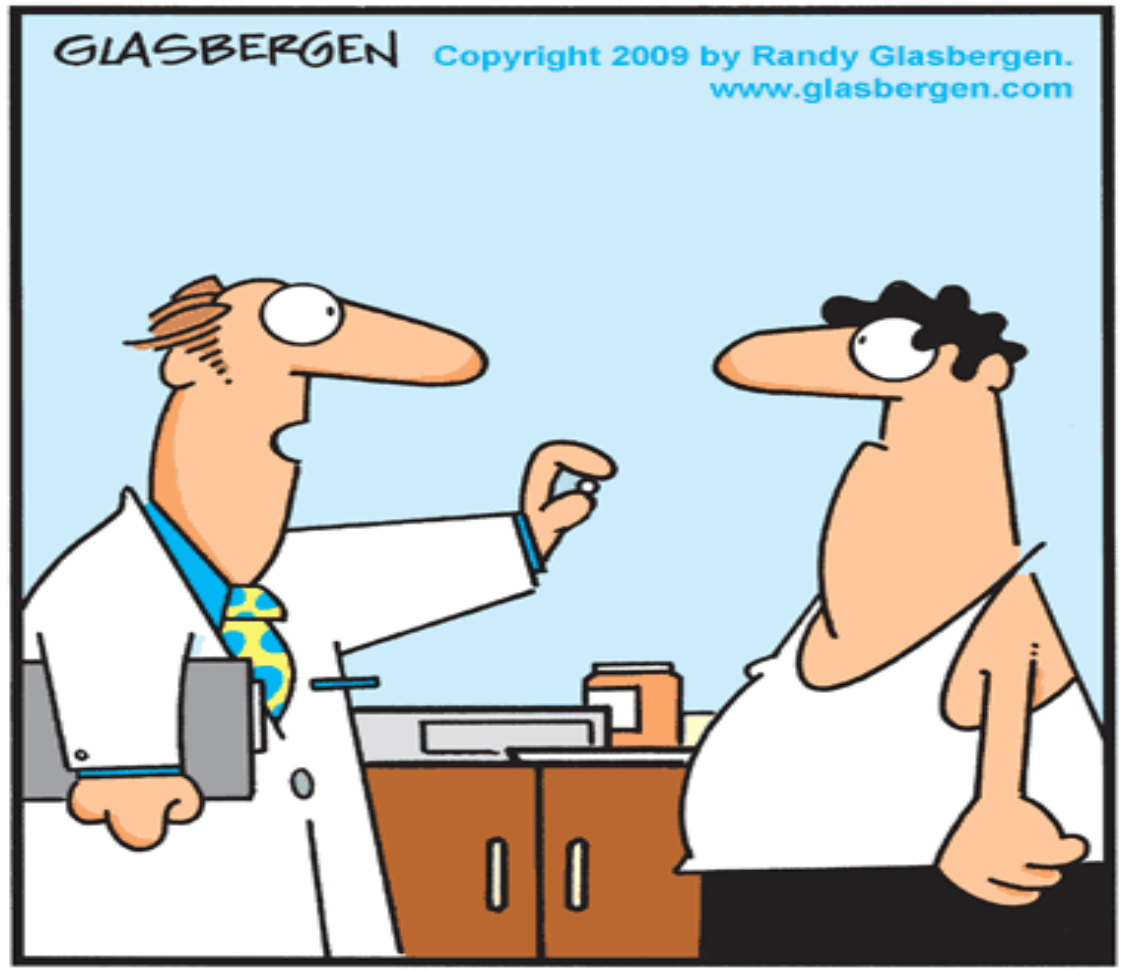
- Prevent of block the release of histamines
  - Cetirizine (Zyrtec)
  - Desloratadine (Clarinex)
  - Fexofenodine (Allegra)
  - Diphenhydramine (Benadryl)
- Side Effects
  - Drowsiness
  - Dizziness
  - Decreased coordination
  - Palpitations



Combination Agents

- 2 or more medications combined to reduce the number of inhaled agents

  - Advair (Flovent and Salmeterol)
    - Corticosteroid, long acting β_2 adrenegic receptor agonist
  - Symbicort (Budesonide and Formoterol)
    - Corticosteroid, long acting β_2 adrenegic receptor agonist
  - Combivent (Ipratropium and Salbutamol)
    - Anticholinergic, short acting β_2 adrenegic receptor agonist
      - COPD patients



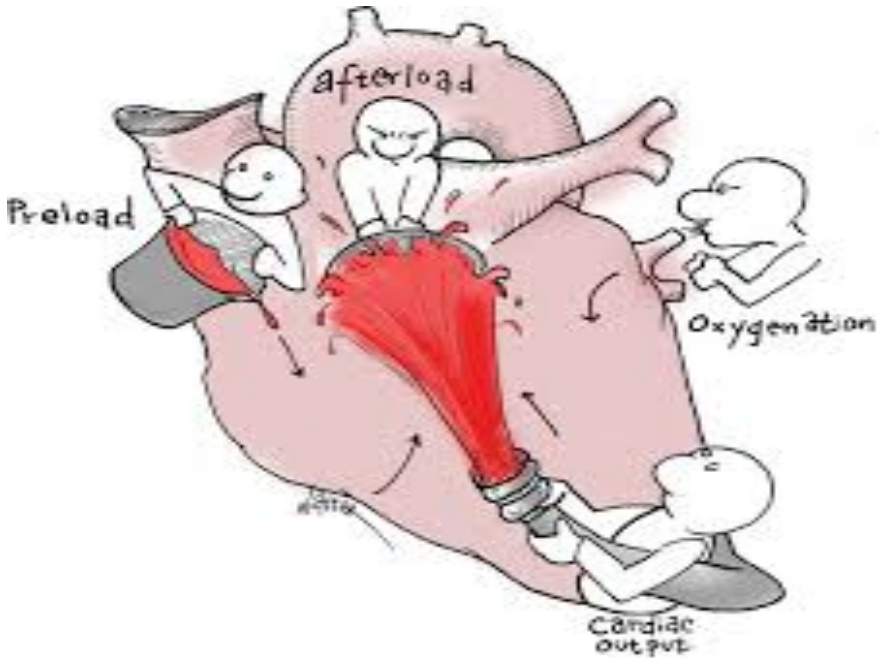
"To prevent a heart attack, take one aspirin every day. Take it out for a run, then take it to the gym, then take it for a bike ride..."

Cardiac Pharmacology Categories

- Beta-blockers
- Calcium channel blockers
- Antiarrhythmic medications
- Nitrates
- Risk reduction medications

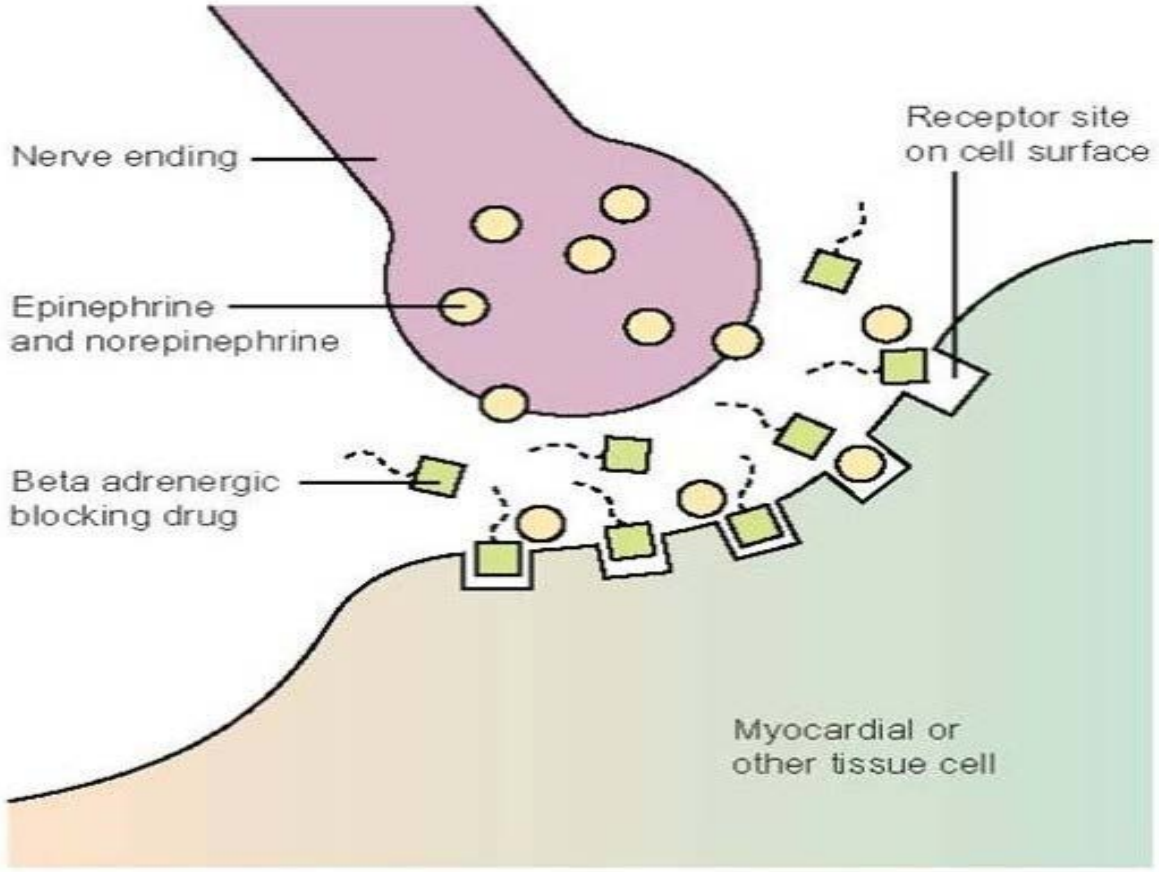
Main Goal and Purpose

- Inotropic Effects
- Chronotropic Effect
- Dromotropic Effect
- Antihypertensive
- Blood lipid management
- Cardioprotective effects



Beta Blockers

- Decrease myocardial O2 demand by decreasing HR, BP and myocardial contractility
  - Chronotropic and inotropic effect
- Sympathetic hormones blocked at β_1 receptor sites
  - β_1 receptors = adrenergic agonists



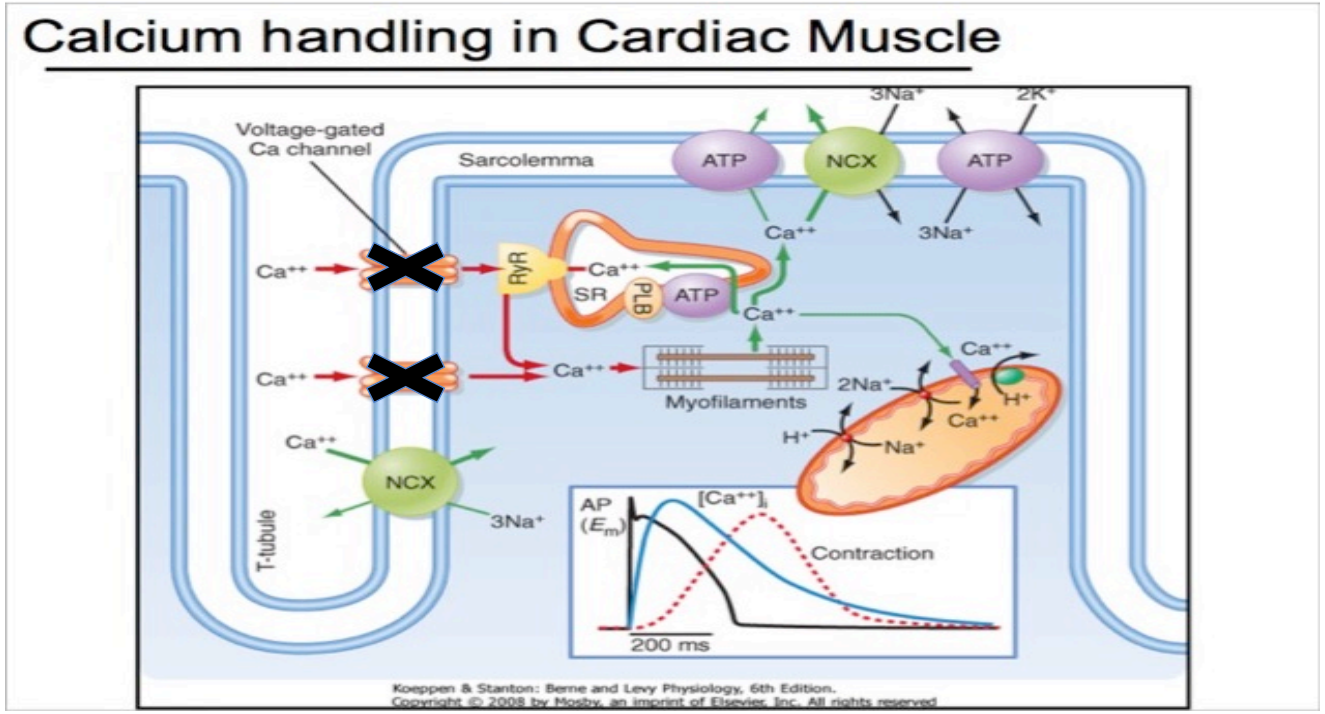
Beta Blockers

- **Main Uses**
  - Hypertension
  - With nitrates for angina
  - Atrial and/or ventricular arrhythmia
  - Heart failure
  - Acute MI
  - Certain types of tremors
  - Migraines
- **Contraindications**
  - Acute heart failure
  - Bradycardia
  - Hypotension
  - Asthma
  - Bronchitis/COPD
  - Cardiogenic Shock
  - AV Blocks
  - Diabetes

Beta Blockers		
Medication	**Effects**	**Side Effects**
Atenolol	Lower mortality in patients with previous MI	
Propanolol		Impotence
Metropolol	Slows progression of CHF	Hair Growth
Sotalol		Cough
Bisoprolol	Decreases HR and BP	Dizziness
Carvidelol		Weakness
Timilol		Nightmares
Nadolol	May suppress some cardiac arrhythmias	Exercise complications
Betaxolol		Heat intolerance
Pindolol		
Labetolol		

Calcium Channel Blockers

- Inhibit flow of CA^{+} ions across membrane of myocardial muscle
- Decrease myocardial O2 demand by decreasing HR, BP and myocardial contractility
  - Chronotropic and inotropic effect
- Peripheral vasodilation



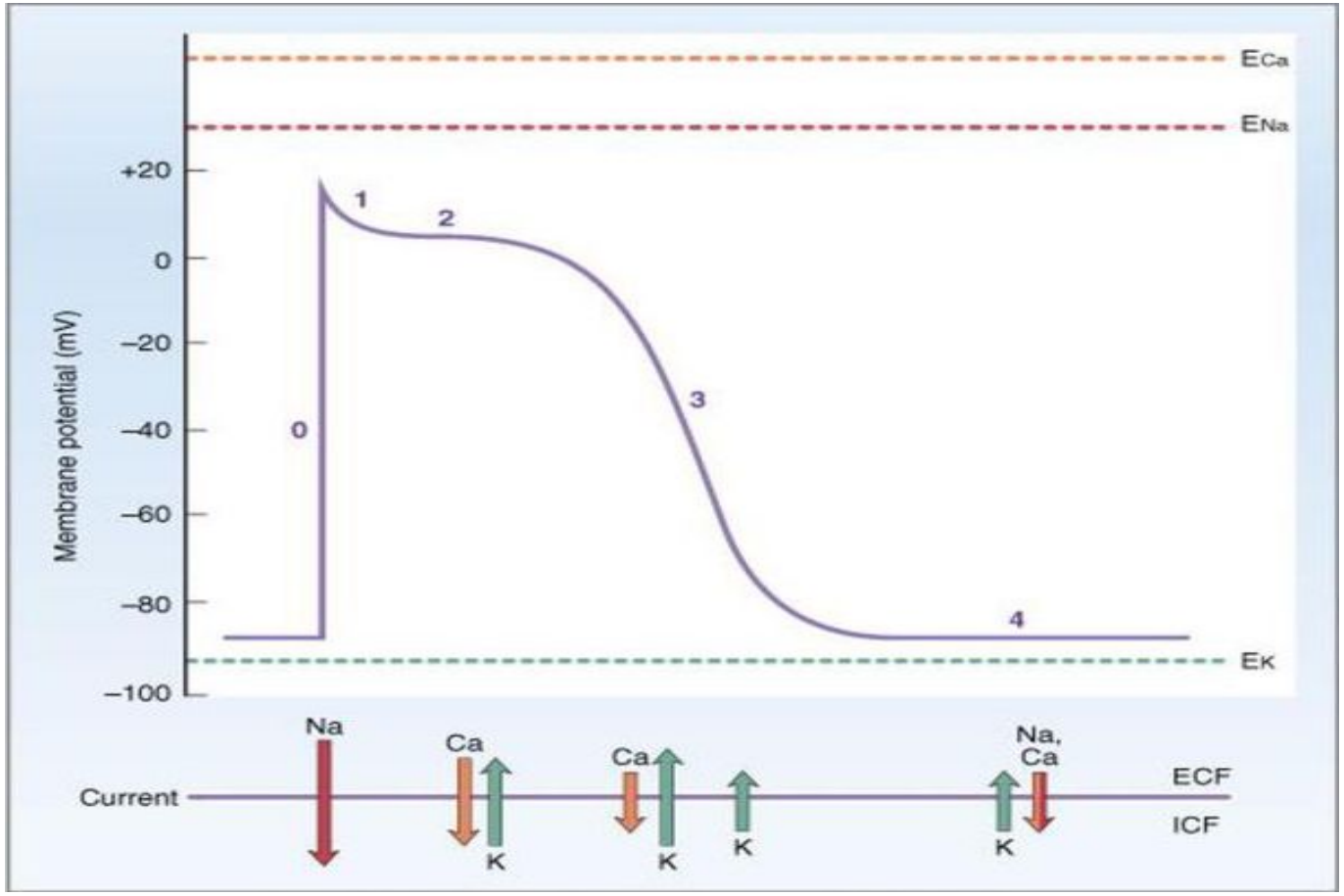
Calcium Channel Blockers

- **Main Uses**
  - Hypertension
  - Atrial and/or ventricular arrhythmia
  - Angina
  - Raynaud's Disease
  - Migraines
- **Contraindications**
  - Bradycardia
  - Hypotension
  - Acute MI
  - Pulmonary Congestion
  - Cardiogenic Shock

Calcium Channel Blockers		
Medication	**Effects**	**Side Effects**
Nifedipine	Treatment of arrhythmias and angina	
Diltiazem		Leg Swelling
Verapamil	Decreases BP	
Amlodipine		Impotence
Felodipine	May lower HR	
Isradapine		
Nicardipine		Dizziness
Nimodipine	Dilates coronary arteries	
Bepridil		Weakness

Antiarrhythmics

- 4 classes, classified by mechanism of action
- Alter conductivity and automaticity of the myocardium
- Slow impulse generation and conduction
  - Suppress ectopic stimuli



Antiarrhythmics

- **Main Uses**
  - Restore heart rhythm to NSR
  - Decrease symptoms associated with arrhythmias
    - Palpitations
    - Lightheadedness
    - Pre-syncope
    - Angina
    - DOE
- **Contraindications**
  - Sinus Bradycardia
  - CHF
  - Cardiogenic Shock
  - AV Blocks
  - Asthma

Antiarrhythmics		
Medication	**Effects**	**Side Effects**
Amiodarone		
Sotalol		Liver toxicity
Disopyramide		
Procainamide		Kidney toxicity
Quinidine	Reduce or eliminate cardiac arrhythmias	
Digitalis/Digoxin (Cardiac Glycoside)		Lung toxicity
		Sudden cardiac death
		Neurological symptoms

Nitrates

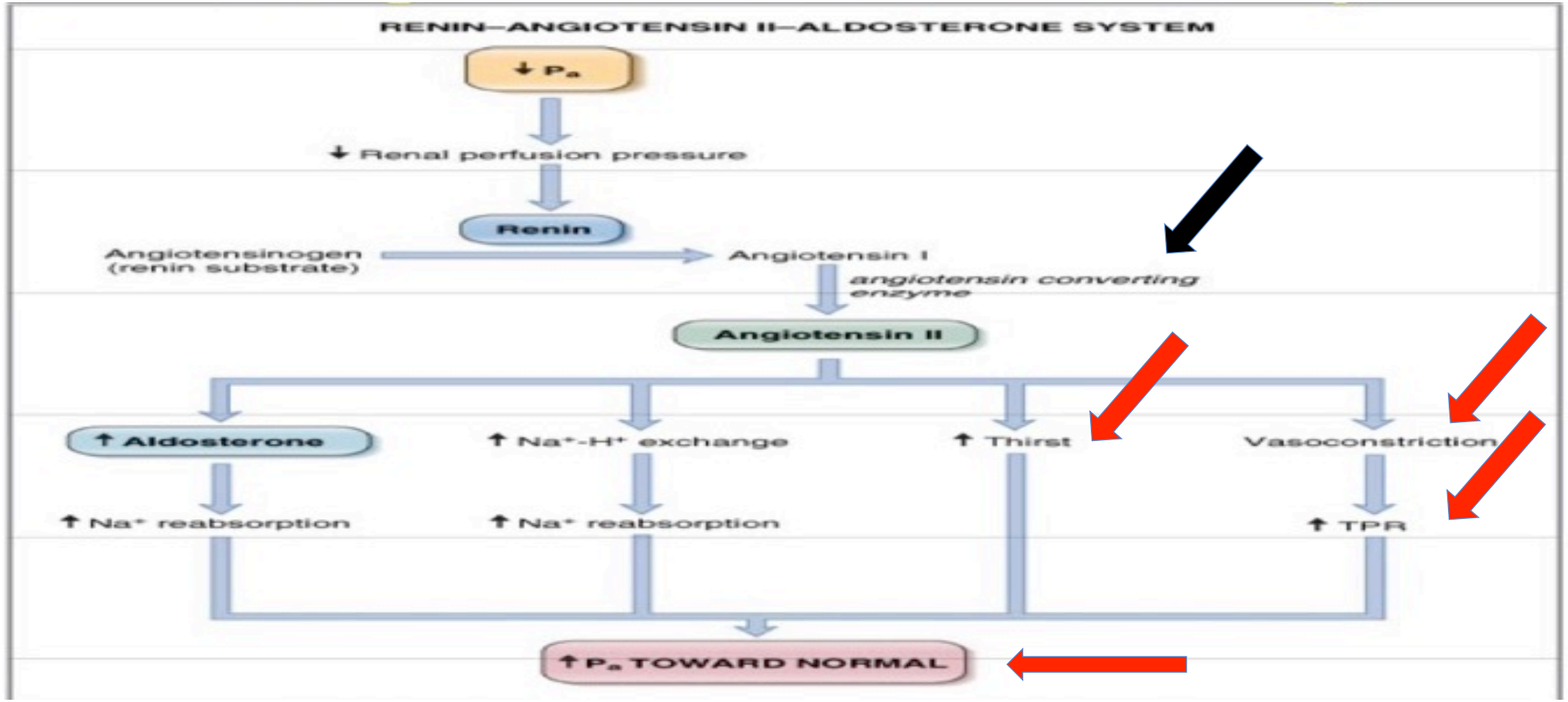
- Potent vasodilators
  - Relaxation of smooth muscle walls
- Decrease venous return
- Decrease preload
- Decrease myocardial O2 demand
- Decrease afterload

- **Uses**
  - Angina
  - MI
  - HTN
  - Heart Failure
- **Contraindication**
  - Hypotension

*****1 sublingual tablet every 5 minutes prn during active angina (NO MORE THAN 3)*****

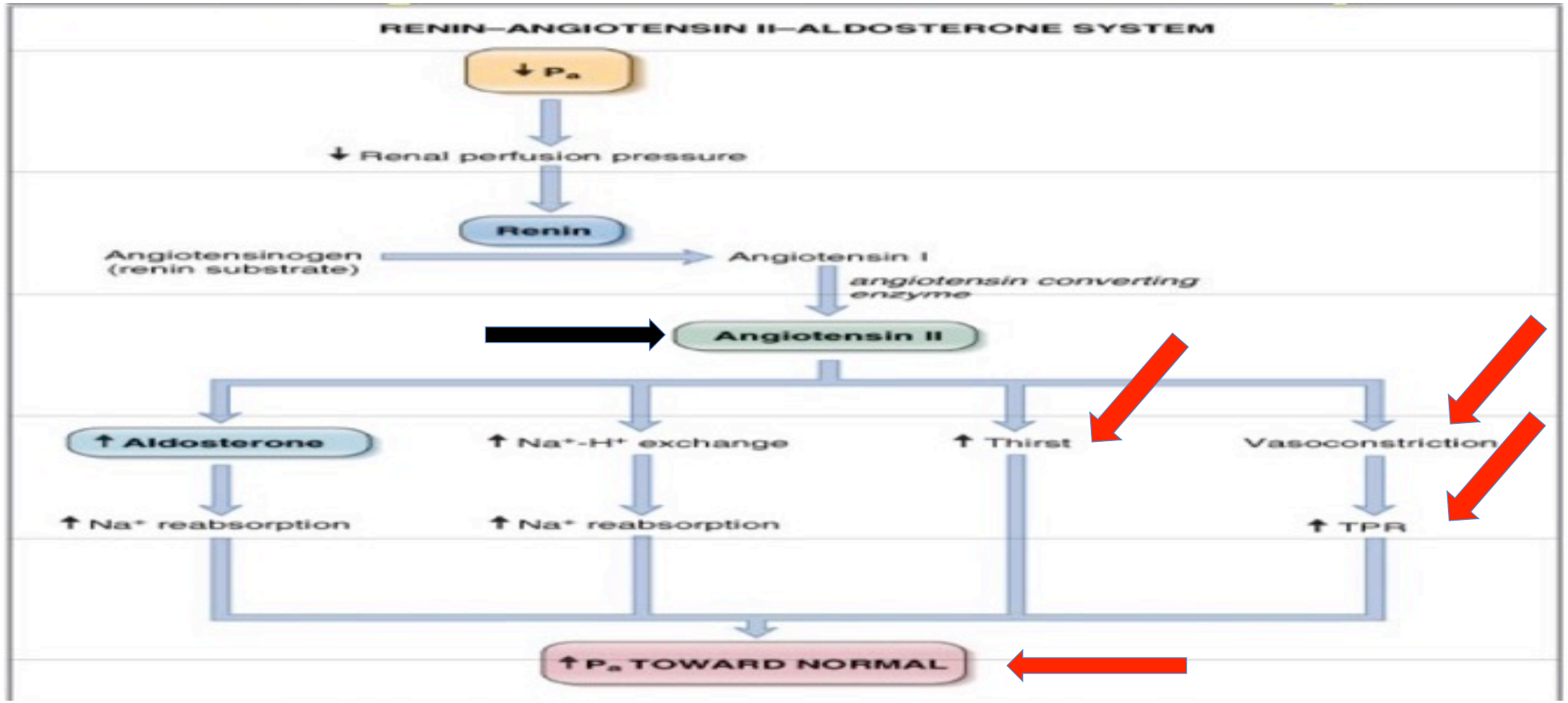
Nitrates		
Medication	**Effects**	**Side Effects**
	Coronary artery vasodilation	
Isosorbide Dinitrate		
Isosorbide Mononitrate		Dizziness
Nitrostat		
Nitro-time	Reduces SOB with CHF	Transient Headache
Rectiv		
		Hypotension
	Photosensitive medication	
	Can loose effect over time	

Angiotensin Converting Enzyme Inhibitors
"ACE Inhibitors"



ACE Inhibitors		
Medication	**Effects**	**Side Effects**
	Lowers Blood Pressure	
Lisinopril		
Catopril		Dry Cough
Enalapril		
Accupril	Decreases TPR	
Quinapril		Hyperkalemia
Benozapril		
Fosinopril	Prolongs life of patients with CHF	

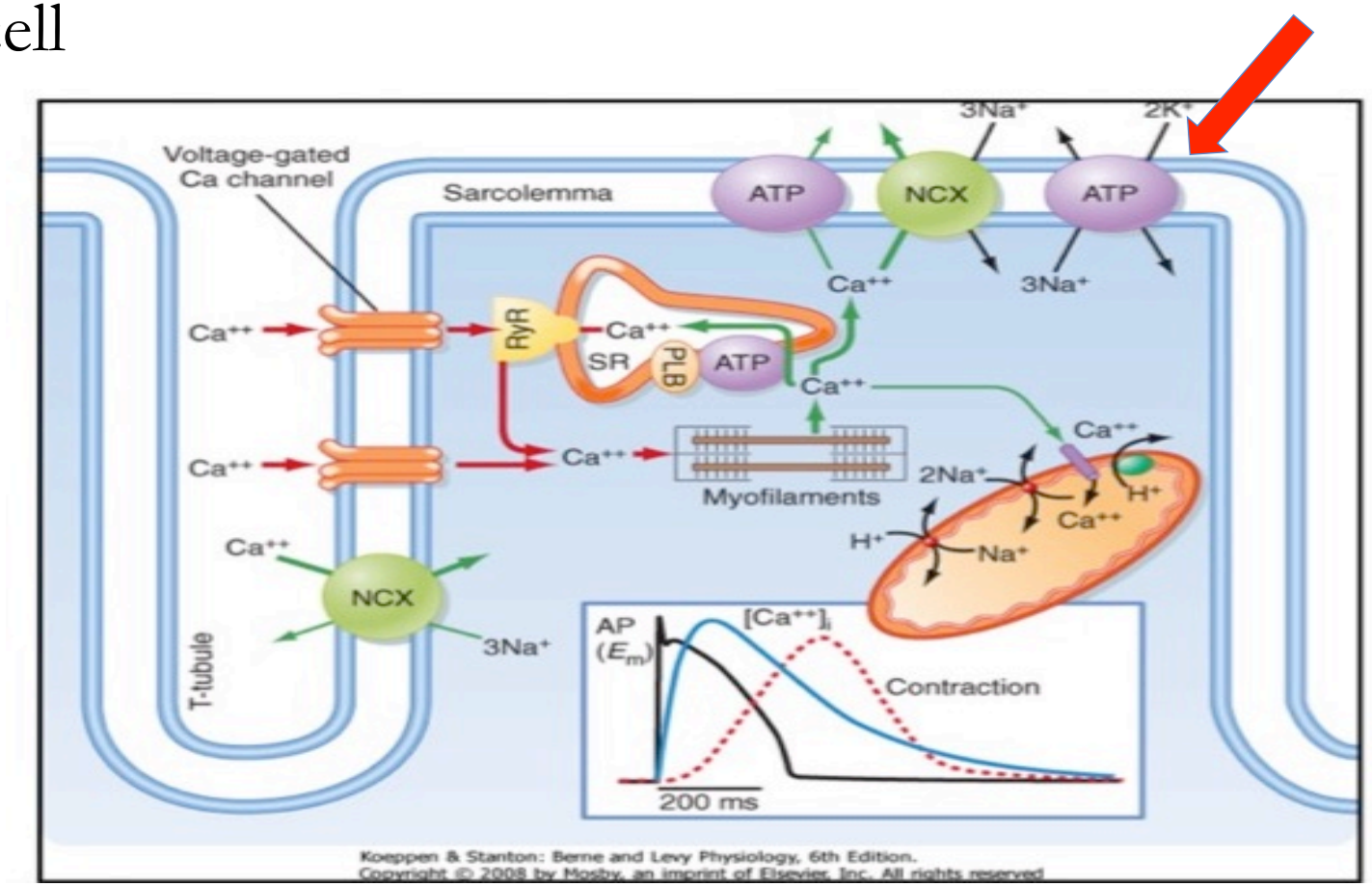
Angiotensin Receptor Blockers
"ARBs"



Angiotensin Receptor Blockers		
Medication	**Effects**	**Side Effects**
	Lowers Blood Pressure	
Losartan		Hyperkalemia
Valsartan		
Candesartan		Metallic Taste
Irbesartan	Decreases TPR	
		Rash
	Prolongs life of patients with CHF	

Cardiac Glycosides

- Increase intracellular CA^{+}
  - Inhibit NA/K pump on cell walls
- (+) Inotropic effect
  - Increased contractility
- Increased cardiac output
- Decreased Preload, cardiac workload and myocardial O2 demand
- (-) Chronotropic effect
  - Decreased HR



Cardiac Glycosides		
Medication	**Effects**	**Side Effects**
		Nausea
Digitalis/Digoxin	Congestive Heart Failure	
Ouabain		Vomiting
Metildigoxin	Atrial Arrhythmias	
Cymarin		Fatigue
		Confusion
		“Digitoxicity”

Digoxin/Digitalis

- Increases myocardial contractility
  - Positive inotrope
- Antiarrhythmic
  - Afib
- Slows SVTs

- Side effects
  - “Digitoxicity”
  - Arrhythmias
  - Nausea
  - Vomiting
  - Confusion
  - Visual disturbances
  - Diarrhea

Digitalis Purpurea
“Common Foxglove”

Putting It All Together

Hypertension Control

- Diuretics
  - Lasix – reduce myocardial afterload
- Centrally acting alpha agonist
  - Catapres (Clonidine) – sympathetic system modulator
    - Blunts HR, vasodilates arterial walls
- Combined drug therapy
  - Beta Blocker/Calcium Channel Blocker
  - Diuretic

Putting It All Together

Hypertension Control

- Angiotensin Converting Enzyme Inhibitor
  - Losartan – Reduces afterload
- Beta Blocker
  - Metoprolol – Alters effect of sympathetic system on B_1 receptors
    - Blunts HR
- Calcium Channel Blocker
  - Diltiazem – inhibits influx of Ca^{+} ions
    - Peripheral vasodilation

Medical Risk Reduction

- Hypertension Control
- Reduce Myocardial Workload/O2 Demand
- Cholesterol/Lipid Management
- Manage Chronic Arrhythmias

"Healthy food is expensive. Can you write me a prescription for groceries?"

BORG RPE	Modified RPE	BREATHING	% MAX HR
6	0	No exertion	50% - 60%
7		Very Light	
8	1		
9			
10	2	Notice breathing deeper, but still comfortable. Conversations possible.	60% - 70%
11			
12	3		
13		Aware of breathing harder; more difficult to hold a conversation	70% - 80%
14	4		
15	5	Starting to breathe hard and get uncomfortable	80% - 90%
16	6		
17	7	Deep and forceful breathing, uncomfortable, don't want to talk	90% - 100%
18	8		
19	9	Extremely hard	
20	10	Maximum exertion	


IT'S FINALLY OVER
I SURVIVED THE PHARMACOLOGY EXAM
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SPOTLIGHT *Series*

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