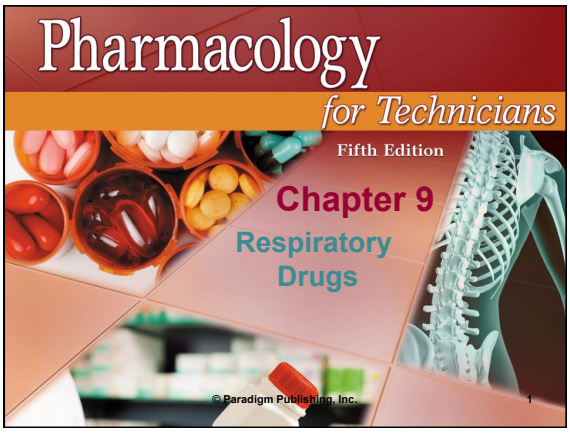


Chapter 9 Topics

- Asthma
- Chronic Obstructive Pulmonary Disease
- Other Lung Diseases
- Cough, Cold, and Allergy
- Smoking Cessation

 2

Learning Objectives

- Differentiate the pulmonary diseases.
- Learn the pathophysiology and treatment of asthma.
- Define the goals of asthma treatment.
- Discuss the pathophysiology and treatment of emphysema and chronic bronchitis.

 3

Learning Objectives

- Describe other diseases related to the lungs.
- Be aware of the reemergence of tuberculosis and of treatment for this disease.
- Understand how the antitussives, expectorants, decongestants, and antihistamines differ, and be able to describe their uses.

 4

Learning Objectives

- Know why some drugs are prescribed for their side effects.
- Outline smoking cessation plans and supportive therapy.

 5

Asthma

- Inflammatory disease in which inflammation causes the airways to tighten
- Reversible condition
- Intermittent attacks are precipitated by specific triggering events
- Causes a decrease in the amount of oxygen and carbon dioxide exchanged

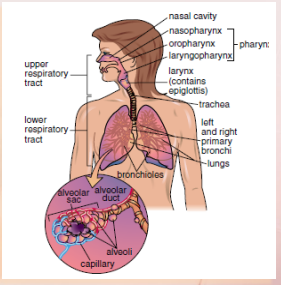
 6

Three Classes of Asthma

- Allergic
  - Present in 35% to 55% of patients
- Exercise Induced
- Nonallergic

 7

Upper and Lower Respiratory Tracts



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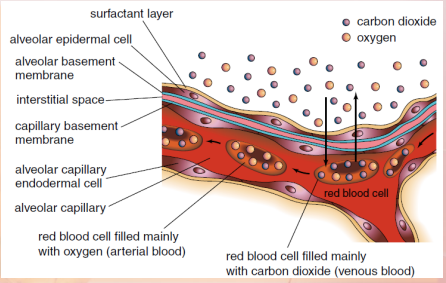
Oxygen and Carbon Dioxide Exchange



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Asthma

- An asthmatic lung compared to a normal lung
  - More sensitive
  - Responds to lower doses of allergens
- Studies strongly support genetic predisposition to developing asthma

 10

Characteristics of Asthma

1. Reversible small airway obstruction
2. Progressive airway inflammation
3. Increased airway responsiveness to variety of stimuli

 11

Characteristics of Asthma

- These 3 characteristics translate into
  - Wheezing
  - Dyspnea
  - Acute and chronic cough

 12

Asthma Attack: First Response

- Triggered by an antigen-antibody reaction
- Causes degranulation of mast cells which release histamine
- Result: bronchospasm and increased mucus production that plugs the small airways

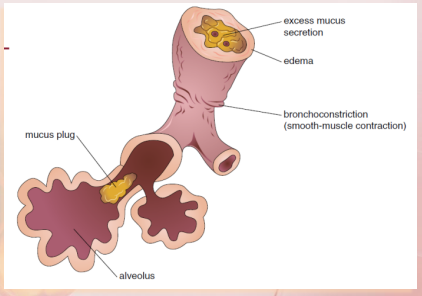
 13

Asthma Attack: Second Response

- Bronchoconstriction with delayed, sustained reactions
- Causes self-sustaining inflammation

 14

Asthmatic Response



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Peak Flow Meter

- Expiratory peak flow rate (PEFR) is the most useful measure to assess
  - Severity
  - Course of asthma
- Patient blows into peak flow meter, PEFR recorded in liters/minute
- Aids in determining course of therapy

 16

Six Goals of Asthma Care

- Sleep well every night
- Be able to go to work or school every day
- Be free from wheezing all day
- Have good control of coughing
- Be able to continue with activities and exercise
- Tolerate medicines well

 17

Asthma Management for Patients

- Know triggers and limit them
- Accurately use a Peak Flow Meter regularly
- Be aware of status asthmaticus, a medical emergency
  - Requires prompt attention
  - May require emergency room

 18

Asthma Drug Therapy

- Drug therapy mainstay of asthma management
- Drug therapy depends on persistence of asthma attacks
- Asthma begins with intermittent attacks. May progress to mild-to-severe, persistent symptoms

 19

Devices Used in Asthma Therapy

- Metered dose inhaler (MDI)
  - Contains medication and compressed air
  - Delivers specific amount of medication with each puff
- Spacer
  - Used with MDIs to get medication into lungs instead of depositing on back of throat
- Nebulizer

 20

HFA Inhalers

- CFCs were propellants of MDIs
  - Depleted Earth's ozone layer
  - Banned in late 1980s
- In 2008 FDA required MDIs to be converted to hydrofluroalkane (HFA), known as HFA MDI inhalers
- HFA inhalers produce finer mist with better lung deposit of drug

 21

Dry Powder Inhalers

- Alternative to CFC-propelled inhalers, no gases used
- Many manufacturers incorporating drugs into dry-powder inhalers
- To use
  - Pellet placed in inhaler and crushed
  - When user inhales, inhaler activates

 22

Priming MDIs

- Prime MDIs before first use, if dropped, or not used for several weeks
- To prime, shake inhaler for 5 seconds. Release spray.
- Also, shake MDIs well before each use

 23

Six Steps to Use HFA MDIs

1. Remove cap and shake inhaler.
2. Breathe out all the way.
3. Place mouthpiece between lips.
4. Press down on inhaler, hold for a few seconds, then breathe in slowly.
5. Hold breath and count to 10.
6. Breathe out slowly.

 24

Five Steps to Use Dry-Powder MDIs

1. Activate the inhaler, insert disk, etc.
2. Breathe out all the way.
3. Place mouthpiece to your lips and breathe in quickly.
4. Hold breath and count to 10.
5. Breathe out slowly.

 25

More MDI Use Instructions

- For a second puff, wait about 1 minute, then return to Step 1.
- If another inhaler is prescribed, wait 5 minutes before use.
- Clean mouthpiece after every use
- Rinse mouthpiece if corticosteroid is used
- Treatment should be reviewed every 3 to 6 months

 26

Nebulizers

- Uses stream of air that flows through liquid medication to make a fine mist for inhalation
- Very effective
- Must be cleaned and taken care of to reduce risk of contamination
- Used for young children

 27

Bronchodilators

- Agents that relax smooth-muscle cells of the bronchioles
  - Airway diameter increases
  - Gases moving in and out of lungs improve
- When using different medications, bronchodilators always used first

 28

Medications Needed By Patients with Asthma

- Both a long-term medication and a rescue medication to treat asthma and control attacks
- Inhaled corticosteroids are the most effective medications

 29

epinephrine (EpiPen)

- Drug of choice for acute attack of asthma
- Many patients with asthma carry an EpiPen

 30

Short-Acting Inhaled Bronchodilators

- albuterol
  - Relaxes bronchial smooth muscle with little effect on heart rate, duration of 3 to 6 hours
- isoproterenol
  - Relaxes bronchial smooth muscle, use up to 5x/day, maximum of 6 inhalations/hour

 31

Short-Acting Inhaled Bronchodilators

- metaproterenol
  - Onset of action within minutes, duration of action 4 hours, little effect on heart rate
- pirbuterol
  - Prevent and treat bronchospasm, duration of action 4 to 6 hours, use up to 12x/day

 32

Long-Acting Inhaled Bronchodilators

- salmeterol
  - For maintenance therapy, use exactly as directed, not for acute situations, long duration useful during night
- terbutaline
  - For reversible airway obstruction and bronchial asthma

 33

Long-Acting Inhaled Bronchodilators

- Formoterol (Foradil)
  - Onset of action within minutes (faster than salmeterol), acts locally in lungs to relax smooth muscle and inhibit release of mast cells
  - Refrigerate until dispensed

 34

Asthma Agents: Xanthine Derivatives

- Drugs structurally similar to caffeine
- Causes relaxation of airway smooth muscle
- Result: Airway dilation and better air movement

 35

Asthma Agents: Leukotriene Inhibitors

- Increase edema, mucus, and vascular permeability
  - Substances can pass through blood vessels
- 100 to 1,000 times more potent than histamine
- Block synthesis of, or the body's inflammatory responses to, leukotrienes

 36

Asthma Agents: Corticosteroids

- Anti-inflammatory agents that suppress the immune response
- Used for more difficult cases of asthma
- Many patients with asthma still not using

 37

Corticosteroids

- Always use lowest effective dose
- Add salmeterol to inhaled corticosteroids if needed to decrease the dose of corticosteroid needed for control

 38

Discussion

Are there any problems with this order?

Serevent should be used BID and should not receive 3 MDIs at a time.

Rx

MT. HOPE MEDICAL PARK
ST. PAUL, MN (651) 555-3591

DEA# _____

Pt. name Mary Lou Jones Date 6-01-15

Address _____

Serevent use as directed prn
three (3)

Azmacort use as directed prn
three (3)

Ventolin use as directed
3–4 Times daily

___ Dispense as written

✓ Fills five times (no refill unless indicated)

Kathy Grad M.D.

 39

Chronic Obstructive Pulmonary Disease (COPD)

- Emphysema and chronic bronchitis
- COPD is irreversible

 40

Emphysema

- Characterized by destruction of air sacs which lose ability to exchange oxygen and carbon dioxide
- Early stages: shortness of breath after heavy exercise
- As disease progresses
  - Patient gasps for air after short walk
  - Causes tachypnea, patient looks flushed

 41

Major Risk Factors For Emphysema

- Cigarette smoking
  - Destroys walls of lungs
- Occupational exposure
- Air pollution
- Genetic factors

 42

Bronchitis

- Lining of the bronchial airways becomes inflamed
- Causes patient to have difficulty breathing out

 43

Two Types of Bronchitis

- Acute
  - Caused by infection, usually viral
  - Runs a brief course
- Chronic
  - Longer lasting condition

 44

Chronic Bronchitis

- Difficult to breathe out
- Characterized by cough that produces purulent, green, or blood-streaked sputum
- Major risk factors
  - Cigarette smoking
  - Exposure to occupational dusts, fumes, and environmental pollution
  - Bacterial infection

 45

Natural Defense System of the Lungs

- In properly functioning system
  - Provides good protection against pathogens
  - Removes potentially infectious agents from the lungs

 46

Six Types of Body Defense Cells

- Ciliary carpet rhythmically moves fluid or mucus up and out of lungs
- Goblet cells secrete mucus
- Clara cells secrete enzymes that break down airborne toxins
- Epithelial cells produce protein-rich exudate

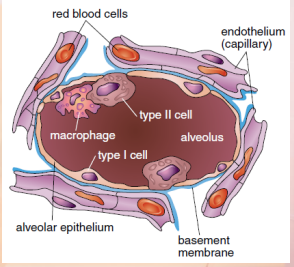
 47

Six Types of Body Defense Cells

- Type I pneumocytes in alveolar membranes act as phagocytes by clearing trash and organisms from the lung
- Type II pneumocytes synthesize and secrete surfactant

 48

Cellular Makeup of an Alveolus and Capillary Supply



 49

Drug Management of Emphysema and Bronchitis

- Largely empirical
- Methylxanthines, corticosteroids, beta agonists, and ipratropium form the foundation of therapy
- One of the best expectorants is water

 50

Drugs Indicated Only for Treatment of COPD

- tiotropium (Spiriva)
  - Similar to ipratropium (Atrovent), but is dosed 1x/daily
- Combivent, DuoNeb, Brovana, and Perforomist

 51

Other Lung Diseases

- Most respiratory infections transmitted through hand contact

 52

Prevention of Lung Diseases

- Do not smoke
- Avoid secondhand smoke
- Avoid air pollution
- Get vaccinations for influenza and pneumonia
- Wash hands

 53

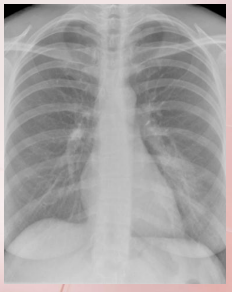
Pneumonia

- Common lung disease, affects all ages
- Can become infected by microorganisms that cause pneumonia by
  - Inhalation of aerosolized particles
  - Entrance through the bloodstream
  - Aspiration (inhalation of fluids from the mouth and throat), commonly occurs during sleep

 54

X-Ray of Pneumonic Lung

X-ray of a patient with pneumonia



 55

Discussion

Why is cigarette smoke implicated in many diseases that affect the lungs?

The chemicals in cigarette smoke destroy the walls of the lungs, including the protective mechanisms.

 56

Cystic Fibrosis

- Hereditary disease that affects the GI and respiratory systems
- Fatal disease; death is associated with the pulmonary system
- GI involvement
  - Increase in production and viscosity of mucus
  - Decreased pancreatic digestive enzymes

 57

Cystic Fibrosis Therapy

- Percussion
  - Tapping movement to induce cough and expectoration of sputum from lungs
- Nebulizer therapy
- Antibiotic therapy
- Annual flu vaccine due to high risk from complications of influenza

 58

Respiratory Distress Syndrome (RDS)

- Occurs in newborns during first few hours
- Characterized by inadequate production of pulmonary surfactant
  - Fluid lowers surface tension between alveoli, causing their collapse
- RDS treated with surfactants

 59

Respiratory Distress Syndrome (RDS)

- Two causes of RDS
  - Prematurity
  - Maternal diabetes
- If RDS occurs, replacement surfactant administered

 60

Tuberculosis

- Caused by bacterium *mycobacterium tuberculosis*
- Primarily affects the lungs, may also affect other body tissues and organs
- Transmission through inhaled droplets from an infected person
  - Droplets descend 1 to 2 inches per hour

 61

Tuberculosis (TB)

- Seen primarily in
  - Alcoholics
  - Prison population
  - Immunocompromised
  - Elderly

 62

Two Classes of Tuberculosis

- Exposed, but showing no disease
  - Test positive on TB test, may not have active disease
- Exposed and have active organisms
  - May or may not produce antibodies
  - Signs and symptoms: weight loss, spitting blood, night sweats and night fever, chest pain, malaise

 63

TB Test

- Protein derivative from killed bacteria injected intradermally
- If patient has been exposed to or has disease, test will be positive
- If positive, patient must have x-rays to look for signs of active disease

 64

Four Goals of TB Therapy

- Initiate treatment promptly
- Convert sputum culture to negative as soon as possible
- Achieve cure without relapse
- Prevent emergence of drug-resistant strains

 65

TB Treatment Regimens

- Patients with no symptoms, but positive x-ray
  - Single agent, usually INH 300 mg QD X 12 months
- Patients with clinical disease
  - At least 2 agents at a time to prevent development of drug-resistance bacteria

 66

Multidrug Resistant Tuberculosis (MDR-TB)

- MDR-TB, a new strain, has emerged and is resistant to commonly used drugs
- Risk factors for acquiring MDR-TB
  - Being exposed to MDR-TB
  - Not completing TB therapy
  - Being prescribed inappropriate agents
  - Having immune deficiencies
  - Having recurrence of TB

 67

Discussion

Why is patient compliance such an issue with tuberculosis patients?

Patient noncompliance is due to severe side effects, length of time for therapy, and the number of medications. Patients being treated for active TB should avoid alcohol, which is a problem for some populations

 68

Histoplasmosis

- Fungal pulmonary disease
- Caused by breathing in spores from droppings of chickens, pigeons, starlings, other birds, and bats
- Called the summer flu due to flu-like symptoms
- Treatment: Amphotericin B and itraconazole

 69

Cough, Cold, and Allergy

- Common cold most prevalent respiratory tract infections; viral infection
- Symptoms
  - Mild malaise
  - Rhinorrhea (runny nose)
  - Sneezing
  - Scratchy throat
  - Fever

 70

Colds

- Bacterial sinusitis and otitis media are frequent complications warranting antibiotic therapy

 71

Allergies

- Symptoms of some allergies same as colds, like runny nose and itchy eyes
- Allergy is state of hypersensitivity induced by exposure to particular antigen
- Colds and many allergies treated with same medications

 72

OTC Products for Colds and Coughs

- People self-treat colds and coughs to relieve symptoms and prevent complications
- 4 groups of drugs, alone or combinations: antitussives, expectorants, decongestants, antihistamines. Most are OTCs
  - Each has different mechanism of action and purpose

 73

OTC Products for Colds and Coughs

- Pharmacy technicians cannot make OTC remedy recommendations
- Technicians can
  - Direct patient to OTC remedies
  - Make patient aware of proper uses and side effects
- Tavist (clemastine) only drug approved by FDA to treat colds

 74

Transmitting Colds

- Colds transmitted person to person
  - Directly when infected person sneezes or coughs
  - Indirectly by surfaces such as telephones, doorknobs, toys
- To cough, turn head and cough into shoulder, not the hand

 75

Preventing Colds

- Often contract cold by rubbing eyes or nose after touching contaminated surface or people with cold
- Best prevention is to wash hands
- In pharmacy, wipe phones with alcohol regularly

 76

Antitussives

- Coughing clears airways of excess secretions and foreign materials
- Reduce the frequency of a cough, especially if dry and nonproductive
  - CNS depression of cough center (reflex)

 77

Cough Reflex and Antitussives

- Cough reflex stimulated by stretch receptors and irritant receptors in lungs and airway
- Antitussive products
  - Correct or block irritation of receptors
  - Block transmission to brain
  - Increase cough center threshold
  - Block action of expiratory muscles

 78

Codeine

- The "Gold Standard," against which all other antitussives are compared
- Drying effect on respiratory mucosa
- By itself, it is a Schedule II controlled substance, but depending on what drug it is paired with, it can have other control schedules
- May be purchased without a prescription in some states
  - Dispensing must be done by the pharmacist who writes initials by patient's signature

 79

Expectorants

- Help rid lungs and airway of mucus when coughing
- Decrease thickness and viscosity (stickiness) of mucus so cough will eject mucus
- Used for dry and productive coughs

 80

Water

- Can work as well as, if not better than, medication expectorants
- Staying well-hydrated thins mucus and allows for easier expectoration
- 6 to 8 glasses of water a day

 81

Decongestants

- Swelling and stuffiness caused by vasodilation and leakage of fluids into nasal mucosa
- Decongestants cause constriction
  - Promotes drainage, improves nasal ventilation, and relieves stuffiness
  - Allows sinus cavities to drain

 82

Decongestants

- Increase heart rate and blood pressure
- Stimulates the CNS
- Patients sometimes take decongestants to overcome drowsiness
- Should not be taken by those who cannot tolerate sympathetic stimulation

 83

Decongestants

- Prolonged use of topical decongestants can cause rebound rhinitis medicamentosa
- Therapy should not exceed 3 to 5 days
- Available in topical and oral forms

 84

Antihistamines

- Used primarily to combat allergic reactions, nausea, vertigo, and insomnia
- Most common side effects are sedation, dry mouth, constipation, urinary retention
- Prevent binding of histamine to receptor sites
- Many are sold OTC

 85

Antihistamines

- Well absorbed in tissues
- Widely distributed across blood-brain barrier causing sedation
- Can cross the placenta and adversely affect fetus

 86

Hypersensitivity Reactions

- Excessive immune response to a foreign agent
- Can range from a slight rash to a serious response such as serum sickness

 87

Nasal Corticosteroids

- Most effective monotherapy for allergic rhinitis
- Must be used daily
- Can cause nasal irritation and bleeding; direct spray away from septum
- Local infections of *Candida albicans* may occur in nose with long term use

 88

Smoking Cessation

- On average, cigarette smokers lose about 15 years of life
- Cigarette smoke contains 4,000^{+} chemical compounds including at least 43 carcinogens
- Secondhand smoke contains all 43 carcinogens and toxins

 89

Smoking

- Can lead to
  - Leukemia
  - Cancer: lung, mouth, pharynx, larynx, esophagus, pancreas, cervix, kidney, bladder, ovaries, uterus, and prostate
- Increases risk of heart disease, COPD, stroke

 90

Smoking

- Related to birth defects of mothers who smoke during pregnancy
- Secondhand smoke puts children at risk of developing asthma, respiratory infection, and middle-ear infection
- Nicotine is addictive component of tobacco. Can interact with some medications

 91

Effects of Nicotine

- CNS and PNS stimulation and depression
- Respiratory stimulation
- Skeletal muscle relaxation
- Increase in blood pressure, heart rate, cardiac output, oxygen consumption
- Physical and psychological dependence

 92

Personal Benefits to Smoking Cessation

- Improved performance in sports and sex
- Better-smelling home, car, clothing, breath
- Economic savings
- Addiction freedom
- Healthier babies
- Improved health and self-esteem
- Improved sense of taste and smell
- No exposing others to smoke
- Set good example

 93

5 Step Quit Plan

1. Set a date
2. Inform family, friends, coworkers
3. Remove cigarettes from daily life
4. Review previous attempts and analyze what caused relapse
5. Anticipate challenges

 94

Smoking Cessation

- Key is abstinence
- Some fears that keep people from quitting: weight gain, nicotine withdrawal
- Most nicotine cessation drugs OTC
  - varenicline (Chantix) most successful

 95

Symptoms of Nicotine Withdrawal

- Anxiety
- Craving tobacco
- Decreased blood pressure and heart rate
- Depression
- Difficulty concentrating
- Drowsiness
- Frustration, irritability, hostility
- GI disturbances
- Headache
- Increased appetite, skin temperature
- Insomnia

 96

Symptoms of Nicotine Excess

- Abdominal pain
- Confusion
- Diarrhea
- Dizziness
- Headache
- Hearing loss
- Hypersalivation
- Nausea
- Perspiration
- Visual disturbances
- Vomiting
- Weakness

 97

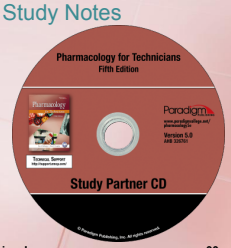
Discussion

You are trying to get a friend to stop smoking. Name five reasons why your friend should quit.

 98

Assignments

- Complete Chapter Review activities
- Answer questions in Study Notes document
- Study Partner
  - Quiz in review mode
  - Matching activities
  - Drug tables



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Pharmacology *for Technicians*

Fifth Edition

Chapter 10

Drugs for Gastrointestinal and Related Diseases

 100

Chapter 10 Topics

- The Gastrointestinal System
- Gastrointestinal Diseases
- Diarrhea
- Constipation and Related GI Diseases
- Nausea and Vomiting
- Obesity
- Parasites and Protozoa
- Hepatitis

101

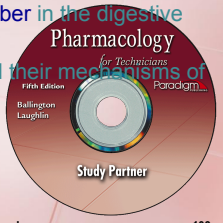
Learning Objectives

- Describe gastrointestinal physiology and how it affects GI diseases.
- Be aware of drug treatments for GI diseases.
- Understand gastroesophageal reflux disease and its ramifications.

 102

Learning Objectives

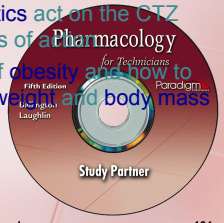
- Discuss antidiarrheal agents and explain how they work.
- Describe the role of fiber in the digestive process.
- Discuss laxatives and their mechanisms of action.



 103

Learning Objectives

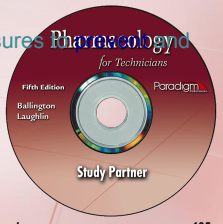
- Identify the chemoreceptor trigger zone (CTZ) and discuss its role in nausea.
- Know which antiemetics act on the CTZ and their mechanisms of action.
- Know the definition of obesity and how to calculate ideal body weight and body mass index.



 104

Learning Objectives

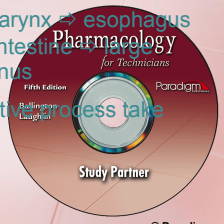
- Recognize medications used to treat malaria and the side effects of these drugs.
- Understand the measures used to prevent and treat hepatitis.



 105

The Gastrointestinal System

- Gastrointestinal (GI) tract is a continuous tube
- Starts at mouth ⇨ pharynx ⇨ esophagus ⇨ stomach ⇨ small intestine ⇨ large intestine ⇨ ends at anus
- Digestive and absorptive process take place in the GI tract



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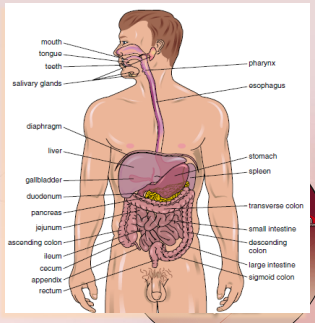
The GI System



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GI Transit Time

- Time it takes for material to pass from one end of GI tract to other end
- Subdivided into gastric emptying and small intestine and colon transit time
- Speeding up transit time = less absorption
- Slowing transit time = more absorption

108

Stomach

- Layers of smooth muscle lined with glands
- Glands secrete gastric juice containing enzyme and hydrochloric acid that break down food and mucus
- Food moves from stomach to small intestine where most absorption takes place

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Gastrointestinal Diseases

- Wide variety of GI tract diseases
- Most common: gastroesophageal reflux disease (GERD or heartburn) and peptic disease
- Other GI diseases include gastritis and inflammatory bowel disease

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Gastroesophageal Reflux Disease (GERD)

- Symptoms
  - Radiating burning or pain in chest
  - Acid taste
  - Recurrent abdominal pain
- Meal-related esophagitis due to reflux (backflow) of acidic stomach contents through incompetent esophageal sphincter

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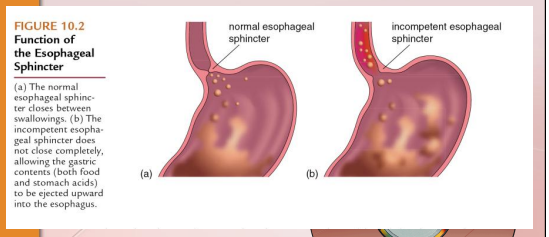

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Factors Contributing to GERD

- Overeating
- Eating on the run
- Eating late at night
- Drinking alcohol
- Smoking cigarettes
- Consuming foods with high fat content, caffeine (chocolate, coffee, tea, and colas), citric and other acids, spices

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Therapy for GERD

- Preventative behavior
- Preventative dietary changes
- Avoiding medications or other substances that promote reflux
- Using a combination of medications

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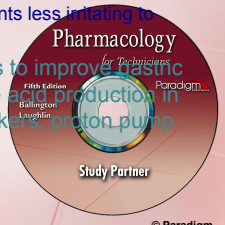
Pharmacologic Therapy for GERD

- Phase I. Antacids to neutralize acidic stomach contents
  - If reflux occurs, contents less irritating to esophageal lining
- Phase II. Medications to improve gastric motility and decrease acid production in the stomach (H_2 blockers, proton pump inhibitors)



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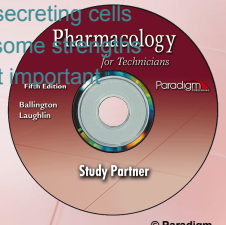
H_2 Histamine Receptor Antagonists

- Block gastric acid and pepsin secretion
- Competitive inhibition of H_2 histamine receptors on gastric-secreting cells
- All available OTC in some strengths
- Bedtime dose is most important



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Proton Pump Inhibitors

- An enzyme maintains acidity in gastric secretions by pumping
  - Acidic hydrogen ions (protons) into stomach
  - Nonacidic potassium ions out
- Proton pump inhibitors (PPIs) block this enzyme, reducing stomach acidity
- PPIs must be taken daily

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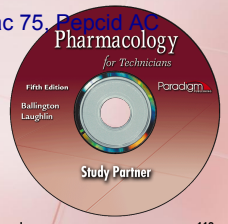
Discussion

What are some of the most common OTC preparations for GERD?

Prilosec OTC, Zantac 75, Pepcid AC



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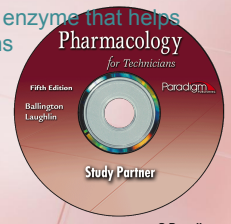
Peptic Disease

- Disorders of upper GI tract caused by the action of acid and pepsin
- Pepsin is a stomach enzyme that helps degrade food proteins



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Ulcer

- Ulcer: local defect or excavation of the surface of an organ or tissue
- Peptic ulcer: ulcer formed on any part of the GI tract exposed to acid and pepsin
- Three common types of peptic ulcers: gastric, duodenal, stress

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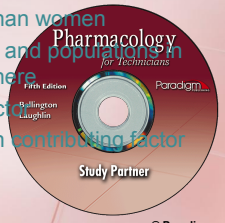
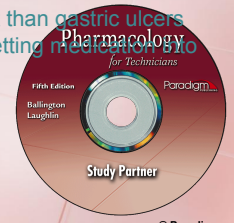
Gastric Ulcers

- Local excavation in the gastric mucosa
- Have malignant potential
- Occur more in men than women
- Prevalent in smokers and populations in the Western Hemisphere
- Family history risk factor
- *H. pylori* is a common contributing factor



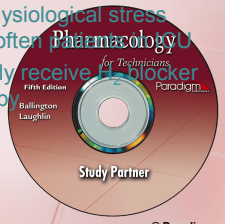
Duodenal Ulcers

- Peptic lesion in the duodenum
- Occur more in hypersecretors
- More difficult to treat than gastric ulcers due to difficulty of getting medication into the duodenum



Stress Ulcers

- Peptic ulcer, usually gastric, that occurs in the clinical setting
- Caused by severe physiological stress from serious illness; often patients in ICU
- Patients in ICU usually receive H_2 blocker as prophylactic therapy

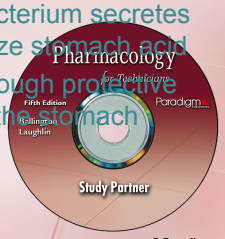


Drugs That May Cause Ulcers

Drug	Adverse Effect
alcohol, aspirin, potassium chloride	irritating to the GI tract
anti-inflammatory drugs	reduce production of mucus
corticosteroids	reduce the mucosal barrier
methotrexate	irritating to the GI tract; ulceration, hemorrhage
iron	causes esophageal ulcers

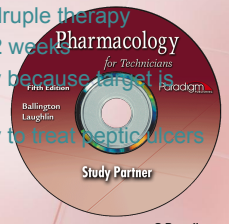
H. pylori, Bacterium

- Causes most peptic ulcers
- Spiral-shaped bacterium secretes enzymes neutralize stomach acid
- Then burrows through protective mucous lining of the stomach



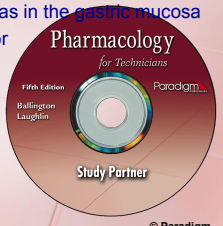
Pharmacologic Treatment of *H. pylori*

- Triple therapy for *H. pylori* is a PPI or antacid and 2 antibiotics
- If unsuccessful, quadruple therapy
- Drugs are taken for 2 weeks
- Antibiotic is mainstay because target is bacteria
- Last resort is surgery to treat peptic ulcers



Other GI Diseases: Gastritis

- Irritation and superficial erosion of the stomach lining
  - Spread over large areas in the gastric mucosa
  - Alcohol common factor



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Other GI Diseases: Ulcerative Colitis

- Form of inflammatory bowel disease
- Irritation and inflammation of the large bowel (colon and rectum)
- Characterized by bloody mucus leading to watery diarrhea with blood, mucus, and pus

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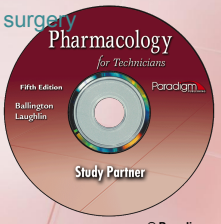
Other GI Diseases: Crohn's Disease

- Form of inflammatory bowel disease
- Can affect any portion of tubular GI tract
- Cannot be cured with surgery



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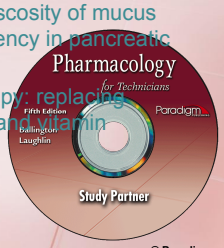
Other GI Diseases: Cystic Fibrosis

- GI and pulmonary disease
- GI tract: increased viscosity of mucus secretions and deficiency in pancreatic enzymes
- Backbone of GI therapy: replacing pancreatic enzymes and vitamin supplementation



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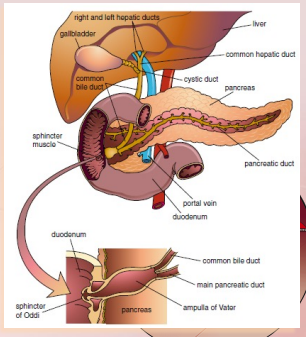
Bile Duct and Pancreas



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Diarrhea

- Many causes: bacterial and viral infection, parasite, medications
- Can quickly lead to dehydration
- Affects absorption of drugs, vitamins, nutrients, and toxins

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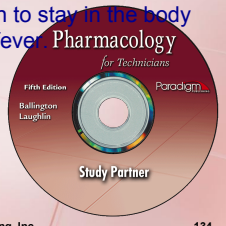
Diarrhea

- Some antidiarrheals should not be used to manage short-term, self-limiting diarrhea
  - Prolong fever
  - Delay clearance of causative pathogen

Discussion

Why is it dangerous to take an antidiarrheal when a pathogen is the cause?

It allows the pathogen to stay in the body longer and prolongs fever.

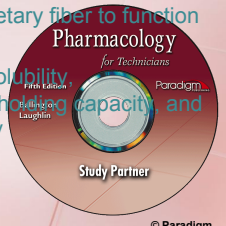


Constipation and Related GI Diseases

- Constipation and several GI diseases are related to dietary fiber

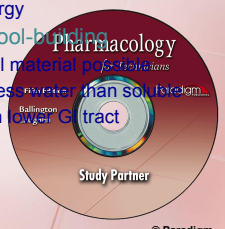
Fiber

- Undigested residue of fruits, vegetables, and other foods of plant origin
- Colon depends on dietary fiber to function normally
- Classified by water solubility, fermentability, water-holding capacity, and stool-bulking capacity



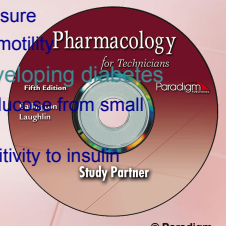
Three Types of Fiber

- Soluble fiber
  - Fermented. End products: short fatty acids, gases, water and energy
- Water-holding and stool-bulking
  - Makes bulking of fecal material possible
  - Insoluble fibers hold less water than soluble
  - Provides lubrication in lower GI tract



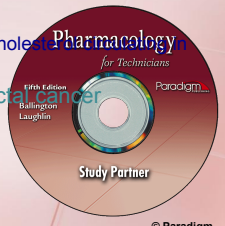
Benefits of Fiber

- Helps alleviate constipation
  - Increases colon content
  - Decreases colon pressure
  - Increases propulsive motility
- Decreases risk of developing diabetes
  - Slows absorption of glucose from small intestine
  - Increases tissue sensitivity to insulin



Benefits of Fiber

- Lowers coronary artery disease risk
- Fiber causes more bile acids to be formed from cholesterol
  - Depletes amount of cholesterol in the body
- Lowers risk of colorectal cancer



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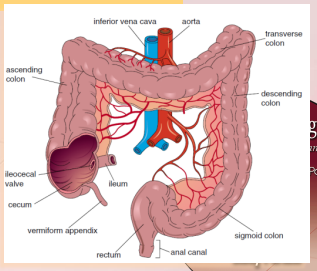
The Large Intestine



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Fiber Supplementation

- Used to decrease constipation, suppress appetite, and achieve weight loss
  - Produces feelings of satiety (fullness)
  - Beneficial fiber intake threshold not established
- Adverse effects
  - Distention
  - Excessive gas
  - Flatulence

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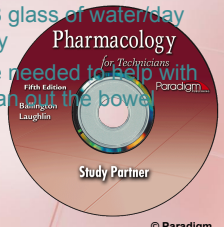
Pharmacologic Treatment of Constipation

- Constipation can have multiple causes, including low-fiber diet
- Important to drink 6-8 glass of water/day and exercise regularly
- Sometimes drugs are needed to help with constipation or to clean out the bowel



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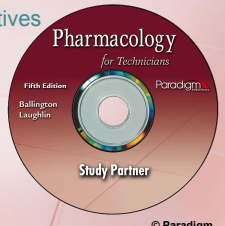
Pharmacologic Treatment of Constipation

- Osmotic laxatives
- Saline laxatives
- Irritant/stimulant laxatives
- Surfactants
- Bulk-forming agents



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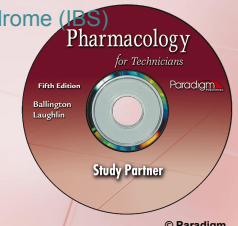
Other GI Diseases That May Accompany Constipation

- Diverticular disease
- Hiatal hernia
- Irritable Bowel Syndrome (IBS)
- Hemorrhoids



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Diverticular Disease

- Formation and inflammation of an outpocketing from the colon wall
- Results from deficiency in fiber over time
- Related to eating more refined carbohydrates and processed foods

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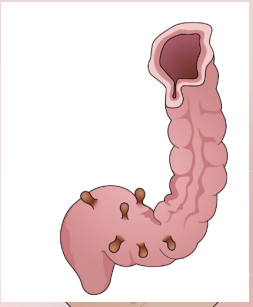
Portion of the Colon with Diverticula



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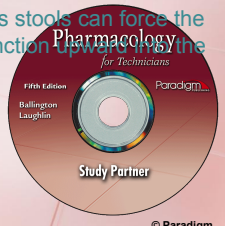
Hiatal Hernia

- Related to chronic constipation
- Takes several years to develop
- Daily straining to pass stools can force the gastroesophageal junction upward into the thoracic cavity



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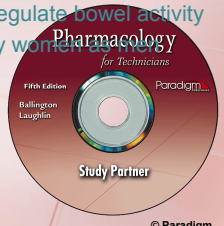
Irritable Bowel Syndrome (IBS)

- Most common GI disorder
- Lower GI tract does not have appropriate tone or spasticity to regulate bowel activity
- Affects twice as many women as men



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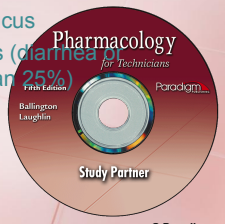
Criteria for Diagnosis of Irritable Bowel Syndrome

- Abdominal distention
- Gas
- Increased colonic mucus
- Irregular bowel habits (diarrhea or constipation more than 25%)
- Pain



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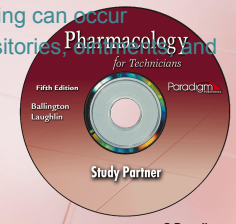
Hemorrhoids

- Caused by pressure exerted on anal veins while straining to pass a stool
- Hemorrhoidal bleeding can occur
- Treated with suppositories, ointments, and sometimes surgery



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Nausea and Vomiting

- Vomiting center in medulla receives impulses from chemoreceptor trigger zone (CTZ)
- CTZ receives input from
  - Cerebral cortex
  - Hypothalamus
  - Blood-borne stimuli

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Two Ways to Initiate Vomiting

- Stimulate the CTZ
  - Which stimulates the GI tract
- Stimulate the vagal receptors in the stomach
  - No CTZ involvement

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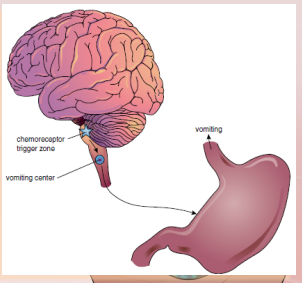
Chemoreceptor Trigger Zone and Vomiting Center



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Vomiting

- Can cause
  - Dehydration
  - Electrolyte imbalance
  - Possible aspiration pneumonia
  - Bradycardia
  - Other arrhythmias

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Vomiting and Narcotics

- Vomiting often occurs from narcotic intake
  - Dose related
- Narcotics increase the inner ears' sensitivity to stimuli
- Stimulating inner ears can result in vertigo

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Vertigo

- Sensation of the room spinning
- Can be due to stimulation of the inner ear
- Same is true of car sickness
- Treated with anticholinergics

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Serotonin Receptor Antagonists

- Bind to serotonin (5-HT) receptors to prevent nausea
- dolasetron (Anzemet) and ondansetron (Zofran)
  - Used for chemotherapy-induced nausea
- granisetron (Kytril)
  - Usually given by IV

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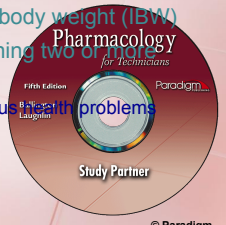
Obesity

- Obesity: total body weight includes greater quantities of fat than normal
- Normal weight: ideal body weight (IBW)
- Morbid obesity: weighing two or more times IBW
  - Results in many serious health problems



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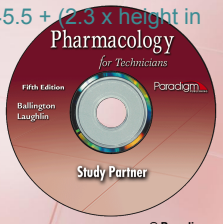
Male and Female Ideal Body Weight (IBW)

- Male IBW in kg = 50 + (2.3 x height in inches over 5 feet)
- Female IBW in kg = 45.5 + (2.3 x height in inches over 5 feet)



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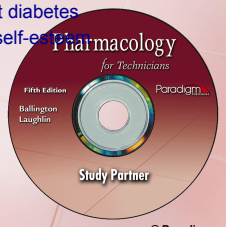
Obesity

- Physiological and psychological problems
  - Higher incidence of cardiovascular disease and non-insulin dependent diabetes
  - Anxiety, stress, poor self-esteem



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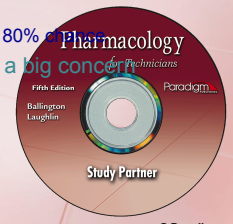
Genetic Factors in Obesity

- Child with
  - 1 obese parent has 50% chance of being obese
  - 2 obese parents has 80% chance
- Childhood obesity is a big concern



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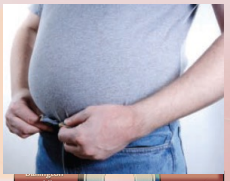
Management of Obesity

- Diet
- Behavioral modification
- Prescription and non-prescription medications
- Surgical procedures
- Other non-drug therapies



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Three Types of Diets

- Calorie restriction
  - To lose 1 pound, decrease food intake by 3,500 calories
- Manipulation of amounts of protein, carbohydrates, and fats but no calorie restriction
- Decrease in grams of fat consumed

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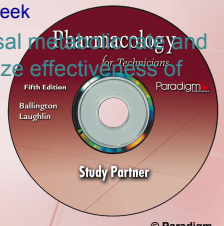
Weight-Loss Diets

- At start of a weight-loss diet, first loss is retained water
  - Up to 6 pounds first week
- Later decrease in basal metabolic rate and activity levels neutralize effectiveness of diet



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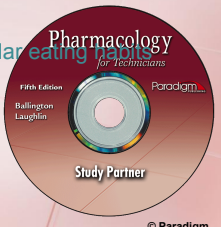
Roller-Coaster Syndrome

1. Weight loss
2. Plateau
3. Cessation of dieting
4. Resumption of regular eating habits
5. Increase in weight



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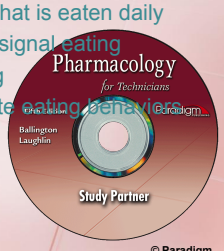
Behavior Modification to Stop Roller-Coaster

- Exercise is most important
- Keeping records of what is eaten daily
- Restricting cues that signal eating
- Slowing rate of eating
- Rewarding appropriate eating behaviors



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Body Mass Index (BMI) and Therapy Options

- To determine BMI, divide patient's weight (kg) by height (m^2)
- BMI used to decide appropriate therapy
  - Stimulants most commonly used as an aid to weight reduction + balanced diet
  - Surgery

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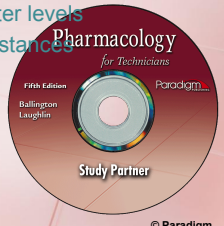
Stimulants

- Most commonly used agents for weight reduction
- Act on neurotransmitter levels
- All are controlled substances



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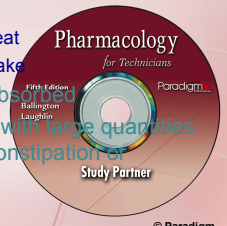
Fiber Supplementation

- Bulk-producing products containing fibers from natural components provide a sense of fullness
  - Decreases desire to eat
  - Decreases caloric intake
- Ingredients are not absorbed
- Must be eaten/taken with large quantities of water to prevent constipation or obstruction



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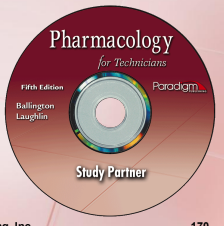
Discussion

Why do you think the roller-coaster syndrome is so prevalent?



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Parasites and Protozoa

- Each parasite has a specific animal host
- Many parasites spend part of their life in two different hosts
  - Vector: intermediate host, transmits parasite to another host
- Factors supporting infection: poor sanitation, overcrowding, warm climate, inadequate health education, poor control of vectors, reservoirs of infection

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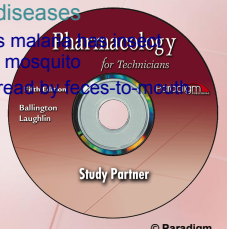
Protozoan Infections

- Single-cell organisms that live in water and soil, usually harmless to humans
- Some cause human diseases
  - Protozoan that causes malaria, transmitted vector, the *Anopheles* mosquito
  - Intestinal protozoa spread by feces-to-mouth



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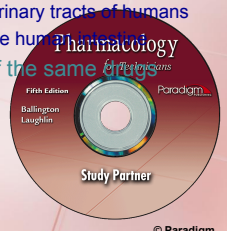
Protozoa and GI Infections

- 2 protozoa cause many GI infections
  - *Trichomonas*, parasitic protozoan found in intestinal and genitourinary tracts of humans
  - *Giardia* common in the human intestinal
- Treated with many of the same drugs



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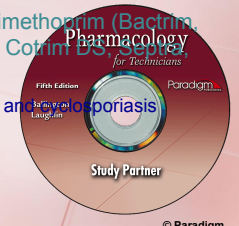
Medications to Treat Protozoan Infections

- metronidazole (Flagyl, Flagyl I.V.)
  - To treat amebiasis
- sulfamethoxazole-trimethoprim (Bactrim, Bactrim DS, Cotrim, Cotrim DS, Sentra, Septra DS)
  - To treat isosporiasis and cyclosporiasis



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Malaria

- Acquired from bite of *Anopheles* mosquito, blood transfusion, or shared needle
- Prevalent in many countries, but not United States
- Travelers should take precautions

 175

Malaria

- Incubation period 10 to 35 days
- Symptoms: high fever, recurrent chills, sweating, jaundice
- Medications can be used as prophylaxis or for treatment

 176

Hepatitis

- Liver disease with forms A through G
- A, B, C most common
- Can damage liver cells and cause the liver to become swollen and tender
- Some cause permanent damage
- Causes: viral, medications, long-term alcohol use, certain industrial drugs

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Transmission of Hepatitis

- Hepatitis A and B can be transmitted from one person to another through
  - Contact
  - Blood and body fluids
  - Fecal-oral route
- Hepatitis C can be transmitted through
  - Blood and body fluids

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Hepatitis A

- Most common and least dangerous form
- Produces epidemics due to fecal-mouth route of transmission
- Treatment is food and rest, no drugs

179

Two Types of Hepatitis B

- Acute usually goes away without treatment
- Chronic most dangerous form of hepatitis
  - Can be cause of liver cancer or cirrhosis
  - Patient may require liver transplant
  - Treated with antivirals

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Vaccines for Hepatitis B

- Vaccines given in 3 dose series over 6 months
- Vaccines are Recombivax HB and Enegerix B
- Most health care workers, including pharmacy technicians, should receive vaccines

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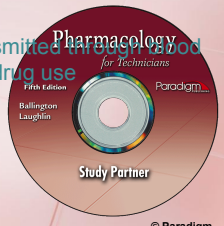
Hepatitis C

- Not spread from person to person
- Can progress to liver fibrosis and end-stage liver disease
- Most commonly transmitted through blood transfusions or illicit drug use



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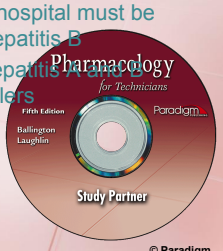
Prevention of Hepatitis

- Prevention is through vaccinations
- Anyone working in a hospital must be vaccinated against hepatitis B
- CDC recommends hepatitis A and B vaccinations for travelers



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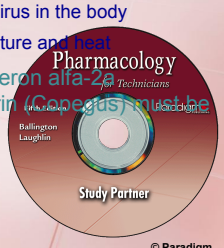
Most Effective Drugs for Hepatitis B and C

- Hepatitis B: adefovir (Hepsera)
  - Blocks replication of virus in the body
  - Store away from moisture and heat
- Hepatitis C: peginterferon alfa-2a (Pegasys) and ribavirin (Copegus) must be used together



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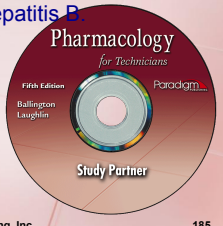
Discussion

Scenario: You go out to eat at a restaurant. Which type of Hepatitis could you acquire?

You could acquire Hepatitis B.



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Assignments

- Complete Chapter Review activities
- Answer questions in Study Notes document
- Study Partner
  - Quiz in review mode
  - Matching activities
  - Drug tables

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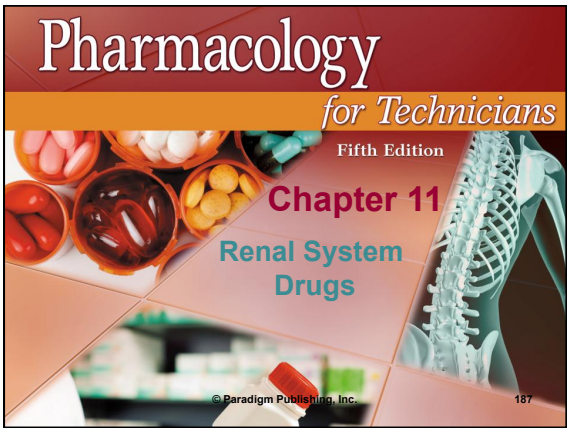
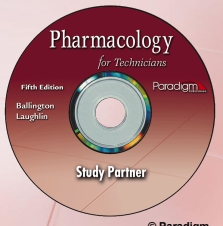


Chapter 11 Topics

- Function of the Renal System
- Drugs for Urinary Tract Diseases and Disorders
- Diuretics



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Learning Objectives

- Understand the renal system, its importance, and how it works.
- Differentiate the parts of the renal system.
- Understand the drugs used to treat renal disease.

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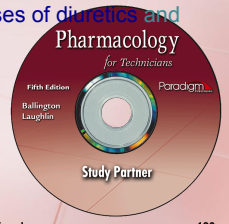
Learning Objectives

- Know the causes and treatment of urinary tract infections.
- Understand the classes of diuretics and how they work.



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Function of the Renal System

- Primary functions
  - Maintain water balance
  - Maintain electrolyte balance
  - Maintain acid and base balance
  - Produce urine

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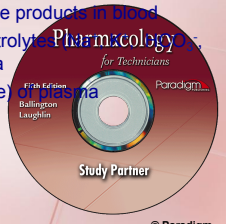
Urine Production

In forming urine, the kidneys regulate

1. Blood volume, thus blood pressure
2. Concentration of waste products in blood
3. Concentration of electrolytes (Na^+, K^+, Ca^{2+}, PO_4^{-3}) in plasma
4. pH (acid-base balance) of plasma



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Kidneys

- Nephrons are the working units of kidneys
  - 2 million per kidney
- Renal tubules of nephrons produce urine through filtration, reabsorption, and secretion

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Three Processes of Urine Production

- Filtration
  - Removal of substances from blood
  - Occurs in the glomeruli
- Reabsorption
  - Filtered substances selectively absorbed back into blood
  - Sodium and chloride absorbed in distal tubule and loop of Henle

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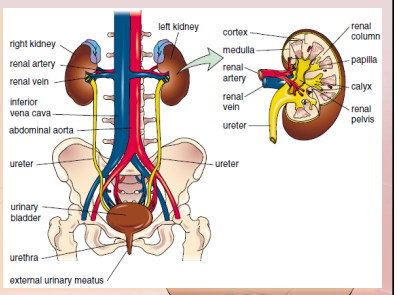
Urinary System and Renal System



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Three Processes of Urine Production

- Secretion
  - Hydrogen ions, potassium ions, weak acids, weak bases
  - Hydrogen ion secretion regulates the acid-base balance
  - Blood pH between 7.32 and 7.42, slightly acidic

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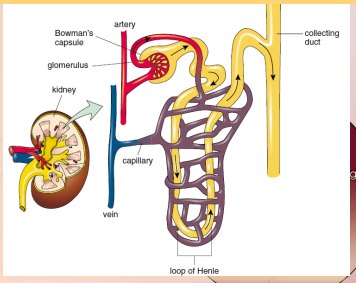
Anatomy of the Nephron



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Acute Renal Failure

- Rapid reduction in kidney function
- Results in accumulation of nitrogen and other wastes in the blood stream
- Causes: renal ischemia, trauma, pregnancy, volume depletion, hemorrhage, surgery or shock

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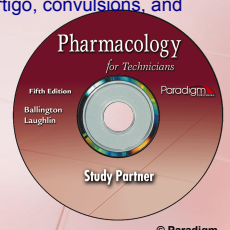
Acute Renal Failure

- Can result in uremia
  - Excessive urea retained in blood, causing nausea, vomiting, vertigo, convulsions, and coma



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Four Stages of Renal Disease

1. Loss of Renal Reserve
   - Generally no symptoms
2. Renal Insufficiency
   - Generally asymptomatic, but may have nocturia and hypertension
   - Blood urea level and creatinine levels slightly elevated, mild anemia

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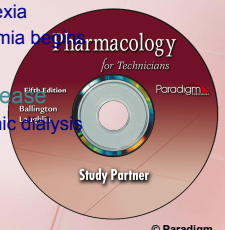
Four Stages of Renal Disease

3. Chronic Renal Insufficiency
   - Easily fatigued, intolerant to cold, abnormal taste sensation, anorexia
   - Anemia worsens, uremia begins
   - Dialysis is indicated
4. End-Stage Renal Disease
   - Patient requires chronic dialysis



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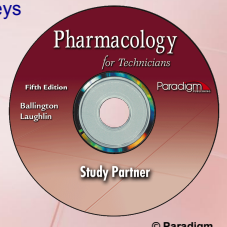
Causes of Renal Failure

- Prerenal Events
  - Reduced renal blood flow due to a problem occurring above kidneys



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Causes of Renal Failure

- Prerenal Events
- Intrarenal Events
  - Damage to kidney
  - Damage to glomeruli may result from damage to vascular tree, change in glomerular permeability, autoimmune reactions, or radiocontrast dyes
- Contrast dyes third most common cause of renal failure in hospitalized patients

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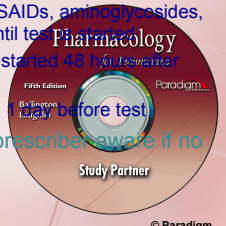
Technicians and Radioactive Dye Tests

- Technician make sure
  - Patient is well hydrated
  - Nephrotoxic drugs (NSAIDs, aminoglycosides, cyclosporines) held until test is ordered
  - Metformin stopped, restarted 48 hours after test
  - Acetylcysteine started 1 day before test
- Make pharmacist or prescriber aware if no orders



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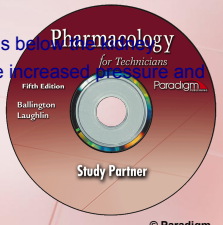
Causes of Renal Failure

- Prerenal Events
- Intrarenal Events
- Postrenal Events
  - Can occur in structures below the kidneys
  - Obstruction can cause increased pressure and tubular damage



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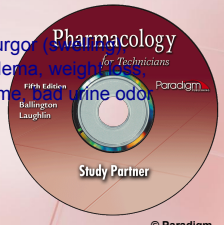
Diagnosis of Renal Disease

- Diagnosis of renal disease made by signs and evaluations
- Signs
  - Orthostatic BP, skin turgor (swelling), temperature, color, edema, weight loss, changes in urine volume, bad urine odor



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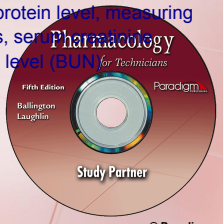
Diagnosis of Renal Disease

- Evaluations
  - Filtration rate, urine volume, electrolyte levels and osmolality, urine protein level, measuring of other urine contents, serum creatinine levels, and blood urea level (BUN)



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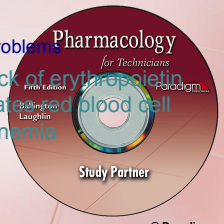
Renal Drug Therapy

- Aimed at correcting
  - Intravascular volume and pressure
  - Restricting fluids
  - Treating underlying problems
- Anemia caused by lack of erythropoietin (hormone that stimulates red blood cell production) causes anemia



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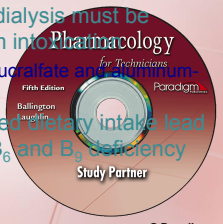
Renal Drug Therapy

- Most renal patients show erythropoietin deficiency
- Patients undergoing dialysis must be watched for aluminum intoxication
  - Could be caused by sucralfate and aluminum-containing antacids
- Blood loss and reduced dietary intake lead to iron and vitamins B_6 and B_9 deficiency



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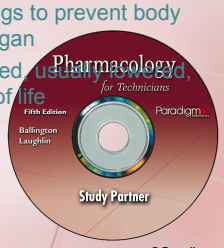
Renal Transplants

- Performed when kidneys fail completely
- Patient must take drugs to prevent body from rejecting new organ
- Doses may be adjusted, usually lowered, but drugs taken rest of life



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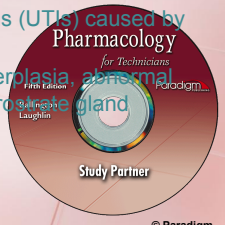
Drugs for Urinary Tract Diseases and Disorders

- Spastic bladder
- Frequent urination
- Urinary tract infections (UTIs) caused by bacteria
- Benign prostatic hyperplasia, abnormal enlargement of the prostate gland



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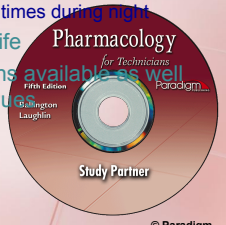
Drugs for Urinary Tract Diseases and Disorders

- Overactive bladder (common in elderly)
  - Voiding 8 or more times in 24 hours
  - Awakening 2 or more times during night
- Can affect quality of life
- Numerous medications available as well as behavioral techniques



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Urinary Antispasmodics

- Used to decrease urinary frequency
- oxybutynin (Ditropan, Oxytrol)
  - Inhibits spasms in smooth muscle and increases bladder capacity
- tolterodine (Detrol)
  - Greater selectivity for urinary bladder receptors than for salivary receptors

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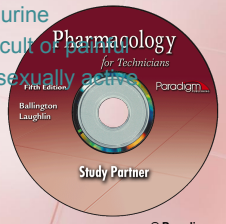
Urinary Tract Infections (UTIs)

- Bacteria enter through the urethra and begin to multiply
- Blood may appear in urine
- Urination may be difficult or painful
- Highest incidence in sexually active women



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Discussion

Why are UTIs more prevalent in sexually active women?

Bacteria readily colonize the vagina and travel the short urethra into the bladder.

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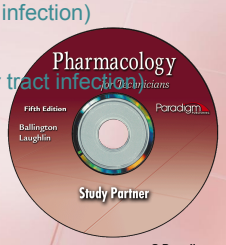
Classification of UTIs

- Cystitis
- Urethritis (lower tract infection)
- Prostatitis
- Pyelonephritis (upper tract infection)



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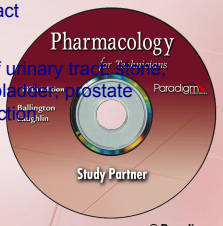
Description of UTIs

- Complicated
  - No underlying structural or neurologic problems of urinary tract
- Uncomplicated
  - Predisposing lesion of urinary tract (e.g., stricture, neurogenic bladder, prostate hyperplasia, or obstruction)



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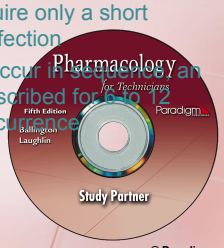
Treatment of UTIs

- UTIs treated with antibiotics
- Some antibiotics require only a short course to clear the infection
- If several infections occur in sequence, an antibiotic may be prescribed for 6 to 12 months to prevent recurrence



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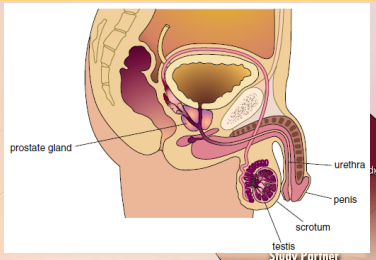
Male Reproductive System



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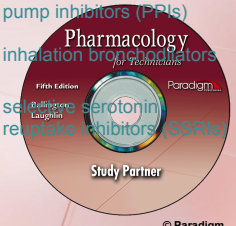
Contraindicated and Alternative Drugs for BPH

Should Not Use	Preferred Alternatives
anticholinergics	sucralfate, antacids, proton pump inhibitors (PPIs)
oral bronchodilators	inhalation bronchodilators
tricyclic antidepressants (TCAs)	selective serotonin reuptake inhibitors (SSRIs)



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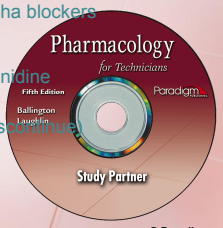
Contraindicated and Alternative Drugs for BPH

Should Not Use	Preferred Alternatives
calcium channel blockers	alpha blockers
disopyramide	quinidine
antihistamines	(discontinue)



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Diuretics

- Increase urine output
- Primary purpose is to rid the body of excess fluid and electrolytes
- Often first drug chosen to treat hypertension
- May also be prescribed for edema

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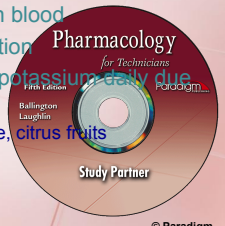
Thiazide Diuretics

- Promote sodium and water excretion in urine
- Lower sodium level in blood
- Reduce vasoconstriction
- Patients must ingest potassium daily due to loss of electrolytes
  - Bananas, orange juice, citrus fruits



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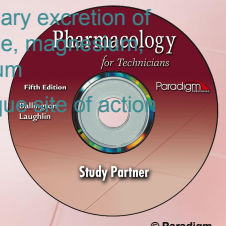
Loop Diuretics

- Inhibit reabsorption of sodium and chloride in ascending loop of Henle
- Cause increased urinary excretion of water, sodium chloride, magnesium, calcium, and potassium
- Work well due to unique site of action



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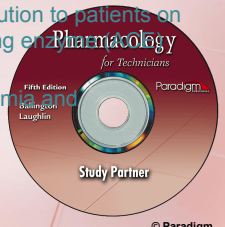
Potassium-Sparing Diuretics

- Inhibit exchange of sodium from urine for potassium from blood
- Administered with caution to patients on angiotensin-converting enzyme (ACE) inhibitors
- Can cause hyperkalemia and gynecomastia in men



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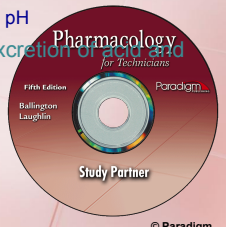
Carbonic Anhydrase Inhibitors

- Act in the proximal tube to
  - Increase urine volume
  - Change to an alkaline pH
- Cause decrease in excretion of acid and ammonia



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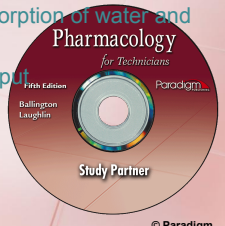
Osmotic Diuretics

- Increase osmotic pressure of glomerular filtrate
- Inhibits tubular reabsorption of water and electrolytes
- Increases urinary output



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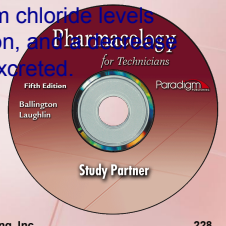
Discussion

Why does excretion of sodium chloride helps reduce edema?

An increase in sodium chloride levels causes water retention, and a decrease causes water to be excreted.



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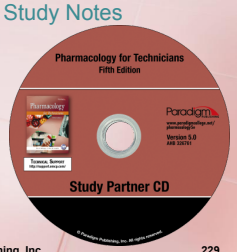
Assignments

- Complete Chapter Review activities
- Answer questions in Study Notes document
- Study Partner
  - Quiz in review mode
  - Matching activities
  - Drug tables



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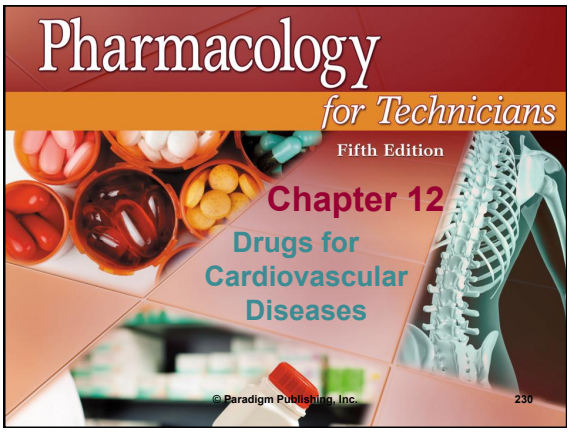

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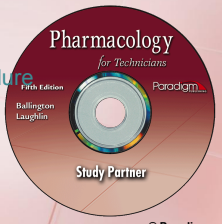
Chapter 12 Topics

- The Heart and Causative Factors of Cardiovascular Disease
- Angina
- Arrhythmia
- Congestive Heart Failure
- Hypertension
- Myocardial Infarction



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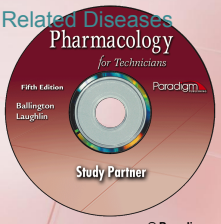
Chapter 12 Topics

- Blood Clots
- Stroke
- High Cholesterol and Related Diseases
- Varicose Veins



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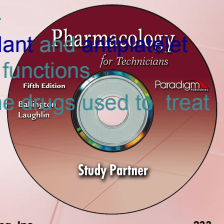
Learning Objectives

- Understand the cardiovascular system.
- Know the drugs and treatment for each type of heart disease.
- Recognize anticoagulant and antiplatelet drugs and know their functions.
- Discuss stroke and the drugs used to treat it.



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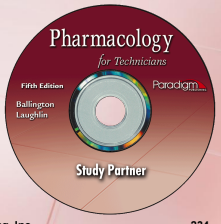
Learning Objectives

- Identify drugs used to treat hyperlipidemia and understand its role in heart disease and stroke treatment.



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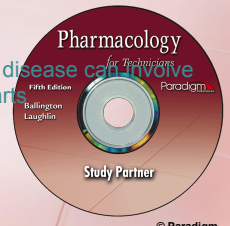
The Heart and Causative Factors of Cardiovascular Disease

- Heart has 3 functional parts
  - Cardiac muscle (myocardium)
  - Conducting system
  - Blood supply
- Cardiovascular (CV) disease can involve any or all of these parts



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The Heart and Causative Factors of Cardiovascular Disease

- Heart is a complicated organ
- Both predetermined and lifestyle factors contribute to heart disease
- Proper diet, exercise, and rest can help heart function

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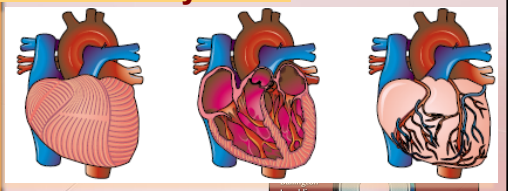
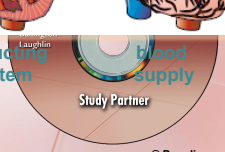
Heart's Functional Anatomy



cardiac muscle | conducting system | blood supply



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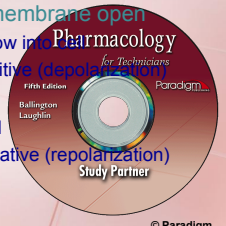
Normal Heartbeat

- Begins in cell membranes of sinoatrial (SA) node
- Ion channels in cell membrane open
  - Na^+ and Ca^{++} ions flow into cell
  - Voltage becomes positive (depolarization)
- Other channels open
  - K^+ ions flow out of cell
  - Voltage becomes negative (repolarization)



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Normal Heartbeat

- Electrical burst (action potential) propagates through conduction system to myocardial cells
  - Depolarizes with Na and Ca flow in
  - Repolarizes with outflow of K
- Proteins in membrane cells continually restore K, Na, Ca balances

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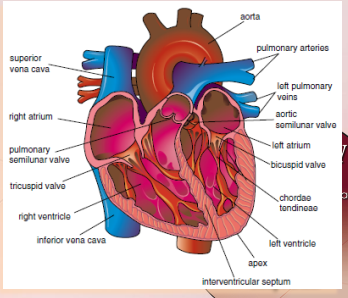
Internal Structures of the Heart



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Conduction System

- Action potential first arrives at atria
- Atria contracts, pumping blood received from veins into ventricles
- Then travels through the atrioventricular (AV) node to reach ventricles
- Left ventricle pumps blood out into arteries

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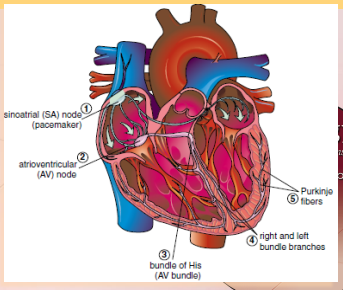
Conduction System of the Heart



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Predetermined Factors for Cardiovascular Disease

- Heredity
  - Children of parents with CV disease higher risk
  - African Americans 2 to 3x more likely than other ethnic groups to have heart disease
- Gender
  - Men greater risk than women until age 55
- Increasing Age

  Almost 55% of heart attack victims age 65+

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Factors Influenced by Lifestyle Modification

- Cigarette Smoking
  - Smokers twice the risk of heart attack than nonsmokers
- High Blood Pressure
  - Increases stroke and heart attack risk
  - Lower blood pressure by diet, exercise, weight loss, reduce salt, drugs

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Factors Influenced by Lifestyle Modification

- High Blood Cholesterol Levels
  - Reduces blood flow to heart
  - Diet low in cholesterol and fats, drugs
- Obesity
  - Increases blood pressure, cholesterol levels, leads to diabetes, strains heart
- Diabetes
  - Leads to vascular problems
  - Diet, drugs

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Angina Pectoris

- Also called angina
- Chest pain due to imbalance of oxygen supply and demand
- Oxygen demand is related to heart rate, strength of contraction, and resistance to blood flow

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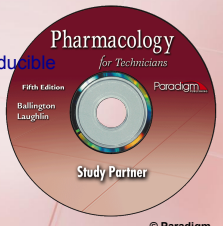
Three Types of Angina

- Stable
  - Effort-induced pain from physical activity or emotional stress
  - Relieved by rest
  - Predictable and reproducible



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Three Types of Angina

- Stable
- Unstable
  - Pain occurs with increasing frequency
  - Diminishes patient's ability to exercise
  - Decreasing response to therapy
  - May signal an oncoming MI

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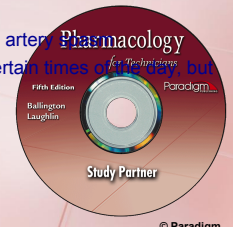
Three Types of Angina

- Stable
- Unstable
- Variant
  - Pain due to coronary artery spasm
  - Pain may occur at certain times of the day, but is not stress induced



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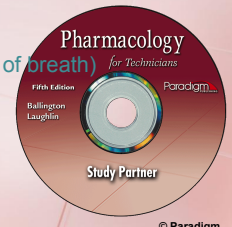
Symptoms of Angina

- Severe chest discomfort: heaviness, pressure, tightness, choking, squeezing
- Sweating
- Dizziness
- Dyspnea (shortness of breath)



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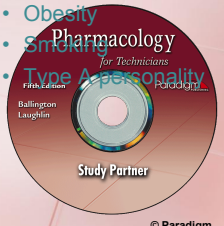
Risk Factors for Angina

- Advanced age
- Coronary artery disease
- Hypertension
- Increased serum glucose levels (diabetes)
- Increased serum lipoprotein levels
- Obesity
- Smoking
- Type A personality



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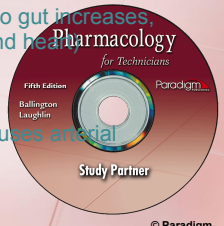
Initiating Factors of an Attack

- Cold weather
- Emotions
- Heavy meals (blood to gut increases, decreases to brain and heart)
- Hypoglycemia
- Pain
- Smoking (nicotine causes arterial constriction)



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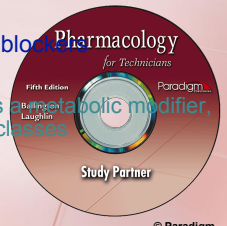
Treatment Goals

- Reduce symptoms, prevent heart attack
- 3 major classes of drugs to treat angina
  - Beta blockers
  - Calcium channel blockers
  - Nitrates
- Fourth type of drug is a metabolic modifier, distinct from other 3 classes



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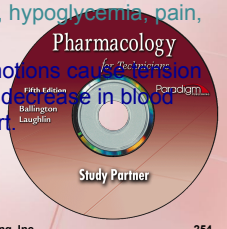
Discussion

Explain why some of these factors may initiate an angina attack: cold weather, emotions, heavy meals, hypoglycemia, pain, and smoking.

Cold weather and emotions cause tension in the muscles and a decrease in blood flow to brain and heart.



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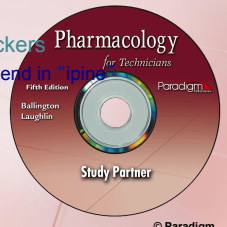
Drugs Used to Treat Angina

- Beta blockers
  - Most generic names end in "lol"
- Nitrates
- Calcium channel blockers
  - Many generic names end in "ipine"
- Metabolic modifier



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Beta Blockers

- Slow heart rate, decrease myocardial contractility, lower blood pressure
- Reduce frequency and severity of attacks
- More beta-1 blocking, rather than beta-2, preferred for heart conditions
- Also used to treat arrhythmias and hypertension, and most commonly used after a myocardial infarction

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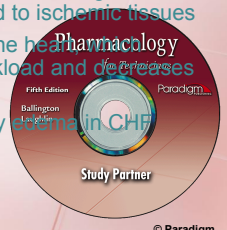
Nitrates

- Most commonly used drugs for angina
- Dilate coronary vessels, leading to redistribution of blood to ischemic tissues
- Reduce preload on the heart, which reduces cardiac workload and decreases afterload
- Helps with pulmonary edema in CHF



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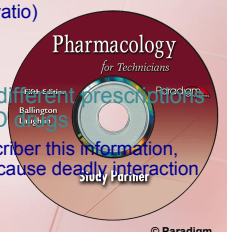
Nitrates and Erectile Dysfunction Drugs

- Technicians—watch for patients who get prescriptions for nitrates and ED drugs
  - sildenafil (Viagra, Revatio)
  - vardenafil (Levitra)
  - tadalafil (Cialis)
- Prescribers are often different prescribers for nitrates and for ED drugs
  - Patient must tell prescriber this information, because drugs could cause deadly interaction



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Calcium Channel Blockers

- Inhibit calcium ions moving into cardiac muscle cells
  - Calcium triggers muscle contraction
  - Reduces contractility of cells
- Relaxes vascular smooth muscle
- Used for most supraventricular tachyarrhythmias

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Calcium Channel Blockers

- Constipation most common side effect
- Some should be taken with food
- Caffeine should be limited
- Also first-line therapy for hypertension

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Metabolic Modifier: ranolozine (Ramexa)

- Indicated for chronic angina
- Helps heart to generate energy more efficiently
  - Heart functions despite a decrease in oxygen
- Add-on therapy; should be used with amlodipine, beta blockers, or nitrates
- Swallow whole, without regard to meals

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Arrhythmia

- Normal heart rhythm generated by sinoatrial (SA) node
- Arrhythmia is variation from normal heart rhythm (70 to 80 beats per minute)
- Occurs when
  - Heartbeat is too slow or too fast
  - Contractions of ventricles and atria not synchronized

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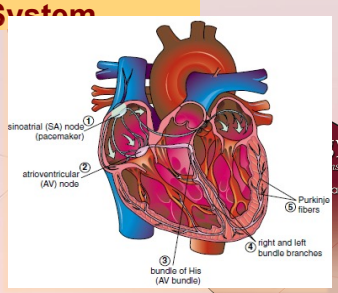
Heart's Conduction System



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Heart Rate Abnormalities

- Caused by ischemia, infarction, or alteration of body chemicals
- Allows heart cells other than SA node to fire automatically and become ectopic pacemakers
- Leads to premature contractions resulting in tachycardia, flutter, or fibrillation

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Heart Rate Abnormalities

- ECG records conduction cycle of the heart
- Different types of arrhythmias show specific ECG patterns
  - Associated with degrees of [illegible] death

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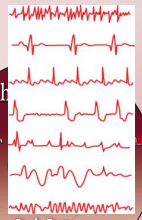
Abnormal Heart Rhythms

Arrhythmia	BPM
tachycardia	150-250
bradycardia	<60
atrial flutter	200-350
atrial fibrillation	>350
prem. atrial cont.	variable
prem. vent. cont.	variable
vent. fibrillation	variable

ECG



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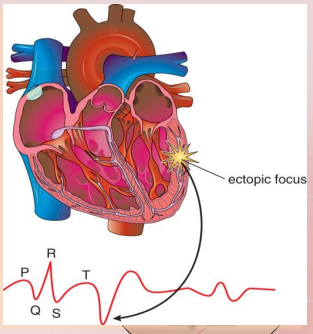
Premature Ventricular Contraction



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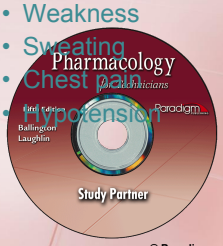
Symptoms of Abnormal Heart Rhythms

- Palpitations
- Syncope
- Lightheadedness
- Visual disturbances
- Pallor
- Cyanosis
- Weakness
- Sweating
- Chest pain
- Hypotension



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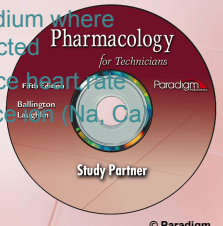
Drug Treatment of Abnormal Heart Rhythms

- Preventing life-threatening conditions by restoring normal rhythm
- Acts on the myocardium where impulses are conducted
- Some drugs influence heart rate
- Other drugs influence [illegible] (Na, Ca) movement



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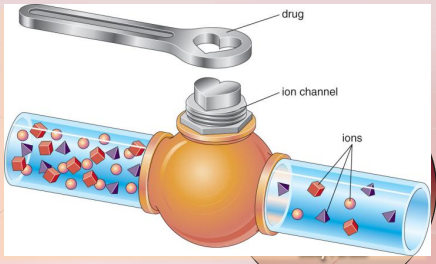
Depressant Closes Gate, Stimulant Opens Gate



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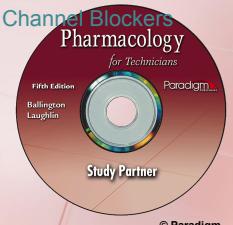
Drug Classes to Treat Arrhythmias

- Class I. Membrane Stabilizing Agents
- Class II. Beta Blockers
- Class III. Potassium Channel Blockers
- Others



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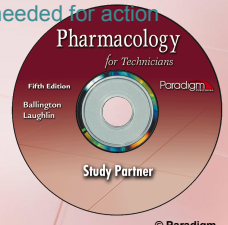
Membrane Stabilizing Agents (Class I)

- Slow the movement of Na ions into myocardial cells
- A stronger signal is needed for action potential



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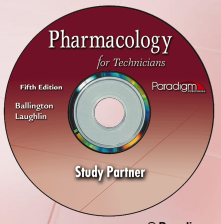
Potassium Channel Blockers (Class III)

- Delay repolarization
- Block the flow of potassium across cell membranes



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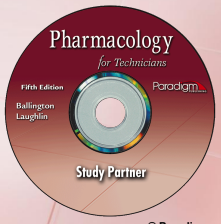
Other Antiarrhythmic Agents

- Have different mechanisms of action than other classes



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Atropine

- Used for bradycardia: heart rates less than 60 beats per minute
- Used preoperatively to inhibit salivation and secretions

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Congestive Heart Failure (CHF)

- Form of heart failure
- Heart pumps less blood than it receives
  - Excess blood pools in the chambers and stretches the walls of the heart

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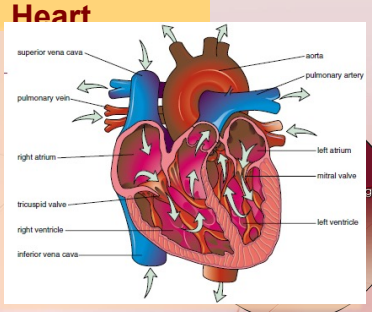
Blood Flow Through Heart



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Fluid Accumulation in CHF

- Kidneys retain water and fluid accumulates in body tissues
- In lungs when left side of heart fails
- In abdomen and lower extremities when right side of heart fails

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Discussion

Why is it dangerous for blood to pool in the chambers of the heart?

There is decreased oxygen supply to tissues, and a risk of blood clot formation and movement throughout the body.

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Congestive Heart Failure (CHF)

- Occurs in 10% of population over 75
- Can result in death through progressive heart damage or sudden death
- Overworking of the heart leads to cardiomegaly and myocardial hypertrophy

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Primary Causes of Congestive Heart Failure

- Cardiomyopathy
- Coronary artery disease
- Hypertension

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Secondary Causes of Congestive Heart Failure

- High salt intake
- Noncompliance with treatment
- Side effects of drug therapy
- Kidney failure
- Stress
- Infection and inflammation
- Cigarette smoking
- Obesity

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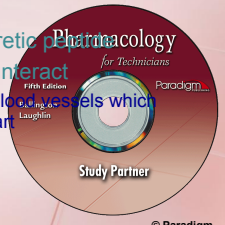
Drugs to Treat CHF or HF

- Vasodilators
- Angiotensin-converting enzyme (ACE) inhibitors
- Human B-type natriuretic peptide
- All 3 medications counteract
  - Contraction of small blood vessels which reduces stress on heart
  - Fluid retention



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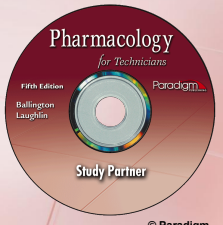
Vasodilators

- Cause blood vessels to dilate
- Reduce resistance against which the heart must work



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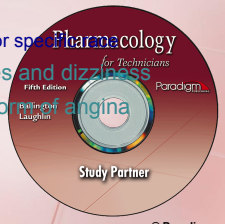
isosorbide-hydralazine (BiDil)

- Combination drug (both vasodilators) used to supplement standard therapy in African American population
  - First drug approved for specific race
- Can cause headaches and dizziness
- Also approved for a form of angina



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ACE Inhibitors

- Inhibits conversion of angiotensin I to angiotensin II
- Lowers blood pressure and stress on the heart
- Used for hypertension, HF, post-MI
- Considered to preserve potassium

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Human B-Type Natriuretic Peptide (hBNP): nesiritide (Natrecor)

- DNA recombinant technology
- Causes relaxation of vascular smooth muscle, lowering blood pressure
- Improves circulation, shortness of breath, and fatigue in acute HF
- Only used in hospitalized patients

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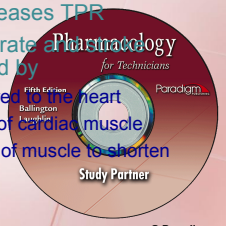
Hypertension and Blood Pressure

- Blood pressure: product of cardiac output (CO) and total peripheral resistance (TPR)
- Vasoconstriction increases TPR
- CO (product of heart rate and stroke volume) is determined by
  - Preload: blood delivered to the heart
  - Afterload: shortening of cardiac muscle
  - Contractility: capacity of muscle to shorten



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Blood Pressure

- Systolic Blood Pressure
  - Pressure when the heart ejects blood
  - Cardiac output is the major determinant
- Diastolic Blood Pressure
  - Pressure when the heart relaxes and fills
- 120 mm Hg systolic, 80 mm Hg diastolic
  - Written as "120/80" Read as "120 over 80"

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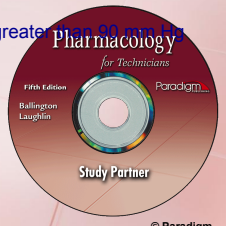
Hypertension

- A disease in which
  - Systolic blood pressure is greater than 140 mm HG
  - Diastolic pressure is greater than 90 mm Hg



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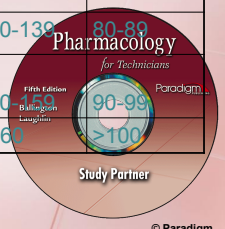
Staging of Blood Pressure

Category	Systolic	Diastolic
Normal	<120	<80
Prehypertension	120-139	80-89
Hypertension		
Stage 1	140-159	90-99
Stage 2	>160	>100



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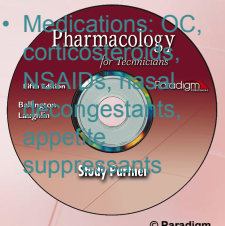
Factors Leading to Hypertension

- Family history
- Cigarette smoking
- High-fat diet
- Kidney disease
- Decreased pressure peripherally
- Obesity
- Adrenal tumor
- Medications: OC, corticosteroids, NSAIDs, nasal congestants, appetite suppressants



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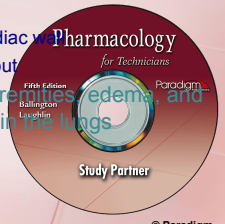
Untreated Hypertension

- Cardiovascular disease can develop
  - Enlargement of the heart
  - Cardiac hypertrophy
  - Thickening of the cardiac wall
  - Reduced cardiac output
- HF results in cold extremities, edema, and accumulation of fluid in the lungs



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Untreated Hypertension

- Renal insufficiency can occur
  - Increased pressure causes reduction in renal blood flow and function
- Accelerated cardiac and peripheral vascular disease can occur
- Higher the pressure, greater the risk

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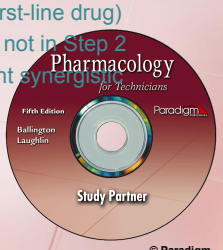
Treatment for Reducing Blood Pressure

Step 1. Change lifestyle
Step 2. Monotherapy (first-line drug)
Step 3. Add a diuretic if not in Step 2
Step 4. Add a third agent synergistic with others



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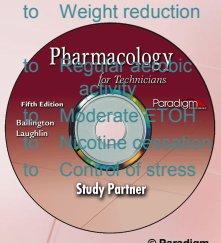
Step 1. Modify Lifestyle Factors

High sodium intake	to	Moderate sodium intake
Excess consumption of calories	to	Weight reduction
Physical inactivity	to	Regular aerobic activity
Excess ETOH	to	Moderate ETOH
Nicotine usage	to	Nicotine cessation
High stress	to	Control of stress



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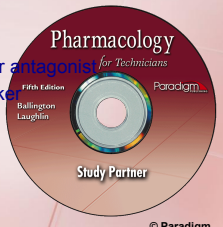
Step 2. Monotherapy

- A single drug, usually
  - Diuretic
  - Beta blocker
  - ACE inhibitor
  - Angiotensin II receptor antagonist
  - Calcium channel blocker



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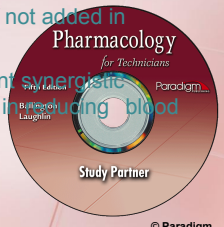
Steps 3 and 4

Step 1. Lifestyle modifications
Step 2. Monotherapy
Step 3. Add a diuretic if not added in Step 2
Step 4. Add a third agent synergistic with other two including blood pressure



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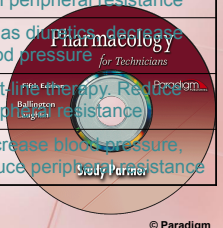
Pharmacologic Antihypertensive Therapies

Drug Class	Mechanism of Action
Diuretics	First-line therapy. Reduce total peripheral resistance
Selective Aldosterone Receptor Antagonists	Act as diuretics, decrease blood pressure
Calcium Channel Blockers	First-line therapy. Reduce peripheral resistance
ACE	Decrease blood pressure, reduce peripheral resistance



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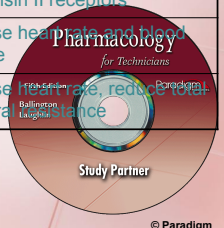
Pharmacologic Antihypertensive Therapies

Drug Class	Mechanism of Action
ARBs	Block vasoconstriction effects of angiotensin II receptors
Beta Blockers	Decrease heart rate and blood pressure
CNS Agents	Decrease heart rate, reduce total peripheral resistance



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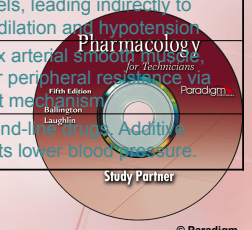
Pharmacologic Antihypertensive Therapies

Drug Class	Mechanism of Action
Peripheral Acting Agents (Alpha Blockers)	Block constriction of blood vessels, leading indirectly to vasodilation and hypotension.
Vasodilators	Relax arterial smooth muscle, lower peripheral resistance via direct mechanism.
Combination Drugs	Second-line drugs. Additive effects lower blood pressure.



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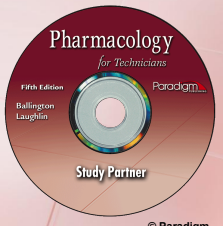
Treatment Effectiveness of Three Classes

- Beta blockers, calcium channel blockers, and ACE inhibitors all equally effective in treating hypertension



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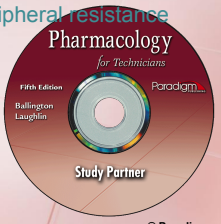
Calcium Channel Blockers

- Reduce blood pressure by arteriolar dilation
- Leads to reduced peripheral resistance



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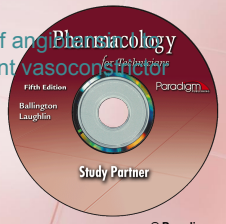
ACE Inhibitors

- Reduce blood pressure by competitive inhibition of angiotensin-converting enzyme (ACE)
- Prevent conversion of angiotensin I to angiotensin II, a potent vasoconstrictor



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Angiotensin Receptor Blockers (ARBs)

- Reduce blood pressure by blocking angiotensin II at its receptors
- Bound angiotension II cannot exert its effects
- ARBs: less coughing and angioedema than ACEIs
- Most generic names end in "artan"

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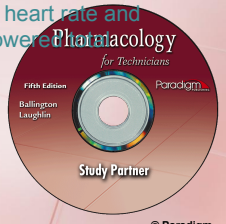
Central Nervous System (CNS) Agents

- Stimulate alpha-2 adrenergic receptors in the brain
- Results in decreased heart rate and cardiac output, and lowered arterial peripheral resistance



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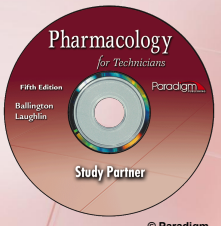
Peripheral Acting Agents (Alpha Blockers)

- Block alpha constriction of blood vessels
- Leads indirectly to vasodilation and hypotension



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Vasodilators

- Direct relaxant effect on arterial smooth muscle
- Leads to reduction in peripheral resistance
- Also used for congestive heart failure

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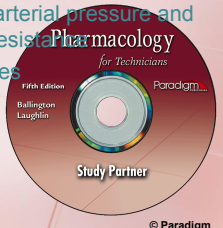
sidenafil (Revatio, Viagra)

- Reduces blood pressure by vasodilator effects
- Reduces pulmonary arterial pressure and pulmonary vascular resistance
- Do not use with nitrates



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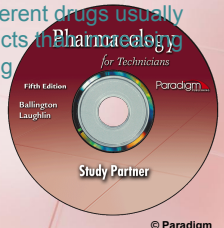
Combination Drugs

- Additive effect to relax blood vessels and lower pressure
- Two low doses of different drugs usually cause fewer side effects than increasing the dose of either drug



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Myocardial Infarction

- Also called heart attack
- Occurs when prolonged decrease in oxygen delivered to a region of cardiac muscle, and muscle dies
- If healing occurs, scars form, and less contractility of heart muscle
- Leading cause of death in industrialized nations

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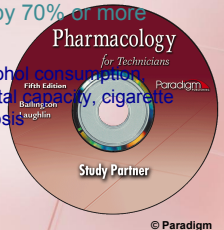
Causes of Heart Attack

- Prolonged decrease in oxygen supply
- Occurs if one or more of the 3 major arteries is narrowed by 70% or more
- Risk factors
  - History of angina, alcohol consumption, reduced pulmonary vital capacity, cigarette smoking, atherosclerosis



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Lifestyle Changes to reduce MI Risk

- Eliminate smoking
- Reduce hypertension: diet, medication, both
- Exercise moderately
- Adjust calories for ideal body weight
- Decrease alcohol consumption
- Control diabetes
- Use aspirin therapy
- Reduce dietary cholesterol and triglycerides

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Symptoms of a Heart Attack

- Oppressive or burning tightness or squeezing in the chest
- Feeling of choking
- Sense of "impending doom"
- Substernal pain with radiations to the neck, throat, jaw, shoulders, and one or both arms
- Pain can last 30 minutes to several hours

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Treatment of Myocardial Infarction

- Aimed at allowing the heart to rest and undergo normal healing
- Beta blockers combined with 81 mg aspirin frequently prescribed to reduce chance of death or recurrence
  - Beta blocker slows action of heart
  - Aspirin prevents blood clot formation

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Blood Clots

- Blood clots also called thrombi (singular: thrombus)
- Develop from abnormalities in
  - Blood coagulation
  - Blood flow
  - Platelet adhesiveness
  - Vessel walls

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Clotting Cascade

- Damage to tissue cells activates a pathway of coagulation, or clotting cascade
- If any factor in the cascade is missing, blood will not clot (hemophilia)

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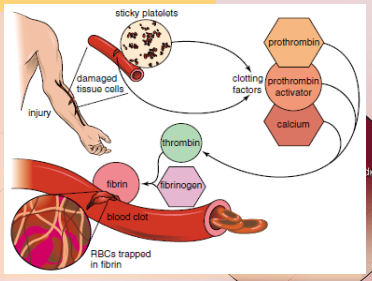
Clotting Cascade



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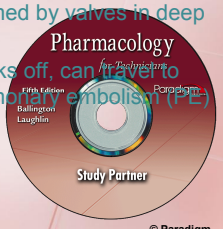
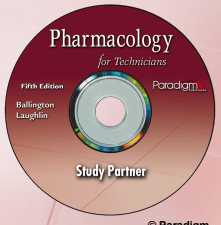
Venous Thrombi

- Usually form in areas of slow blood flow, surgical or vein injuries, or large venous sinuses (pockets formed by valves in deep veins)
- If a piece of clot breaks off, can travel to the lung causing pulmonary embolism (PE)



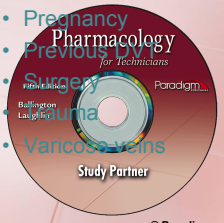
Deep Vein Thrombosis (DVT)

- DVT above the knee is the most serious
- May be fatal



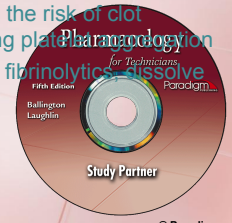
Risk Factors for DVT

- Age over 40
- Bed rest for over 4 days
- Estrogen combined with nicotine
- High-dose estrogen therapy
- Major illness
- Obesity
- Pregnancy
- Previous DVT
- Surgery
- Trauma
- Varicose veins



Classes of Drugs to Reduce Risk of Blood Clots

- Anticoagulant: prevents clot formation by inhibiting clotting factors
- Antiplatelet: reduces the risk of clot formation by inhibiting platelet aggregation
- Third class of drugs, fibrinolytics, dissolve clots already formed



Laboratory Testing

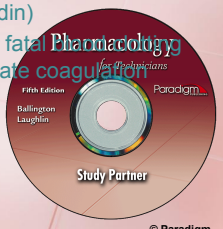
- Certain lab tests must be done on patients on anticoagulant therapy
  - Prevent future embolisms and minimize risk of hemorrhage

Most Frequently Used Laboratory Tests

- Partial thromboplastin time (PTT), affected by heparin
- Prothrombin Time (PT), affected by warfarin
- International Normalized Ration (INR)
  - Most important indicator
- Hematocrit: proportion of blood sample that is red blood cells

Therapy for DVT

- Low-dose heparin, adjusted-weight heparin, or low-molecular weight heparin and warfarin (Coumadin)
- Purpose is to prevent fatal clot while ensuring adequate coagulation



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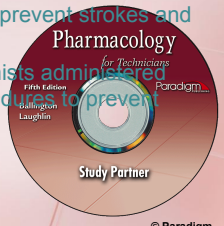
Antiplatelet Agents

- Interfere with chemical reactions that cause platelets to be sticky
- Aspirin prescribed to prevent strokes and MIs
- Glycoprotein antagonists administered during invasive procedures to prevent artery closure



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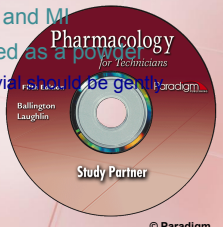
Fibrinolytic Agents

- Fibrinolytics dissolve clots by binding to the clot protein formed by fibrin
- Used for massive PE and MI
- All fibrinolytics supplied as a powder
  - When reconstituting, vial should be gently swirled, not shaken



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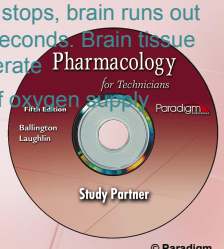
Stroke

- Brain is very oxygen-enriched organ
- If cerebral circulation stops, brain runs out of oxygen within 10 seconds. Brain tissue dies, does not regenerate
- Stroke: interruption of oxygen supply



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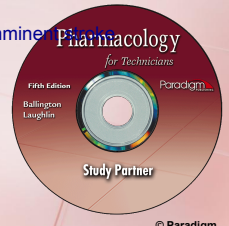
Types of Strokes

- Transient ischemic attack (TIA)
  - Temporary warning signs over brief period of time
  - Strong predictor of imminent stroke



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Types of Strokes

- Transient ischemic attack (TIA)
- Reversible ischemic neurologic deficit (RIND)
  - Reverses spontaneously, but less rapidly than a TIA
  - Lasts more than 24 hours
  - Resolves in less than 21 days

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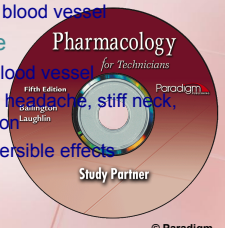
Causes of Stroke: Primary Events

- Ischemic Stroke
  - Results of obstruction to flow due to thrombus or emboli lodging in a blood vessel
- Cerebral Hemorrhage
  - Primary rupture of a blood vessel
  - Signs: sudden severe headache, stiff neck, stupor, or a combination
  - Long-lasting and irreversible effects



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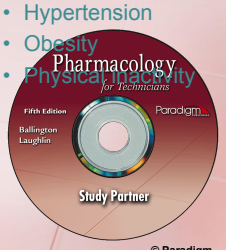
Modifiable Stroke Risk Factors

- Cigarette smoking
- Coronary artery disease
- Diabetes
- Excessive alcohol intake
- Hyperlipidemia
- Hypertension
- Obesity
- Physical inactivity



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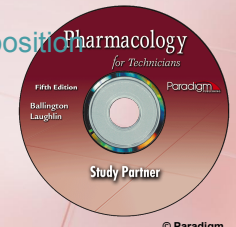
Not Modifiable Stroke Risk Factors

- Age
- Gender
- Genetic predisposition
- Prior stroke
- Race



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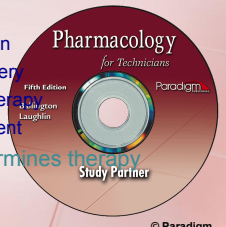
Stroke Management Options

- Emphasis on prevention
  - Antiplatelet therapy
  - Anticoagulant therapy
  - Fibrinolytic intervention
  - Cerebrovascular surgery
  - Nonpharmacologic therapy
  - Poststroke management
- Cause of stroke determines therapy



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Antiplatelet Agents

- Prevent platelet activation and formation of platelet plug
  - Interfere with platelet aggregation induced by ADP, or
  - Interfere with synthesis of thromboxane A2
- Most often used to prevent initial and recurrent thrombotic stroke

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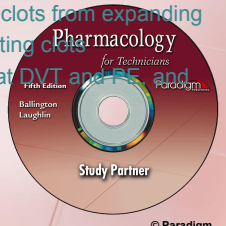
Anticoagulant Agents

- Interfere with synthesis or activation of the coagulation factors in blood
- May prevent existing clots from expanding
- Does not reduce existing clots
- Routinely used to treat DVT and PE, and prevention of stroke



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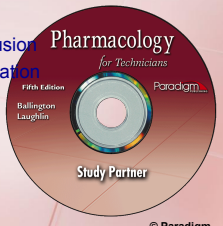
Fibrinolytic Agents

- Dissolve existing emboli or thrombi
- Indications
  - DVT
  - Acute peripheral occlusion
  - Acute MI with embolization
  - PE
  - Coronary embolus



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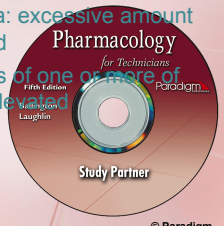
High Cholesterol and Related Diseases

- High blood cholesterol is major risk factor for heart attacks and strokes
- Hypercholesterolemia: excessive amount of cholesterol in blood
- Hyperlipidemia: levels of one or more of the lipoproteins are elevated



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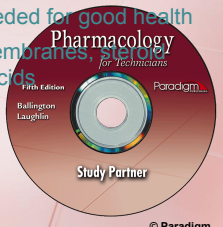
Cholesterol

- Cholesterol in all foods of animal origin, but not in foods of plant origin
- Some cholesterol needed for good health
- Used to make cell membranes, steroid hormones, and bile acids



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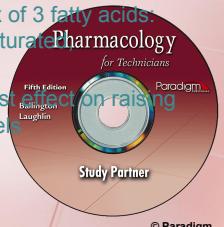
Hypercholesterolemia

- Can be inherited or can develop from environmental factors
- Food fats contain mix of 3 fatty acids: saturated, monounsaturated, polyunsaturated
- Saturated has greatest effect on raising blood cholesterol levels



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Lipoproteins

- Liver packages triglycerides, cholesterol, and carrier proteins in spherical particles called lipoproteins; circulate in blood
- High-density lipoproteins (HDL)
- Low-density lipoproteins (LDL)
- Triglycerides: neutral fat for storage in fat cells that release fatty acids in blood

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HDL and LDL

- HDL: Good cholesterol
  - Carry 20 to 30% of the total serum cholesterol
- LDL: Bad cholesterol
  - Carry 60 to 70% of the total serum cholesterol

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Atherosclerosis

- LDL not used by cells may be deposited in artery walls, eventually clogging them
- Atherosclerosis: narrowing of arteries due to deposits of cholesterol and fat on inner surface of blood vessel
  - Can result in stroke, MI, or limbs lost to gangrene
- High HDL lowers risk of atherosclerosis

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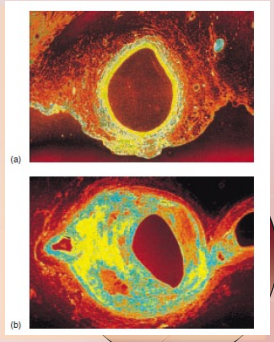
(a) Normal Artery

(b) Clogged Artery



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Treatment of Hyperlipidemia

- Reduce amount of saturated fats
- Total fat intake should not exceed 30% of total calories
- Goal: to decrease total cholesterol levels, specifically LDL levels
- Proper diet control and adjunct of cholesterol (lipid)-lowering drugs

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HMG-CoA Reductase Inhibitors (Statins)

- Inhibit enzyme responsible for cholesterol biosynthesis
- Side effects: GI upset and headache
- Take at night (most cholesterol is synthesized at night)
- Generic name ends in "statin"

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Statins

- Some combinations of these drugs are synergistic and some may be dangerous
- Report any symptom of muscle pain to physician immediately
- Thiazide diuretics, loop diuretics, and glucocorticoids increase lipid profile unfavorably

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Statin Equivalency Chart

Generic Name	Brand Name	Equiv. Dose
atorvastatin	Lipitor	20 mg
rosuvastatin	Crestor	5 mg
fluvastatin	Lescol	160 mg
lovastatin	Altacor, Mevacor	80 mg
pravastatin	Pravachol	80 mg
simvastatin	Zocor	40 mg

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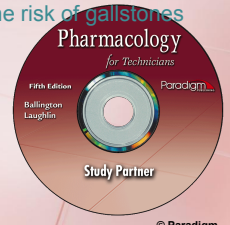
Fibric Acid Derivatives

- Exact mechanism of action is unknown
- Increase excretion of cholesterol in bile, thereby increasing the risk of gallstones
- Report muscle pain



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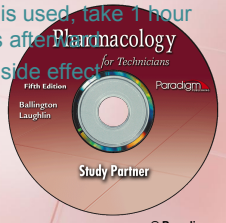
Bile Acid Sequestrants

- Form a nonabsorable complex with bile acids in the intestine
- If second medication is used, take 1 hour before or 4 to 6 hours after
- Constipation primary side effect



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omega-3 Fatty Acids

- In form of fish oil supplements, decrease triglycerides
- Used as alternative or adjunct with niacin, statins, or fibric acid derivatives
- In flaxseed may decrease heart disease, but not triglycerides

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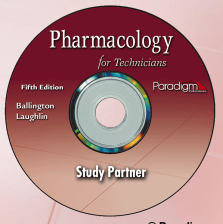
Combinations

- Manufacturers have combined drugs with synergistic mechanisms of action to lower cholesterol



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Discussion

What are some ways that people can lower their cholesterol levels?

Eat less fat, particularly saturated fat; exercise, take medications as directed

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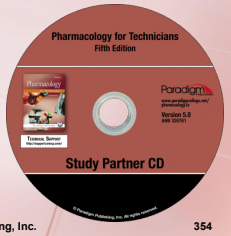
Assignments

- Complete Chapter Review activities
- Answer questions in Study Notes document
- Study Partner
  - Quiz in review mode
  - Matching activities
  - Drug tables



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