Pharmacology

- 2/3 doctor visits include prescriptions
- $180 billion/year
Pharmacology

- **Pharmacotherapy** – use of drugs for the treatment of disease and health maintenance
- **Medicine** – chemical used for diagnosis, prevention, treatment of symptoms, or cure
- Prescription and over the counter
Pharmacology

- **Pharmacology** – study of drugs, properties and their effects
- **Pharmacokinetics** – study of drug absorption, distribution, metabolism and excretion
Pharmacology

• An understanding will improve patient outcomes, maximize nutritional status, decrease complications and risks
• JCAHO requires monitoring, documentation, and patient education of food-drug interactions
Pharmacotherapy

- Nutrition affects drug action
- Drug action affects nutrition
- “Drug-nutrient” interactions
- ADA position statement (2003)
- Preventing interactions is one part of nutrition assessment/pharmacotherapy
Drug Mechanisms

- Binding to specific receptors on cell
- Initiating enzyme reactions
- Can interact with more than one cell receptor
- Stimulating (induction) or inhibiting enzyme systems
  ✓ ACE inhibitors
A. Angiotensin-converting enzyme (ACE) 
   Angiotensin I → Angiotensin II → Vasoconstriction—blood pressure increases

B. Angiotensin-converting enzyme (ACE) 
   ACE inhibitor 
   Angiotensin I → Inhibited conversion to angiotensin II → Vasodilation—blood pressure decreases
Drug Administration

- Sublingual or buccal – mouth or cheek
  - e.g. nitroglycerin
- Parenteral
  - SC, ID, IM, IP, IV
- Topical – skin or mucous membrane
- Inhalation
- Directly to target tissue
  - Eye, ear, spinal canal
Pharmacokinetics

• Absorption
  ✓ Same basic processes as nutrients
    • Passive diffusion, facilitated diffusion, active transport
  ✓ Solubility and ionization
  ✓ Excipients affect dissolution (dissolving)
    • Binders, lubricants, coating, coloring, flavor, tablet formulation
  ✓ Time, pH, and surface area
  ✓ Chemical properties
  ✓ Integrity of GI, circulation of blood
Pharmacokinetics

• Distribution
  ✓ Movement throughout body to target tissue
  ✓ Affected by circulation and binding
  ✓ Physiological features
Pharmacokinetics

- Metabolism
  - Biotransformation rendering inactive for excretion via urine or bile
  - Liver major site
  - Through catalyst of enzyme systems
    - CP450
  - Inhibitor – competition for receptor site; increased drug effect
  - Inducer - stimulates synthesis of enzyme; decreased drug effect
Pharmacokinetics

- Excretion
  - Urinary or biliary, lungs, bowel, breast milk
  - Urinary excretion in all stages within kidney
    - Filtered
    - Bound to large molecules
    - Reabsorption
Pharmacokinetics

• Alterations
  ✓ Altered GI
  ✓ Altered distribution
  ✓ Altered metabolism
  ✓ Altered urinary excretion
Pharmacokinetics

- Altered GI
  - Simultaneous consumption with food
    - Iron
  - Vomiting & diarrhea
  - Interruptions in transit time or surface area
    - Crohn’s disease
    - Malabsorptive conditions
  - Circulation deficits
  - Competition for carriers

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Pharmacokinetics

• Altered Distribution
  ✓ Circulation
    • Age and disease
    • Vasodilation
  ✓ Body size & composition
    • Body fat may slow distribution
  ✓ Any situation altering albumin
    • Liver, kidney, malnutrition
Pharmacokinetics

• Altered Metabolism
  ✓ Age
  ✓ May appear as decreased effectiveness or toxicity
  ✓ Adequate function of organs
  ✓ Genetic factors
  ✓ Gender
  ✓ Concurrent use of other medications
Pharmacokinetics

• Altered Urinary Excretion
  ✓ pH of urine
  ✓ Presence of competitor for active transport
  ✓ Urinary flow rates & kidney function
  ✓ Creatinine clearance
Nutrition on Drug Action

- Nutrition on drug dissolution
  - pH of stomach
    - Achlorhydria
    - HIV/AIDS
    - Meds: H2 blockers, proton pump inhibitors, antacids
  - Gastric emptying rate
    - Prokinetics
    - Food in stomach/high-fat meal
    - Vomiting, diarrhea
    - Gastric surgical resection
Nutrition on Drug Action

• Nutrition on drug absorption
  ✓ Food may affect availability of drug
    • e.g. Fosomax, Saquinavir - food reduces absorption
    • Erythromycin – food increases absorption
  ✓ Chelation
    • e.g. calcium with antibiotic tetracycline
Nutrition on Drug Action

• Nutrition on drug metabolism
  ✓ Inducer or inhibitor for metabolic enzyme systems
  ✓ Compete for carrier systems
    • e.g. St. John’s wort decreases effectiveness
    • Herbal supplements and anesthesia prolong effect
    • Vitamin K and warfarin
    • Tyramine and MAOs – Box 13.2
  ✓ See Table 13.1
Nutrition on Drug Action

- Nutrition on drug excretion
  ✓ Control of urine pH
    - Kidney stones
Complications

• On Nutrient Absorption
  ✓ Meds that speed transit time or gastric emptying
  ✓ Side effects such as nausea, vomiting, diarrhea, constipation
  ✓ e.g. corticosteroids & decreased absorption of calcium
Complications

• On Nutrient Metabolism
  ✓ Interfere with macronutrient, vitamin and mineral metabolism
  ✓ e.g. Dilantin inhibits folate and vit. D metabolism leading to megaloblastic anemia
  ✓ See Table 13.4
Complications

• On Nutrient Excretion
  ✓ Increased urinary output
  ✓ e.g. Lasix and hypokalemia
  ✓ Those affecting renal function reduce reabsorption
  ✓ See Table 13.5
At-Risk Populations

• Elderly
  ✓ Multiple meds – polypharmacy
  ✓ Both OTC and prescribed
  ✓ Physiological changes
  ✓ Compliance
  ✓ Inappropriate dosing
  ✓ Beer’s criteria – see Table 13.6
At-Risk Populations

- HIV/AIDS
  - Multiple medications
  - Specific guidelines regarding consumption with or without food
  - Significant nutritional side effects
At-Risk Populations

- Nutrition support
  - Tube feedings decrease absorption of some meds
  - Macronutrients may cause chelation of meds
  - Guidelines – ASPEN
    - See pp. 310-311
Nutrition Therapy

- Evaluate past and current medical hx for cardiac, liver, kidney
- Baseline lab measures for kidney, liver function, and glucose
- Treatment regimes with potential drug-nutrient interactions
- OTC, drugs, supplements, and CAM
Nutrition Therapy

- Potential barriers to compliance
- Drug-drug interactions among meds
- Drug-nutrient interactions
- See Box 13.4 and Figure 13.5 for clinical application
Past and current medical history: 65 YOM

Treatment regimens that may potentiate drug-nutrient interactions: none

Diagnoses affecting:

- Kidney function: type 2 DM hypertension
- Liver function: probable alcohol abuse
- Cardiac function: hypertension previous MI cardiac surgery

Biomedical assessment

Nutritional implications of medications used

- Drug-drug int: Toprol-Amaryl Altace-Amaryl Plavix-Aspirin
- Drug-nutrient int: Altace-serum K Toprol-food Altace/Amaryl-alcohol

Kidney function
- BUN: 21 Creatinine: 1.2

Liver function
- No lab values available at this time

Glucose: 180 mg/dL