# BASIC SCIENCES

## ANATOMY

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

*Junior Level: PGY-I, PGY-II*

1. Outline the general concepts of anatomy and its subdivisions, including:

    a. Gross anatomy

    b. Cellular and subcellular anatomy

    c. Molecular biology

2. Compare the organization, characteristics, and functions of the tissues and their components within each organ system, including:

    a. Skin

    b. Circulatory system

    c. Nervous system

    d. Musculoskeletal system

    e. Respiratory system

    f. Digestive system

    g. Urinary system

    h. Reproductive system

    i. Organs of special sense

3. Review, identify, and delineate the vulnerable anatomical structures encountered in common general surgical operations such as:

    a. Venous and arterial access in infants

    b. Catheterization

    c. Colonoscopy

    d. Cricothyrotomy

    e. Mastectomy

    f. Inguinal hernia repair

    g. Cholecystectom

h. Cardiac procedures

i. Aortic aneurysm repair

j. Insertion of Swan-Ganz catheter

k. Insertion of chest tubes

l. Application of leg cast

m. Appendectomy

n. Burr holes

o. Vagotomy and pyloroplasty

p. Colectomy

q. Renal transplant

r. Thyroidectomy

s. Resection of the liver

t. Urinary procedures

4. Recognize those anatomic structures commonly encountered in other surgical subspecialties, such as:

a. Orthopedics

b. Otolaryngology

c. Neurosurgery

d. Gynecology

e. Urology

5. Discuss the differences in visualization of organ structures by various technologies, such as:

a. Routine radiograms

b. Contrast studies

c. Computed axial tomography (CAT) scans

d. Ultrasound

e. Magnetic resonance imaging (MRI) scans

f. Angiograms

g. Positron emission tomography (PET) scans

6. List and access the source materials for anatomic references, guides for exposure, and the anatomic aspects of common general surgical procedures.

7. Describe the anatomic aspects of conception, human development, normal embryology, and common developmental anomalies encountered in general surgery, such as:

a. Pelvic inflammatory disease

b. Appendicitis in pregnancy

c. Omphalomesenteric remnants

d. Diaphragmatic hernia

e. VATER syndrome

f. Tracheoesophageal fistula

g. Biliary atresia

h. Malrotation

i. Gastroschisis

j. Urachal cyst

k. Imperforate anus

l. Trisomy 18

m. Tetralogy of Fallot

n. Atrioseptal defect

8. Differentiate between the following anatomic terms:

a. Topographic anatomy
b. Radiographic anatomy
c. Supination
d. Pronation
e. Dorsal
f. Ventral
g. Median plane
h. Midsagittal plane
i. Coronal plane

9. Describe the anatomic changes due to aging on a gross, cellular, and molecular level with special emphasis on the following organs: eyes, bone, brain, GI tract, lungs, kidneys, reproductive system, and vascular system.

*Senior Level: PGY-III, PGY-IV, PGY-V*

1. Summarize the embryologic explanations for the common major birth anomalies.
2. Define and describe the anatomic aspects of such general surgical operations such as:
   a. Repair of an abdominoperineal aneurysm
   b. Whipple procedure
   c. Pneumonectomy
   d. Abdominoperineal resection
   e. Liver resection
   f. Liver transplantation
   g. Bilateral radical neck dissection
   h. Gastric bypass
3. Interpret various imaging technologies to derive anatomic information.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

Integrate knowledge of anatomy into the following:

a. The diagnosis of general surgical disease

b. Explanations to patients and families regarding:

(1) Embryologic causes of disease

(2) Planning of surgical procedures

(3) Progress of disease

(4) Explanation of complications

c. The performance of surgical procedures appropriate for the level of training

d. Postoperative management of the patient, including long-term follow-up

e. The planning of procedures for different age groups, such as split thickness skin grafts (depending upon the thickness of the skin), and care for fracture of the wrist

## PHYSIOLOGY

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Describe concepts of normal physiology, including:

a. Fundamental processes of cell differentiation and growth

b. Endocrine and autocrine control of genetics and development

c. Normal pregnancy, embryology, and parturition

d. Concept of homeostasis and cellular mediators

e. Biochemistry of normal nutrition and metabolism

f. Fluid mechanics and dynamics

g. Hemostasis, coagulation, thrombogenesis, fibrinosis

h. Excretory and regulatory renal function

i. Biomechanics of normal respiration and gaseous exchange

j. Wound healing and inflammatory response

k. Oncogenesis

l. Neuroendocrine control of development of secondary sexual characteristics, breasts

m. Neurophysiology of pain

n. Response to sepsis

o. The immune response

p. Cellular division, telomeres, apoptosis

2. In each of the above systems, identify physiologic variations in geriatric, pediatric, immunosuppressed, and pregnant patients.

3. Indicate the normal values of commonly applied clinical tests.

4. Describe the applications of physiologic principles to surgical monitoring and therapy, including the following approaches:

a. Application of pulmonary artery catheters

b. Ventilator management

c. Renal function studies

d. Noninvasive vascular testing

e. Interpretation of results of the common metabolic panel blood tests

f. Interpretation of electrocardiogram (EKG), cardiac echograms and other cardiac function studies

g. Interpretation of a nutritional profile

h. Endocrine function studies

5. Describe how aging affects the tests listed in the section immediately above.

6. Describe the abnormal physiology of complex diseases or entities such as:

a. Cardiac failure

b. Renal failure

c. Pulmonary failure

f. Intestinal obstruction

g. Malnutrition

h. Cardiopulmonary bypass

d. Immunosuppression

e. Malignancy

i. Advanced age

7. Analyze the aspects of aging within each organ system that can

alter the surgeon's approach to care of the elderly patient, to include consideration of:

a. Genetic factors (e.g., alterations in DNA synthesis and chromosomal functioning)

b. Cumulative cellular damage (e.g., changes from free radicals and radiation)

c. Errors in protein synthesis

d. Alterations in the immune system

e. Effects of endogenous steroid hormones

f. The cross-linkage theory (resulting in loss of elasticity, increased tissue brittleness)

g. Apoptosis

h. Telomere function

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Interpret laboratory tests and clinical findings based upon physiologic concepts.

2. Manage patients with surgical illnesses and/or major physiologic disruptions such as:

a. Liver failure

b. Malnutrition

c. Renal failure/bowel obstruction

d. Hemorrhage

e. Cardiopulmonary failure

f. Electrolyte imbalance

g. Endocrine disorders such as multiple endocrine neoplasia (MEN)

h. Sepsis

i. Shock

j. Immunosuppression

k. Diabetes

l. Advanced age

3. Adapt treatment plans to reflect physiologic variations in pediatric, geriatric, and pregnant patients.

4. Utilize clinical findings, laboratory tests, and hemodynamic measurements to alter patient physiology.

5. Adjust treatment plans in response to abnormal physiologic values.

6. Identify and formulate treatment plans for improved nutrition.

7. Interpret hemodynamic monitoring and adjust treatment to restore homeostasis:

a. Insert and maintain arterial venous and central lines.

b. Monitor catheters.

8. Solve problems interfering with normal hemostasis.

9. Analyze pulmonary function tests, solve problems causing abnormal respiration, and delineate weaning parameters.

## FLUID AND ELECTROLYTE HOMEOSTASIS

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Describe body water volumes and distribution.

2. Indicate the normal electrolyte distribution of cell water and extracellular fluid to include the following:

a. Sodium

b. Potassium

e. Calcium

f. Magnesium

c. Chloride

d. Bicarbonate

g. Phosphate

3. Outline the normal electrolyte content of body fluids such as blood, extracellular fluid (ECF), urine, saliva, gastric juice, bile, and pancreatic fluid.

4. Identify water and electrolyte changes in response to various stress situations such as:

a. Diseases, including trauma and burns

b. Operative therapy

c. Non-operative therapy

5. Analyze water and electrolyte disorders affecting the hospitalized elderly by discussing the etiology and treatment of such conditions as:

a. Water overload

b. Plasma volume depletion

c. Changes in serum sodium levels

d. Changes in serum potassium levels

6. Describe the role of the following hormones in fluid and electrolyte homeostasis:

a. Vasopressin (ADH)

b. Renin

c. Angiotensin

d. Aldosterone

e. Steroids

f. Adrenocorticotrophic hormone (ACTH)

7. Apply the physiology of water and sodium imbalance to the following:

a. Salt and water depletion (depletion of extracellular fluid volume [ECFV])

b. Salt and water excess (expansion of ECFV)

c. Hyponatremia (hypo-osmolarity)

d. Hypernatremia (hyperosmolarity)

8. Explain the treatment for water and sodium imbalance, including the use of and complications from diuretics and fluid restrictions.

9. Summarize normal potassium physiology, the causes and consequences of depletion and excess, and the treatment for potassium imbalance.

10. Discuss the complexities of calcium, phosphorus, and magnesium excesses and deficiencies in such situations as:

a. Metastatic breast cancer

b. Hepatic failure

c. Hyperparathyroidism

d. Milk-alkali syndrome

e. Eclampsia

11. Illustrate treatments for high or low calcium, phosphorus, and magnesium in the instances listed directly above.

12. Discuss the changes that affect water and sodium regulation, related to patient age and renal maturity, to include:

a. Concentrating ability

b. ADH secretion

c. Ability to conserve sodium

d. Secretion of atrial natriuretic peptide

13. Outline the pathophysiology of fluid and electrolyte problems in cardiac, aortic, and peripheral revascularization, including reperfusion injury.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Use patient fluid balance data as general measures of fluid homeostasis.

2. Estimate the patient's state of sodium and water balance by history and physical examination in the following locations/situations:

a. Emergency department

b. Pre- and post- operative patients

c. In conjunction with nutritional considerations in patients on long-term total parenteral nutrition (TPN).

3. Provide fluid and electrolyte orders to nursing staff for such situations as:

   a. Sepsis

   b. Burns

   c. Major surgery requiring transfusion

   d. Ascites

   e. Cardiac failure

   f. Malnutrition

   g. Fistulas (high output intestinal)

   h. Hypertrophic pyloric stenosis

4. Coordinate orders involving nutrition, acid-base, and electrolyte problems.

5. Apply fluid and electrolyte principles to the following special applications:

   a. Neonates

   b. Infants

   c. Geriatric patients

   d. Cardiac bypass patients

6. Manage outpatients and inpatients with hypo- and hyper- kalemia.

7. Manage patients with hypo- and hyper- calcemia.

## ACID-BASE HOMEOSTASIS

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Explain hydrogen ion biochemistry and physiology to include:

   a. The Henderson-Hasselbalch equation

(1) Ventilatory component ($pCO_2$)

(2) Renal component ($HCO_3^-$)

b. Hydrogen ion production and disposal

c. Buffering systems

(1) Acute (bicarbonate)

(2) Chronic (bone, renal, and pulmonary)

2. Relate the biochemistry of membrane gas exchange using the example of gases exchanging over the alveolar/capillary interface.

3. Explain the physiology of hydrogen ion production and renal excretion of hydrogen ions.

4. Describe renal bicarbonate reabsorption and regeneration.

5. Summarize the contributions of the skeleton, kidneys, and lungs in maintaining a normal pH.

6. Classify metabolic acidosis, including "anion gap" and hyperchloremic acidosis.

7. Identify specific causes of metabolic acidosis.

8. Given values for pH, $pCO_2$, and $HCO_3^-$, distinguish between compensated and uncompensated metabolic acidosis, respiratory acidosis, metabolic alkalosis, respiratory alkalosis, and mixed abnormalities; derive a differential diagnosis for each.

9. Explain age-associated changes that may occur in certain respiratory and renal regulatory processes that are known to maintain normal pH. How does aging affect:

a. Ability to hyperventilate in response to acute metabolic acidosis

b. The kidney's response to an acid load (Describe recovery of the blood pH.)

10. List disorders, common in elderly patients, that contribute to acid-base disturbances. Explain the mechanisms that can lead to acid-base disturbances associated with:

a. Heart failure

b. Anemia

c. Sepsis

d. Renal disease

e. Pulmonary disease

f. Diabetes mellitus

11. Identify specific acid-base disturbances in elderly patients caused by such frequently used drugs as:

a. Salicylates
b. Diuretics
c. Laxatives

12. Relate metabolic alkalosis to the following:

a. Chloride-responsive alkalosis
b. Chloride-resistant alkalosis
c. Paradoxic aciduria

13. Predict the importance of primary diseases and their complications to the evaluation of patient risk for:

a. Shock
b. Bowel obstruction
c. Sepsis

14. Analyze the acid-base problem and its cause in specific clinical situations, and determine an appropriate course of therapy for the following conditions:

a. "Medical" problems such as:

(1) Diabetic ketoacidosis
(2) Lactic acidosis
(3) Renal tubular acidosis
(4) Renal insufficiency
(5) Respiratory failure

b. "Surgical" problems such as:

(1) Pyloric stenosis
(2) Gastric outlet obstruction
(3) Fistulas
(4) Ureteroileal conduit

(5) Shock

15. Why are disturbances of acid-base balance common in elderly patients? Explain by discussing the implications of:

a. Impaired homeostatic mechanisms

b. High prevalence of drug use and disease

16. Summarize the adverse effects of acid-base disturbances on the following body systems:

a. Central nervous system / intracranial pressure

b. Renal physiology

c. Pulmonary physiology

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Diagnose and treat acid-base disturbances of all types.

2. Diagnose and treat complex and combined problems in acid-base disturbances as a component of overall care.

3. Manage complex situations in the intensive care unit where acid-base abnormalities coexist with other metabolic derangements, including:

a. Fluid and electrolytes
b. Total parenteral nutrition
c. Renal disease
d. Pulmonary disease

## METABOLISM

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

*Section 1: Energy*

1. Describe the principles of energy conversion to mechanical work and the efficiency of energy conversion and thermal balance.

2. Define basic energy units such as the calorie and the kilocalorie.

3. Discuss the routes of heat loss and their relationship to energy balance.

4. Relate oxygen consumption and carbon dioxide production to thermogenesis, energy production, and measurement of energy balance by indirect calorimetry.

5. Explain the respiratory quotient, its usefulness in determining substrate utilization patterns, and its relationship to respiratory function.

6. Define basal and resting metabolic rates and their relationship to body weight, size, age, and sex.

7. Predict daily energy requirements using metabolic rate equations.

8. Discuss the effects of ambient temperature, injury, burn, infection, pain, fear, anxiety, and starvation on energy requirements.

9. Integrate the above knowledge with prediction equations to estimate metabolic demands of critically-ill patients (e.g., the Harris-Benedict Equation).

10. Discuss how different substrates (carbohydrates, fats, and proteins) contribute to specific disease processes.

*Section 2: Temperature and Fuel Homeostasis*

1. Describe how the brain controls body temperature and alters temperature set point in response to stress and other factors.

2. Describe the mediators that influence temperature set point and the febrile response; explain their relation to changes in oxygen consumption.

3. Explain the differences between endogenous, exogenous, and bacterial pyrogens. Summarize their relation to post-traumatic fever and other disease processes resulting in fever.

*Section 3: Hormonal Control of Body Fuels*

1. Identify the hormones responsible for storage and mobilization of energy. Describe their effects.

2. Explain the metabolic effects of glucagon and insulin on protein, fat, and carbohydrate metabolism.

3. Explain the effects of catecholamine release during stress and the results of these effects on metabolism of glucose, fat, and protein as well as heat production.

4. Summarize the causes of negative nitrogen balance following injury, and explain the role of glucocorticoids on protein metabolism.
5. Discuss the systemic effects of corticosteroids on the body's response to injury and infection.

6. Describe the function of growth hormone and thyroid hormone as anabolic or catabolic mediators.

*Section 4: Intermediary Metabolism*

1. Explain the processes involved in carbohydrate metabolism, including glycogen synthesis and degradation, glycolysis, and gluconeogenesis.

2. Summarize the following metabolic processes:

    a. Protein synthesis and degradation

    b. Role of alanine and glutamate in deamination

    c. Urea cycle

3. Explain the metabolism of lipids, including:

    a. Synthesis

    b. Catabolism

    c. Formation of ketone bodies

    d. Role of the tricarboxylic acid cycle

4. Describe the role of macrophages and cytokines in response to stress and metabolism.

5. Summarize the metabolic responses to short-term starvation that maintain euglycemia.

6. Identify the changes in fuel oxidation and substrate utilization that occur during fasting.

7. Describe the alanine and Cori cycles, and relate them to alterations in renal, hepatic, and cardiopulmonary function during adaptation to long-term starvation.

8. Explain the routes of nitrogen loss during starvation, injury and infection. Describe the effects of glucose, fat, and protein on nitrogen metabolism in these situations.

9. Describe the changes in body composition that occur with:

a. Bed rest
b. Complicated and uncomplicated operations

c. Trauma

d. Sepsis

10. Explain how protein metabolism is affected by hormonal regulators. Summarize its relationship to oxygen consumption, temperature regulation, and energy balance.

11. Summarize the hormonal regulation of gluconeogenesis after trauma and during critical illness.

12. Describe the caloric contribution of endogenous substrates, and analyze the association between tissue loss and weight loss.

13. Compare the differences between the alterations in intermediary metabolism occurring with hypothermia and intense exercise with those in trauma, infection, and prolonged critical illness.

*Section 5: Implications for the Elderly Patient*

1. Describe the changes in calorie requirements, basal metabolic rate, and fat stores in elderly patients.

2. Discuss impaired glucose tolerance and renal excretion in the elderly patient.

3. Name specific vitamin and mineral deficiencies in older people and their causes and effects.

4. Describe the problem with decreased total body water and its impact in the elderly patient.

5. What is the prevalence and cause of protein-calorie malnutrition in the geriatric population; what is the impact on abdominal surgery?

6. How does the temperature set point differ in elderly patients, and how does the presentation of peritonitis differ?

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Determine daily energy requirements of critically-ill patients using established formulas accounting for varied metabolic demands.

2. Utilize metabolic cart and indirect calorimetry to calculate metabolic needs in similar patients. Discuss the efficacy and limitations of this method.
3. Calculate nitrogen balance status in critically-ill patients, and alter metabolic supply and demand to establish positive balance.

## NUTRITION

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Discuss risk factors contributing to malnutrition in the hospitalized patient, including:

   a. Low nutritional reserve

   b. Extensive preoperative studies

   c. Lack of oral (PO) intake secondary to underlying disease

   d. High stress conditions

2. Summarize the characteristics of the indicators for nutritional assessment, including:

   a. Weight loss greater than 10% of body weight

   b. Serum albumin less than 3.4 gm/dl

   c. Impaired immunologic response: anergic response and total lymphocyte count (TLC) less than 1500/cc

   d. Specific physical signs

3. Analyze methods of nutritional assessment using:

   a. Pertinent history

   b. Anthropomorphic measurements

   c. Laboratory measurements

d. Immunologic measurements

4. Analyze and be prepared to explain potential problems associated with primary nutritional problems affecting older people, including:

a. Protein-energy undernutrition

b. Vitamin deficiencies

c. Trace mineral deficiencies

d. Obesity

5. Explain methods of calculating energy requirements, including:

a. Simple estimate (resting: 20 kcal/kg-d; moderate stress: 30 kcal/kg-d; severe stress: 40 kcal/kg-d)

b. Harris-Benedict Equation

c. Nitrogen balance

d. Basal metabolic cart

6. Analyze the metabolic responses to starvation and stress/trauma.

7. Provide general guidelines for determining nutritional composition:

a. Non-protein calorie to protein ratio

b. Protein requirements

c. Carbohydrate/fat balance

d. Ventilation issues (effect on respiratory quotient)

8. Summarize factors that can lead to problems in elderly patients, resulting from effects of mild vitamin deficiencies, especially in those institutionalized elderly patients that are associated with:

a. Cognitive impairment

b. Poor wound healing

c. Anemia

d. Bruising

e. Increased risk of infections

f. Increased risk of developing certain cancers

9. Discuss the indications, contraindications, and benefits of enteral feedings: describe sites of delivery and potential complications and their treatment.
10. Discuss the indications, contraindications, and disadvantages of parenteral feeding; describe the details of initiating total parenteral nutrition (TPN), monitoring delivery, and managing potential complications.

11. Summarize content and rationale for special formulations used in patients with:

a. Congestive heart failure
b. Liver failure
c. Renal failure
d. Respiratory failure
e. Glucose intolerance

12. Explain recent advances in surgical nutrition, including:

a. Role of glutamine
b. Role of arginine
c. Growth factors
d. Omega-3 fatty acids

13. Analyze the potential implications of nutritional deficiencies in certain disease states, and define the role of nutritional components in preventing acquired and malignant disease.

14. The following examples are conditions that can result from protein-energy undernutrition. Discuss the significance of each to the elderly surgical patient:

a. Cognitive dysfunction
b. Decreased muscle strength
c. Pressure sores
d. Altered thyroid function

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Perform nutritional assessment of hospitalized patients.

2. Select appropriate methods of nutritional support, and provide necessary monitoring.

3. Calculate nutritional requirements for patients with:

a. Malignancy
b. Stress/trauma
c. Pancreatitis
d. Enterocutaneous fistula

4. Insert enteral and parenteral tubes and lines.

5. Manage nutritional support in patients with specific clinical conditions listed above.
6. Recognize and correct the subtle caloric and vitamin imbalances in patients receiving TPN.

7. Perform operative gastrostomies, jejunostomies, and percutaneous endoscopic gastrostomies.

8. Recognize and treat complications of enteral and parenteral feeding, including:

a. Diarrhea
b. Dehydration
c. Line sepsis
d. Fatty metamorphosis of liver
e. Glucose intolerance

9. Become familiar with the use of the "SCALES" protocol for evaluating risk of malnutrition in elderly patients, using these variables:

a. Sadness
b. Cholesterol level
c. Albumin level
d. Loss of weight
e. Eating problems
f. Shopping and food preparation problems

## HEMATOLOGY

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

*Section One: Blood Physiology*

1. Describe the fundamental components of hematopoiesis, including the development of lymphocytes and hematopoietic cells from multipotent cells.

2. Discuss the structure, function, production, and degradation of hemoglobin.

3. Discuss the structure, function, lifespan, metabolic activity, and degradation of red blood cells (RBC's).

4. Outline and compare the common congenital and acquired anemias, such as those associated with:

   a. Decreased RBC production

   b. Excessive RBC destruction, including hemoglobinopathies

5. Briefly discuss polycythemia and implications for surgical patients.

6. Describe hemoglobin S disease (sickle cell disease), and understand the implications of this and related disorders for surgical management.

7. Discuss the fundamental roles of the following in inflammation, immune response, and infection:

   a. Granulocytes (polymorphonuclear leukocytes [PMN's], basophils, eosinophils)

   b. Lymphocytes

   c. Monocytes

8. Discuss platelet production and physiology, and relate these to common problems such as autoimmune thrombocytopenia (ITP).

9. Discuss the effect of common drugs on hemostasis.

*Section Two: Hemostasis, Coagulation, and Fibrinolysis*

1. Discuss the phases of normal hemostasis, including:

   a. Primary hemostasis (vasoconstriction and platelet aggregation/activation)

   b. Secondary hemostasis (activation of the coagulation cascade and formation of a fibrin clot).

2. Categorize the fundamental cellular and molecular events involved in platelet activation.

3. Identify and describe the endogenous procoagulants and anticoagulants in blood.

4. Diagram the intrinsic, extrinsic, and common coagulation pathways and their sites of activation.

5. Describe and explain the delicate interaction of the following forces in the control of coagulation:

a. Blood flow
c. Thrombomodulin

b. Endothelium
d. Fibrinolysis

6. Discuss indications for and methods of conducting common tests of coagulation and hemostasis, such as:

a. Partial-thromboplastin time (APTT)

b. Prothrombin time (INR)

c. Thrombin time

d. Bleeding time

e. Platelet aggregation studies

7. Indicate the mode of action and site of action for the following common drugs affecting blood clotting:

a. Heparin

b. Coumadin

c. Aspirin and other non-steroidal anti-inflammatory drugs (NSAID's)

8. Identify congenital coagulopathies and summarize considerations made in the diagnosis and management in patients with these disorders undergoing elective surgery.

9. Identify and discuss pathophysiology and the management of common acquired disorders of coagulation (coagulopathies) associated with stress, trauma, surgery, and co-morbid disease, including:

a. Disseminated intravascular coagulation (DIC)

b. Dilutional thrombocytopenia

c. Mechanical circulation

d. Vitamin K deficiency

e. Uremia

f. Liver failure

g. Hypothermia

10. Differentiate between the features, diagnosis, and management of the known hypercoagulable states, including:

a. Protein C deficiency

b. Protein S deficiency

c. Antithrombin III deficiency

d. Antiplatelet antibody production

e. Factor V Leiden

11. Discuss various aspects of pharmacologic therapy to modify hemostasis, including:

a. Agents which affect platelet function

b. Heparin

c. Coumarin-type drugs

d. Hirudin

e. Epsilon aminocaproic acid and other antifibrinolytic agents

12. Describe methods to reverse or modify the activities of heparin and coumarin-type drugs.

13. Discuss management of the anticoagulated patient referred for elective surgery.

14. Discuss fibrinolytic therapy, indications and complications.

*Section Three: Transfusion Therapy*

1. Discuss the clinical and economic rationale for blood component transfusion therapy.

2. Briefly describe the method of preparing, handling, and use of additives for the following blood components:

a. RBC's

b. Platelets (PLT's)

c. Fresh frozen plasma (FFP)

d. Cryoprecipitate

e. Granulocytes

f. Factor concentrates

3. Point out the indications for blood component transfusion at your hospital consistent with National Institutes of Health (NIH) consensus recommendations.

4. Understand the elements of informed consent for blood transfusion.

5. Discuss factors that influence the decision to transfuse.

6. Explain the principles of blood typing and transfusion therapy, including indications and complications to include the following:

   a. Major and minor blood group antigens and their laboratory evaluation

   b. Blood components and indications for transfusion

   c. Risks of transfusion, diagnosis, and therapy of transfusion complications

   d. Indications for and methods of autotransfusion and autologous blood donation

   e. Complications resulting from blood transfusion, including relative risk of viral infections

7. Explain the significance of the following:

   a. Major and minor blood group antigens

   b. Role of autoantibodies

   c. Difference between blood screening, typing, and compatibility testing

8. Discuss cardinal features of the following immediate transfusion reactions, including their diagnosis and management:

   a. Febrile

   b. Allergic

   c. Hemolytic

9. Assess the incidence and risk of transfusion-related infections such as:

   a. Acquired Immune Deficiency Syndrome (AIDS)

   b. Cytomegalovirus (CMV)

   c. Hepatitis

10. Define the methods, indications, and benefits of autologous blood donation.

11. Illustrate the application of erythropoietin, granulocyte-colony stimulating factor, and similar agents to the surgical patient with co-morbid disease.
12. Explain the mechanics, application, and limitations of intraoperative autotransfusion.

13. Describe indications for DDAVP in patients with coagulation disorders.

*Section Four: Hematologic Considerations in Elderly Patients*

1. Describe changes in the hematopoietic and coagulation systems associated with aging.

2. List chronic diseases that influence the hematopoietic or coagulation systems that are prevalent in elderly patients.

3. List common drugs prescribed to elderly patients which are prone to alter hematopoietic reserve or coagulation.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

(Combining Sections One through Four)

1. Outline a cost-effective strategy to identify preoperative patients at risk for abnormal bleeding based on:

   a. History of bleeding diathesis

   b. Magnitude of surgery

   c. Potential for vascular involvement

2. Evaluate patients with known hematologic disorders.

3. Recommend and perform preoperative, intraoperative, and postoperative interventions to minimize morbidity in patients with hematologic disorders.

4. Diagnose and definitively treat unexpected intra- and post- operative hemorrhage.

5. Assess risks and perform vascular access procedures in patients with anemic, neutropenic, and coagulopathic disorders.

6. Recognize and treat immediate transfusion reactions.

7. Discuss with patient and family the risks, benefits, and alternatives to blood component transfusion.

8. Participate in the surgical care of patients undergoing splenectomy, liver biopsy, and nodal staging for hematologic disease

9. Identify patients at risk for developing deep venous thrombosis (DVT) and prophylax against DVT, using pharmacologic and mechanical methods.

10. Manage patients on chronic anticoagulation therapy who require elective surgery.

11. Discuss pathophysiology of hemoglobin S disease (sickle cell disease) and its surgical implications.

12. Manage patients with hemoglobin S disease requiring surgery.

13. Manage patients on fibrinolytic therapy.

## CLINICAL, LABORATORY, AND SURGICAL PATHOLOGY

*Section One: CLINICAL PATHOLOGY*

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Describe the basic principles of:

    a. Pathogenesis of reversible and irreversible cell injury

    b. Acute and chronic inflammatory responses

2. Discuss the pathogenesis, clinical significance, signs and symptoms, and therapy for:

    a. Derangements of normal wound healing

    b. Fluid and hemodynamic derangements including shock, edema, congestive heart failure

    c. Disorders of coagulation and hemostasis, including complications of: hemorrhage, disseminated intravascular coagulation (DIC), deep venous thrombosis (DVT), pulmonary embolism (PE)

    d. Disorders of the immune system, especially hypersensitivity reactions and autoimmune disease

e. Infectious diseases involving bacteria, viruses, fungi, or parasites

f. Neoplastic disease

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Recognize the early signs and symptoms and initiate therapy for the following:

a. Alterations of normal wound healing including infection and disruption

b. Fluid and hemodynamic derangements

c. Disorders of coagulation and hemostasis

d. Disorders of the immune system

e. Infectious diseases involving bacteria, viruses, fungi, or parasites

f. Neoplastic disease

2. Participate in deciding the appropriate surgical procedure for benign and malignant disease.

3. Monitor patients for possible postoperative complications and institute appropriate diagnostic studies and therapy for such conditions as:

a. Wound infections

b. Atelectasis/respiratory compromise

c. Cardiac dysrhythmias/myocardial infarction

d. Ileus

e. Urinary retention

f. Deep venous thrombosis/pulmonary embolus

g. Systemic infection

4. Teach medical students and more junior residents about basic pathologic principles while on rounds and in the operating room.

*Section Two: LABORATORY PATHOLOGY*

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Describe appropriate containers for storing blood and other body fluids during laboratory transport to sites where common serum chemistry studies are to be performed.

2. Discuss the relative sensitivity, specificity, and accuracy of common laboratory studies.

3. Demonstrate competency in interpreting:

   a. Abnormal urinalysis

   b. Abnormal thyroid function studies

   c. Steroid suppression tests

4. Outline the standard components of a coagulation profile, including the common clinical conditions associated with their abnormalities.

5. Identify significant components for each of the following:

   a. A complete blood count

   b. The meaning of "left shift"

   c. Common clinical conditions causing elevations in each component

6. Analyze causes for artificially abnormal laboratory values, including:

   a. Specimen hemolysis

   b. Impact of hyperglycemia

   c. Impact of hypoalbuminemia

7. Identify potential adverse effects of repeated phlebotomies, and discuss potential remedies for the following concerns:

   a. Patient pain

   b. Anemia

   c. Thrombophlebitis

   d. Arterial thrombosis

e. Patient and hospital costs

8. Discuss the typical presentation of microbiologic data, and the importance of the following:

a. Specimen identification and timing of sample

b. Organism identification

c. Drug sensitivity profile

d. Minimum inhibitory concentration

e. Beta-lactam resistance

f. Resistance

g. Colonization

h. Contaminated specimen

9. Explain the importance of laboratory quality control in the hospital and outpatient setting. Clarify the meaning of role reference laboratory.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Identify the indications for routine preoperative laboratory studies, recognize clinically significant abnormalities, and provide appropriate management.

2. Manage the postoperative course of patients, using relevant laboratory studies (including their indication, relevance to clinical condition, and continued need).

3. Manage the anticoagulation status of patients using heparin and Coumadin, while considering the patient's prothrombin time (PT) and partial thromboplastic time (PTT).

4. With the assistance of medical consultation, investigate and diagnose a new coagulation defect in a surgical patient.

5. Modify patient's infectious disease treatment plan using data from a microbiology report.

*Section Three: SURGICAL PATHOLOGY*

COMPETENCY-BASED KNOWLEDGE OBJECTIVES

1. Discuss the indications, contraindications, and limitations of the following biopsy techniques:

    a. Fine-needle aspiration (FNA)

    b. Stereotactic biopsy

    c. Core biopsy

    d. Incisional biopsy

    e. Excisional biopsy

2. Explain the methods of handling and transporting tissue obtained by the methods listed above.

3. Describe the role of needle aspiration in the diagnosis and management of:

    a. Breast pathology

    b. Thoracic pathology

    c. Abdominal pathology

    d. Thyroid pathology

    e. Head and neck malignancy

4. Discuss principles and indications for the following methods of tissue preparation:

    a. Hematoxylin and eosin stains

    b. Immunohistochemistry

    c. Specific stains (enolase, argentaffin)

    d. Polymerase chain reaction

5. Discuss the use and interpretation of genetic analysis of neoplastic tissue, including:

    a. Ploidy status

    b. Mitotic activity

    c. Cell-cycle phase

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Perform FNA, core, incisional, and excisional biopsies; and discuss the results and implications of each with the attending surgeon, the pathologist, and then the patient.

2. Review and discuss the details of a surgical pathology report with the attending surgeon.

3. Discuss intraoperative gross findings, and guide differential diagnosis formulation with the surgical pathologist and surgical team.

4. Review intraoperative frozen section and postoperative permanent section histology with the surgical pathologist and surgical team.

5. Participate in autopsies performed for deaths following acquired disease and trauma.

6. Participate in a multidisciplinary conference including surgeon, pathologist, radiologist, and oncologist by discussing pertinent patient history, operative findings, pathophysiology, and proposed treatment.

## SURGICAL INFECTIONS

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

*Section One: Mechanisms of Infection, Surgical Hazards, and Epidemiology*

1. Discuss the mechanisms of infection acquisition in surgical patients, to include: 1) mode of transmission, 2) patient risk factors, and 3) methods of prevention:

    a. Community--acquired

    b. Procedure--related

    c. Nosocomial

2. Explain the role of bacterial inoculum and virulence as well as local and systemic adjuvant factors that contribute to infection and abscess formation.

3. Discuss how the host defenses of dissemination, inflammation, and loculation participate in the coordinated inflammatory response to infection and subsequent abscess formation.

4. Demonstrate an understanding of and correct technique for handwashing as the single most important method for preventing infectious disease transmission.

5. Analyze the infectious disease risks to which patients and surgeons are exposed, considering the most common infections and the use of universal precautions to minimize disease transmission.

6. Understand the operating room wound classification system as it applies to infection rate surveillance.

7. Understand the role and purpose of hospital surveillance and/or infection control management groups.

8. Understand the impact of "surgeon-related" factors to surgical infections such as: length of operation, handling of tissues, electrocautery, choice of suture, hair clippings.

9. When elderly persons mount a "significant fever" of 38.5ºC (101ºF) or greater, severe life-threatening bacterial infection is oftentimes present. Summarize the factors involved in and frequency of occurrence of the following factors in the febrile elderly patient:

a. Altered mental status
b. Leukocytosis
c. Rapid change in functional status
d. Appetite
e. Respiratory rate
f. Serum glucose
g. Serum sodium

10. More than half of the occurrences of bacteremia in persons 65 and older are hospital acquired. Discuss the significance of the following organisms to elderly patients who, as a group, experience increased infection associated with morbidity and mortality:

a. Gram-positive cocci (coagulase-negative staphylococci, Staphylococcus aureus, enterococci)

b. Gram-negative bacilli (E. coli, Klebsiella species)

11. Explain the older adult's susceptibility to pneumonia, summarizing effects of the following factors:

a. Age-related changes in pulmonary reserve (e.g., alterations in lung volumes, elasticity, compliance ventilation)

b. Diminished cough

c. Airway collapse

d. Comorbid conditions (interfering with gag reflexes and ciliary transport)

e. Aspiration of oropharyngeal flora

f. Hematogenous spread of microbes

*Section Two: Surgical Infections*

1. Describe the mode of transmission, diagnosis, and treatment of typical infections seen in surgical patients, including:

a. Those common to all patients (pneumonia, urinary tract infections [UTI], skin infections)

b. Those uniquely cared for by surgeons (complex soft tissue, diabetic foot ulcers, postoperative abdominal abscesses, dehiscences)

2. Suggest common sources of postoperative fever; outline a diagnostic approach and proposed plan of intervention.

3. Differentiate between the following types of postoperative pneumonia, discussing patient risk factors, unique diagnostic clues, and treatment strategies:

a. Non-ventilatory-associated

b. Ventilatory-associated

c. Aspiration-acquired

4. Demonstrate an understanding of intra-abdominal abscesses, paying particular attention to:

a. Etiology

b. Bacterial participation

c. Surgical management

d. Therapy failure

5. Differentiate cellulitis, lymphangitis, lymphadenitis, and fasciitis from cutaneous abscess; describe the management of each.

6. Discuss the pathophysiology, diagnosis, and treatment of necrotizing fasciitis with special attention to risk factors and physical examination findings.

7. Outline the Advanced Trauma Life Support (ATLS) guidelines for tetanus prophylaxis; describe treatment principles for Clostridium tetani infection.

8. Summarize characteristics of those fungal infections of surgical significance, differentiating between community-acquired, nosocomial, and opportunistic infections.

9. Describe the RNA and DNA viruses of surgical significance, indicating their prevalence and modes of transmission.

10. Outline the management strategies for the diagnosis and treatment of infected catheters, implantable devices, and surgical hardware.

*Section Three: Use of Antibiotics in Surgery*

1. Summarize indications for prescribing prophylactic antibiotics associated with:

    a. Clean procedures (hernia, vascular, thyroid)

    b. Clean-contaminated procedures (GI, GU, Oropharyngeal)

    c. Contaminated procedures

    d. Implantable devices

        (1) Vascular grafts

        (2) Orthopedic hardware

        (3) Soft tissue implants and synthetic reinforcements (breast, hernia)

2. Analyze situations where prophylactic antibiotics are discouraged:

    a. Burns

    b. Post-splenectomized patient

    c. Early aspiration

3. Discuss the importance of timing and dosing for prophylactic antibiotic use; analyze antibiotic use in older patients, and analyze potentially adverse consequences of their use.

4. Justify the empirical first-line approach to antibiotic use in the treatment of surgical infections and early intra-abdominal infection.

5. Summarize the method by which microbiologic data are gathered, interpreted, and applied to altering antibiotic choice, dose, and duration.

6. Discuss the mechanism of action, mechanism of resistance, applications, side effect profile, and costs of the following antimicrobials:

    a. Penicillins and derivatives

b. Cephalosporins

c. Vancomycin

d. Erythromycin and derivatives

e. Metronidazole

f. Quinolones

g. Aztreonam

h. Sulfonamides

i. Anti-fungal agents

j. Aminoglycosides

k. Anti-virals

7. Demonstrate an understanding of the general pharmacology of antibiotics, pharmacologic changes that occur in the septic patient, and describe the effect of local environment on volume of distribution and protein binding.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Appropriately diagnose and treat common infections seen in surgical patients.

2. Make an appropriate and timely diagnosis for simple and complex infections in the postoperative patient; alter therapy as dictated by clinical, radiologic, and microbiologic response.

3. Competently diagnose and treat necrotizing fasciitis, and Clostridium perfringens infections.

4. Prepare patients for elective surgery by providing effective parenteral and enteral prophylactic antibiotics when indicated.

5. Coordinate the treatment of aggressive soft tissue infections to include:

a. Early operative debridement and re-debridement as necessary

b. Urinary and fecal diversion when necessary

c. Antibiotic management

d. Postoperative critical care, including fluid and nutrition management

6. Identify sources of implantable device infection; confirm diagnosis; and appropriately treat such infections.

7. Practice the effective use of universal precautions, including meticulous handwashing to minimize infection transmission risk from health care professional (HCP) to patient, and vice versa.

8. Contact the office of epidemiology, infection control, or the resident supervisor when breaches in techniques of universal precautions have been committed.

9. Work with members of the infectious disease specialty team in the management of complex surgical wounds.

## WOUND HEALING

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

*Junior Level: PGY-I, PGY-II*

1. Describe the physiological process of normal wound healing, including the healing relationship to:

   a. Anatomy
   b. Physiology
   c. Biology
   d. Biochemistry
   e. Microbiology
   f. Immunology
   g. Molecular Biology

2. Explain the effect of the following factors on wound healing:

   a. Nutrition
   b. Pathologic metabolic states (including diabetes mellitus)
   c. Hematologic status
   d. Radiation
   e. Immune response
   f. Growth factors
   g. Super oxide radical formation
   h. Pharmacologic manipulation
   i. Infection/sepsis
   j. Chemotherapeutics

k. Trauma

3. Describe the steps of normal of wound healing, including:

a. Inflammation
b. Proliferation
c. Remodeling
d. Epithelialization
e. Contracture/contraction

4. Discuss the pathophysiology of delayed wound healing due to microbial physiology, virulence, and host defenses.

5. Differentiate between the pathophysiology of thermal, chemical, and electrical burns.

6. Discuss the principles of aseptic technique in uncomplicated cases related to the following procedures:

a. Incision making
b. Debridement
c. Wound closures
d. Dressings, splints, and casts

7. Describe the common chemical agents which are classically discussed in relation to burns and their antidotes.

8. Explain the principles of wound care as they relate to:

a. Debridement
b. Traumatic wounds
c. Burn wounds
d. Chronic wounds
e. High-pressure injection injury
f. Medication infiltration

9. Summarize the principles of wound protection and subsequent healing using:

a. Dressings

(1) Occlusive
(2) Non-occlusive
(3) Alginates
(4) Casting

b. Other wound dressing materials

(1) Collodium
(2) Petroleum gauze
(5) Dakin's solution
(6) Acetic acid solution

(3) Xeroform

(4) Scarlet Red

(7) Silvadene, sulfamylon

(8) Iodine, Bacitracin

c. The concept of "moist wound healing"

d. Adjunctive therapies: hyperbaric oxygen, electrical stimulation, vacuum assisted wound management, pulse irrigation

10. Discuss potential problems in complicated wound healing, including such challenges as snake, animal, insect, and human bites; electric burns; deep space infections of the hand; penetrating wounds; and radiation.

11. Define and describe the causes of postoperative wound complications such as:

a. Dehiscence

b. Evisceration

c. Fasciitis and abscess formation

12. Discuss the concept of the reconstructive ladder.

13. Describe the microbiology of gangrene and necrotizing fasciitis.

14. Explain the principles associated with the selection of appropriate incisions applying surgical anatomy to include:

a. Blood supply

b. Lines of tension

c. Access

d. Strength

e. Cosmesis/aesthetics

15. Describe the rationale for selection of appropriate wound closure and reconstruction as it relates to wound healing in:

a. Primary and delayed primary closure

b. Secondary healing

c. Skin graft, split and full thickness

d. Local flaps

e. Regional flaps

f. Microvascular flaps

g. Composite grafts

16. Assess the properties and uses of different types of suture material, including those that are absorbable and non-absorbable.

17. Analyze the therapeutic options for treatment of abnormal or delayed wound healing because of:

a. Host resistance
b. Infection
c. Diabetes mellitus
d. Radiation
e. Ischemia

18. Discuss treatment choices for the following wound healing problems:

a. Dehiscence
b. Infection
c. Hernia

19. Identify the resources needed to assist with wound healing outside the hospital and outline methods for resource acquisition to include home health care and equipment rental.

20. Describe the use of pressure relief devices and beds to prevent pressure ulcerations.

21. Differentiate between fetal wound healing and adult wound healing. Discuss the possible applications of fetal wound healing.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

*Junior Level: PGY-I, PGY-II*

1. Provide basic care to wounds from abrasions and small lacerations, including acute debridement, closure, and dressing placement.

2. Provide care for complex traumatic injuries considering:

a. Management of hemorrhage

b. Acute pain control

c. When to explore operatively

d. Debridement

e. Acute closure or coverage

f. Secondary reconstruction

3. Evaluate the progress of wound healing.

4. Apply all types of dressings and casts.

5. Make and close common incisions in the outpatient clinic, outpatient emergency department, and in the operating room.

6. Remove casts and complex dressings.

7. Assess thermal and non-thermal burns and initiate treatment.

8. Debride and care for wounds of low to intermediate complexity, including traumatic injuries.

9. Apply all types of complex dressings, including body casts.

10. Make and close incisions of low to intermediate complexity.

11. Debride complex wounds and provide postdebridement care of such wounds.

12. Manage wounds of low to intermediate complexity, and alter therapy as indicated.

13. Perform complex procedures for the closure of difficult wounds, including various local and regional skin flaps and grafts.

14. Manage the care of various complex wound complications such as dehiscence, wound infections, and incisional hernias.

15. Analyze the use and need for complex reconstructive flaps and grafts; (e.g., application of the "reconstructive ladder").

## WOUND HEALING IN ELDERLY PATIENTS

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

1. Describe the process of normal wound healing in older patients, highlighting the differences from the adult and child with respect to:

   a. Physiology

   b. Microbiology

   c. Immunology

2. Explain the effect of the following factors on wound healing in older patients:

   a. Nutrition

   b. Metabolic state (including diabetes mellitus)

   c. Collagen deposition

   d. Pharmacologic manipulation

   e. Physical activity/mobility

3. Explain the principles of wound care as they relate to chronic wounds.

4. Define and describe the causes of postoperative wound complications such as:

   a. Dehiscence

   b. Evisceration

   c. Fasciitis

5. Describe the rationale for selection of appropriate wound closure and reconstruction as it relates to geriatric wound healing in:

   a. Primary and delayed primary closure

   b. Secondary healing

   c. Skin graft, split and full thickness

   d. Local flaps

   e. Regional flaps

   f. Microvascular flaps and transfers

g. Tissue substitutes and adjuncts

6. Analyze the therapeutic options for treatment of abnormal or delayed wound healing in elderly patients because of:

a. Host resistance

b. Infection

c. Diabetes mellitus

d. Ischemia

7. Identify the resources needed to assist with chronic wound healing outside the hospital and outline methods for resource acquisition to include home health care and equipment rental.

8. Describe the use of pressure relief devices and beds to prevent pressure ulcerations.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

1. Provide basic care to chronic wounds and pressure ulcers, including acute debridement and dressing placement.

2. Identify the clinical stages of pressure ulceration.

3. Evaluate the progress of wound healing.

4. Apply all types of dressings and casts.

5. Remove casts and complex dressings.

6. Perform wound debridement, and be able to provide postdebridement care to debrided wounds.

7. Perform procedures for the closure of difficult wounds in older patients, including frequently used local and regional skin flaps and grafts.

8. Manage the care of various complex wound complications such as dehiscence, wound infections, and incisional hernias.

9. Analyze the pros and cons of complex reconstructive options in older patients' chronic wounds.

10. Be able to instruct other health care professionals in basic evaluation, prevention, and dressing care of chronic wounds or pressure ulcers.