

## Goals and Objectives for Host and Defense Section

Note: items listed here that may receive only a brief introduction or not be covered at all in this section, such as tumor immunology, are indicated in **light blue font**.

### Key stakeholders:

immunology  
pathology  
microbiology  
pharmacology  
biochemistry (little)  
histology (little)  
gross anatomy (little)  
physiology (little)  
hematology (little)  
physical diagnosis  
science of medicine  
humanities and bioethics  
medical informatics

## GOALS

### Clinical Medicine

1. Effectively interview and examine patients in order to gather essential and accurate information especially in the context of common infectious diseases, immunologic, autoimmune and rheumatologic diseases (p. 3)
2. Discriminate between normal physical exam findings from pathologic findings seen in common infectious diseases, common autoimmune diseases, immunodeficiencies and rheumatologic diseases (pp. 4-6)
3. Accurately organize and document information gathered in a patient encounter into SOAP (Subjective, Objective, Assessment, Plan)/progress notes and complete histories and physical exams on patients with common infectious diseases, common autoimmune diseases, immunodeficiencies and rheumatologic diseases (pp. 7-9)
4. Develop strategies to explain the clinical presentation and pathophysiology of various common infectious, immunologic and autoimmune diseases (pp. 10-12)
5. Develop basic differential diagnoses for common infectious diseases, autoimmune, immunologic and rheumatologic problems (pp. 13-15)
6. Develop an understanding of the evaluation and management of common infectious diseases, autoimmune and immunologic problems (p. 16)
7. Understand the basic concepts and utility of common laboratory, imaging and other pathology-based studies used in the diagnosis and management of common infectious diseases, autoimmune, immunologic and rheumatologic problems (pp. 17-18)
8. Understand appropriate strategies for disease prevention for children, adults and special populations with particular emphasis on vaccine recommendations for these groups (p. 19)

**Medical Arts** (pp. 20-21)

1. *History of Medicine, Medicine and Society*: discuss the impact of the history of medicine on modern day medical practice particularly in the context of microbiology, the discovery of antibiotics and vaccinations
2. *Professionalism*: demonstrate ability to act professionally toward patients and colleagues
3. *Ethics*: demonstrate understanding of ethical principles and be able to analyze ethical issues
4. *Communication Skills*: demonstrate the ability to communicate effectively with patients, families and medical colleagues across a broad range of socioeconomic and ethnic backgrounds to assure comprehensive patient care
5. *Doctor-Patient Relationship*: describe the important aspects of the doctor patient relationship in the practice of medicine and demonstrate understanding of patient confidentiality and protected health information
6. *Physician Development*: describe the various aspects of personal development in the practice of medicine, including self-reflection, independent learning, and an appreciation of the unique aspects of caring for patients
7. *Medical Economics*: begin to understand the business aspects of practice management and the complex nature of practicing cost-effective health care and resource allocation without compromising quality of care
8. *Medical Systems*: demonstrate ability to use information technology, multidisciplinary resources and operate within systems of health care to improve care of the patients
9. *Medical Humanities*: describe the role of the humanities in developing a larger sociocultural understanding of the development and current practice of medicine.

**Medical Sciences**

1. Understand the classification and basic biology of common bacteria, viruses, fungi, parasites, and prions that cause human disease (pp. 22-23)
2. Understand the pathophysiology and treatment of common bacterial, viral, fungal, parasitic and prion causes of disease (pp. 24-28)
3. Understand principles of antipyretic, anti-inflammatory, antimicrobial agents, and immunomodulatory agents including: indications, contraindications, mechanisms of action, distribution, metabolism, side effects, and common interactions (pp. 29-30)
4. Understand the normal development of the human immune system, abnormalities of immune regulation, and immunodeficiencies (pp. 31-32)
5. Understand the role of the immune system in response to common infections, tissue damage, and cancer, and its role in autoimmune and rheumatologic diseases. (pp. 33-35)
6. Understand the biology of tissue response to stress, damage, and disease including inflammation, wound healing, hemostasis, and tissue repair (pp. 36-43)

## Clinical Medicine Objectives

1. Demonstrate ability to interview patients/family members in order to gather essential and accurate information, especially in the context of common infectious diseases, immunologic, autoimmune and rheumatologic diseases, including

- A. Elicit concerns of patients using non-directive (open ended) and directive (closed ended) questions, paraphrasing and summarizing where appropriate
- B. Demonstrate behavior that promotes effective communication with patients, including avoiding use of medical jargon, minimizing interruption, allowing patients to tell their story
- C. Describe how patients' situations affect their medical care and how underlying medical illness affects patients' lives
- D. Recite and define the vocabulary in a complete review of systems
- E. Identify and obtain past medical, social, family history and medications which are pertinent to a patient's presenting complaint
- F. Demonstrate ability to obtain a targeted review of systems as dictated by a presenting patient's complaint
- G. Demonstrate ability to obtain a sexual history and identify risky behaviors which place patients at risk for sexually transmitted illnesses
- H. Discuss the importance of travel and exposure history in gathering information about infectious illnesses
- I. Demonstrate ability to obtain a complete medication list including drug name, dose, route, frequency of administration and patients' compliance with drug regimen
- J. Identify and correctly document patient allergies including specific reactions to medication, foods or other allergens
- K. Discriminate between adverse reactions to medications and true allergy

2. Discriminate between normal physical exam findings and pathologic findings seen in common infectious diseases, common autoimmune diseases, immunodeficiency states and rheumatologic diseases

A. Physical Exam: Vital Signs – Temperature, Heart Rate, Respiratory Rate, Blood Pressure

1. Demonstrate appropriate technique in obtaining
  - a. Temperature: oral, axillary, rectal and tympanometric
  - b. Respiratory Rate
  - c. Heart Rate
  - d. Blood Pressure
2. Define the following for children and adults:
  - a. normal core body temperature
  - b. normal heart rate
  - c. normal respiratory rate
  - d. normal blood pressure
3. Compare and contrast variability in results between different methods of obtaining temperature – oral, rectal, axillary, tympanometric
4. Define (for both adults and children) the following:
  - a. hyperthermia and hypothermia
  - b. hypotension and hypertension
  - c. tachycardia and bradycardia
  - d. tachypnea, hypopnea and apnea
5. Define and discriminate between SIRS (systemic inflammatory response syndrome) and sepsis

B. Physical Exam: Lymph Nodes

1. Demonstrate proper technique in performing an examination of the lymph nodes recognizing all lymph node chains in the neck, axillary, inguinal, and epitrochlear regions
2. Differentiate between normal and pathologic lymph nodes
3. Differentiate between lymphadenitis and lymphadenopathy

C. Physical Exam: Abdomen and Back

1. Spleen
  - a. Describe and demonstrate the appropriate technique in performing an exam of the spleen, including:
    - (1) appropriate patient positioning
    - (2) beginning the exam from the right lower quadrant
    - (3) appropriate identification and percussion of Castell's spot
  - b. Define the significance of a positive Castell's sign
  - c. Define splenomegaly

2. Liver
  - a. Describe and demonstrate the appropriate technique in performing an exam of the liver, including:
    - (1) appropriate patient positioning
    - (2) beginning the exam from the right lower quadrant
    - (3) appropriate determination of liver size in centimeters using percussion technique
  - b. Define hepatomegaly and differentiate between hepatomegaly and hepatitis in children and adults
3. Costovertebral angle
  - a. Demonstrate the appropriate technique in examining the back for CVAT
  - b. Discriminate between normal and abnormal findings on exam
4. Physical Exam: Musculoskeletal
  - a. Demonstrate appropriate technique in performing a complete examination of the muscles, bones, joints and spine
  - b. Discriminate between bone pain, myalgias, myositis, arthritis and arthralgias
5. Physical Exam: Integument
  - a. Demonstrate appropriate technique in performing a complete skin exam
  - b. Describe characteristics of normal perfusion and abnormal perfusion
  - c. Define normal capillary refill time
  - d. Differentiate between physical findings of cellulitis, erysipelas, impetigo, macular rashes, papular rashes, vesicular rashes and discuss common causes of each in children and adults
6. Physical Exam: HEENT
  - a. Demonstrate proper technique in performing examination of the following
    - (1) scalp and hair
    - (2) orbit, conjunctivae, anterior chamber, sclera, retina
    - (3) nares and nasopharynx
    - (4) sinuses
    - (5) oropharynx
    - (6) external auditory canals, tympanic membranes
  - b. Differentiate between the following in children and adults:
    - (1) Conjunctivitis
    - (2) Uveitis, episcleritis, iritis, retinitis
    - (3) Exudative pharyngitis
    - (4) Otitis externa and otitis media
    - (5) Rhinitis and sinusitis
7. Physical Exam: Pulmonary
  - a. Demonstrate proper technique in performing examination of the
    - (1) Anterior and posterior thorax
    - (2) Right and Left Upper lobes
    - (3) Right Middle Lobe, Right Lower Lobe
    - (4) Left Lower Lobe and Lingula
  - b. Describe normal breath sounds and explain how adventitious sounds differ from normal breath sounds, specifically addressing the significance of the following: Wheezing, Rhonchi, Rales, Stridor, Pleural friction rub
  - c. Describe and perform maneuvers to identify pulmonary consolidation, specifically: Egophony, Whisper pectoriloquy, Tactile fremitus
8. Physical Exam: Cardiovascular

- a. Demonstrate proper technique in performing examination of the
    - (1) Jugular veins
    - (2) Carotid Arteries
    - (3) Heart
    - (4) Major arteries of the upper and lower extremities and abdomen
  - b. Heart:
    - (1) Differentiate between
      - (a) Physiologic splitting of the second heart sound and fixed splitting of the second heart sound
      - (b) Innocent and pathologic systolic murmurs
    - (2) Describe murmurs according to:
      - (a) duration of the murmur
      - (b) characterization of the murmur – systolic or diastolic, regurgitant or ejection type
      - (c) proximity to S1 and S2
      - (d) area of the chest where the murmur is most intense
      - (e) description of the associated LVAI (left ventricular apical impulse) (normal, enlarged, displaced)
      - (f) description of associated carotid sounds and impulses
      - (g) description of associated jugular venous impulses and pressure
  - c. Recognize other pathologic findings seen in infectious endocarditis (IE) and be able to define the following: roth spots, splinter hemorrhages, janeway lesions, oslers nodes
  - d. Recognize murmurs typically associated with IE with particular attention to
    - (1) aortic regurgitation
    - (2) mitral regurgitation
    - (3) tricuspid regurgitation
9. Physical Exam: Genitourinary
- a. Demonstrate proper technique in performing examination of the
    - (1) Female external genitalia, vagina, cervix, uterus ovaries, fallopian tubes and urethra
    - (2) Male external genitalia, prostate and urethra
  - b. Describe normal findings on male and female external genital and pelvic exams in children and adults and differentiate between normal findings and the following: genital ulcerations and lesions, purulent urethral discharge, vaginal and cervical discharge, cervical motion tenderness, adnexal tenderness, uterine tenderness, testicular tenderness, prostatic tenderness

3. Organize and document information gathered in a patient encounter into SOAP (Subjective, Objective, Assessment, Plan)/progress notes and complete history and physical exams on patients with common infectious diseases, common autoimmune diseases, immunodeficiencies and rheumatologic diseases, including

A. Physical Exam: Vital Signs

1. Demonstrate ability to consistently document with each patient encounter:  
Temperature, Heart Rate, Respiratory Rate, Blood Pressure, Height, Weight

B. Physical Exam: Lymph Nodes

1. Describe and document the qualities of lymph nodes using the following:
  - a. location: submandibular, submental, occipital, pre-auricular, post-auricular, anterior cervical, posterior cervical, supraclavicular, axillary, epitrochlear, inguinal
  - b. size
  - c. number: single, multiple, matted/confluent
  - d. consistency: hard, firm, soft
  - e. mobility: mobile, or fixed to underlying tissue
  - f. tenderness: yes or no

C. Physical Exam: Abdomen/Back

1. Describe and document an exam of the abdomen and back with attention to:
  - a. abdominal curvature (distended, normal, scaphoid)
  - b. bowel sounds – hyperactive, hypoactive, absent;
  - c. tenderness to light percussion – yes or no
  - d. tenderness to light and deep palpation – yes or no
  - e. palpable masses – yes or no  
(1) If yes, size (in cm) & location (R or L upper or lower quadrant)
  - f. CVAT – yes or no, unilateral or bilateral
2. Describe and document an exam of the spleen in a child and an adult, including
  - a. palpable: yes or no
  - b. size in cm below R costal margin
  - c. tender: yes or no
3. Describe and document an exam of the liver in a child and an adult, including evaluation for ascites and with attention to
  - a. Size: in centimeters
  - b. Texture: hard, soft, nodular, smooth
  - c. Tender: yes or no
  - d. Ascites: yes or no (demonstrate exam for shifting dullness and fluid wave)
4. Differentiate between normal and pathologic states, such as hepatitis and cirrhosis

D. Physical Exam: Musculoskeletal

1. Describe and document normal range of motion of all joints in the upper extremities, lower extremities and spine

2. Demonstrate ability to document findings of: synovitis, joint effusion, limited range of motion

E. Physical Exam: Integument

1. Describe and document a normal skin examination
2. Demonstrate ability to document findings of
  - a. Cellulitis
  - b. Erysipelas
  - c. Impetigo
  - d. Scalded skin syndrome
  - e. Vesicular skin rashes
  - f. Viral exanthems and enanthems
3. Compare and contrast the appearance of skin findings seen in the following:
  - a. Cellulitis
  - b. Erysipelas
  - c. Impetigo
  - d. Scalded skin syndrome
  - e. Vesicular skin rashes
  - f. Viral exanthems and enanthems
4. Physical Exam: HEENT
  - a. Demonstrate proper description and documentation of a normal HEENT exam
  - b. Demonstrate ability to document findings of
  - c. Conjunctivitis
    - (1) in a child and in an adult
  - d. Exudative pharyngitis
  - e. Otitis externa and otitis media
  - f. Rhinitis and sinusitis
5. Physical Exam: Pulmonary
  - a. Demonstrate proper description and documentation of a pulmonary exam including: general appearance of patient (comfortable, dyspneic, labored), pattern of respiration (regular, tachypneic), work of breathing (use of accessory muscles, retractions),
  - b. Describe normal and adventitial breath sounds specifically addressing: Wheezing, Rhonchi, Rales, Stridor, Pleural friction rubs
  - c. Demonstrate ability to document findings of pulmonary consolidation, specifically: Egophony, Whisper pectoriloquy, Tactile fremitus
6. Physical Exam: Cardiovascular
  - a. Demonstrate ability to document the cardiovascular exam, including:
    - (1) Jugular venous pulsations and pressure
    - (2) Carotid Arteries
    - (3) Heart sounds: S1, S2, S3 (yes or no), S4 (yes or no)
    - (4) Left ventricular apical impulse
    - (5) Pulses in the bilateral upper and lower extremities and abdomen, bruits (yes or no)
    - (6) Demonstrate ability to document murmurs including
      - (a) duration of the murmur
      - (b) characterization of the murmur – systolic or diastolic, regurgitant or ejection type
      - (c) proximity to S1 and S2
      - (d) area of the chest where the murmur is most intense

- (e) description of the associated LVAI (left ventricular apical impulse) (normal, enlarged, displaced)
  - (f) description of associated carotid sounds and impulses
  - (g) description of associated jugular venous impulses and pressure
  - (7) Demonstrate ability to describe findings on physical exam consistent with infective endocarditis (IE), including oslers nodes, janeway lesions, roth spots and splinter hemorrhages
7. Physical Exam: Genitourinary
- a. Demonstrate ability to document findings of the
    - (1) Female external genitalia, vagina, cervix, uterus ovaries, fallopian tubes and urethra
    - (2) Male external genitalia, prostate and urethra
  - b. Describe and document findings on male and female external genital and the female pelvic exam including: genital ulcerations and lesions, purulent urethral discharge, vaginal and cervical discharge, cervical motion tenderness, adnexal tenderness, uterine tenderness, testicular tenderness, prostatic tenderness

4. Develop strategies to explain the clinical presentation and pathophysiology of various common infectious, immunologic and autoimmune diseases, specifically addressing

A. Vital Signs

1. Discuss the significance of fever in the context of
  - a. a child (age <90 days)
  - b. an adult
  - c. an immunocompromised host
  - d. compare and contrast between infections seen in patients with a compromised humoral immune system vs. compromised cellular immune system vs. both
2. Discuss the significance of the following:
  - a. hyperthermia and hypothermia
  - b. hypotension and hypertension
  - c. tachycardia and bradycardia
  - d. tachypnea, hypopnea and apnea
3. Discuss the differences between SIRS and sepsis

B. Lymph Nodes

1. Describe the significance of the regional drainage of each lymph node chain with consideration for infectious, malignant, rheumatologic and autoimmune causes of lymph node enlargement
2. Discuss the significance of the following lymph node findings in children and adults
  - a. tender lymph nodes
  - b. firm, matted, nontender lymph nodes

C. Abdomen and Back

1. Discuss the significance of tenderness in the four abdominal quadrants (RUQ, LUQ, RLQ, LLQ) and the identify organs the areas typically represent on physical exam
2. Discuss the significance of diffuse abdominal tenderness and peritoneal signs including rebound tenderness and guarding
3. Discuss the significance of a positive Castell's sign
4. Discuss the significance of splenomegaly in children and adults with consideration for infectious, malignant, rheumatologic and autoimmune causes
5. Discuss the significance of hepatomegaly in children and adults with consideration for infectious, malignant, rheumatologic and autoimmune causes
6. Discuss the significance of a positive fluid wave or shifting dullness with consideration for infectious, malignant, rheumatologic and autoimmune causes
7. Discuss the significance of CVAT in evaluating disorders related to the urinary tract

D. Musculoskeletal

1. Discuss the significance of bone pain, joint pain/redness/ stiffness, myalgias, arthralgias in children and adults with consideration for infectious, malignant, rheumatologic and autoimmune causes

#### E. Integument

1. Discuss the significance of abnormal perfusion or delayed capillary refill time in children and adults with consideration for infectious, malignant, rheumatologic and autoimmune causes
2. Discuss the significance of tender, warm, erythematous skin and their distribution on exam with consideration for infectious, malignant, rheumatologic and autoimmune causes
3. Discuss the significance of pustular, vesicular, papular and macular rashes and their distribution on physical exam with consideration for infectious, malignant, rheumatologic and autoimmune causes in children and adults

#### F. HEENT

1. With consideration for infectious, malignant, rheumatologic and autoimmune causes, discuss the significance of the following abnormal findings when identified in children and adults:
  - a. hair and scalp (e.g. tinea capitis)
  - b. orbit (e.g. orbital cellulitis), conjunctivae (e.g. conjunctivitis), anterior chamber (e.g. iritis and uveitis), sclera (e.g. episcleritis), retina (e.g. retinitis)
  - c. nares and nasopharynx (e.g. impetigo, rhinitis)
  - d. sinuses (e.g. sinusitis)
  - e. oropharynx (e.g. gingivitis, stomatitis, pharyngitis, tonsillitis, epiglottitis)
  - f. larynx (e.g. laryngitis, laryngotracheobronchitis, tracheitis)
  - g. external auditory canals, tympanic membranes (e.g. otitis externa, otitis media)

#### G. Pulmonary

1. Discuss the significance of the following with consideration for infectious, malignant, rheumatologic and autoimmune causes in adults and children:
  - a. Wheezing
  - b. Rales
  - c. Rhonchi
  - d. Stridor
  - e. Pleural friction rub
  - f. Egophany
  - g. Tactile fremitus
  - h. Whisper pectoriloquy
  - i. Discuss the ability to localize disease to the various lobes of the right and left lungs based on location of findings on physical exam

#### H. Cardiovascular

1. With consideration for infectious, malignant, rheumatologic and autoimmune causes, discuss the significance of the following abnormal findings when identified in children and adults:
  - a. elevated jugular venous pressure
  - b. hypotension and decreased perfusion
  - c. regurgitant systolic murmurs
  - d. diastolic murmurs
  - e. pericardial friction rub

- f. splinter hemorrhages, oslers nodes, janeway lesions, roth spots
- I. Genitourinary
1. With consideration for infectious, malignant, rheumatologic and autoimmune causes, discuss the significance of the following abnormal findings when identified in children and adults:
    - a. genital ulcerations
    - b. painless genital ulcerations
    - c. purulent urethral discharge
    - d. vaginal and cervical discharge
    - e. cervical motion tenderness
    - f. adnexal tenderness
    - g. uterine tenderness
    - h. testicular tenderness
    - i. prostatic tenderness

5. Produce basic differential diagnoses for common infectious diseases, autoimmune, immunologic and rheumatologic problems

A. Vital Signs

1. Discuss common causes of following in children and adults:
  - a. hyperthermia and hypothermia
  - b. hypotension and hypertension
  - c. tachycardia and bradycardia
  - d. tachypnea, hypopnea and apnea
2. Discuss common causes of SIRS and sepsis in children, adults and geriatric patients

B. Lymph Nodes

1. List common causes of lymphadenitis, and lymphadenopathy with consideration for immunologic, rheumatologic and malignant causes

C. Abdomen and Back

1. List and defend at least 3 diagnostic possibilities for the following:
  - a. Acute abdominal pain
    - (1) Localized to the upper abdomen
      - (a) With and without peritoneal signs
      - (b) In children and in adults
    - (2) Localized to the lower abdomen
      - (a) With and without peritoneal signs
      - (b) In children and in adults
    - (3) Acute diarrhea
      - (a) In children and in adults
2. List common causes of the following with consideration for immunologic, rheumatologic and malignant causes in children and adults
  - a. Peritoneal signs
  - b. Diffuse abdominal tenderness
  - c. Ascites with and without abdominal pain/tenderness
  - d. Hepatomegaly
  - e. Splenomegaly
  - f. CVAT

D. Musculoskeletal

1. Discuss common causes of the following in children and adults with consideration for immunologic, rheumatologic and malignant causes
  - a. bone pain
  - b. myalgias and arthralgias
  - c. arthritis: monoarticular, polyarticular
  - d. joint effusions
  - e. myositis

#### E. Integument

1. Discuss common causes of the following in children and adults with consideration for location/distribution of the findings, and immunologic, rheumatologic and malignant causes
  - a. Cellulitis, impetigo, erysipelas
  - b. Macular, papular, pustular and vesicular rashes
  - c. Hypo- and hyper-pigmented patchy skin rashes

#### F. HEENT

1. Describe common causes of the following in children and adults with consideration for infectious, immunologic, rheumatologic and malignant causes:
  - a. Rashes involving the hair follicles and scalp
  - b. Orbital cellulitis
  - c. conjunctivitis: unilateral and bilateral, with and without purulent discharge
  - d. iritis, uveitis, episcleritis, retinitis
  - e. rhinitis, sinusitis
  - f. pharyngitis: exudative and nonexudative
  - g. Ludwig's angina, stomatitis, dental abscesses
  - h. otitis media and otitis externa
  - i. laryngotracheobronchitis, epiglottitis

#### G. Pulmonary

1. Describe common causes of the following in children and adults with consideration for infectious, immunologic, rheumatologic and malignant causes:
  - a. Cough
  - b. Community acquired pneumonia
  - c. Atypical pneumonia
  - d. Health care and ventilator associated pneumonias
  - e. Pleural effusions
  - f. Lung masses
  - g. Hemoptysis
  - h. Hoarseness
  - i. Stridor
  - j. Wheezing
  - k. Pleural friction rub

#### H. Cardiovascular

1. Describe common causes of the following in children and adults with consideration for infectious, immunologic, rheumatologic and malignant causes:
  - a. Myocarditis
  - b. Pericarditis
  - c. Infectious endocarditis
  - d. Marantic endocarditis
  - e. Heart block

I. Genitourinary

1. Describe common causes of the following in children and adults with consideration for infectious, immunologic, rheumatologic and malignant causes:
  - a. genital ulcerations
  - b. painless genital ulcerations
  - c. purulent urethral discharge
  - d. vaginal and cervical discharge
  - e. cervical motion tenderness
  - f. adnexal tenderness
  - g. uterine tenderness
  - h. testicular tenderness
  - i. prostatic tenderness

6. Develop an understanding of the evaluation and management/treatment of common infectious diseases, autoimmune and immunologic problems

- A. Describe common diagnostic tests and basic management strategies (including pharmacologic therapy) employed in the care of children and adults with the following problems:
1. Fever in a child <90days
  2. Fever in an immunocompromised host
  3. Apnea in an child <90 days
  4. Lymphadenitis
  5. Acute abdominal pain
  6. Acute diarrhea
  7. CVAT, dysuria, urgency, frequency
  8. myalgias and arthralgias
  9. arthritis: monoarticular, polyarticular
  10. Cellulitis and impetigo
  11. Macular, papular, pustular and vesicular rashes
  12. Rashes involving the hair follicles and scalp
  13. conjunctivitis
  14. rhinitis, sinusitis
  15. pharyngitis, stomatitis
  16. otitis media and otitis externa
  17. laryngotracheobronchitis, epiglottitis
  18. Cough
  19. Pneumonia: Community acquired, atypical pneumonia, Health care associated pneumonias
  20. Pericarditis
  21. genital ulcerations
  22. vaginal discharge
  23. dyspareunia

7. Understand the basic concepts and utility of common laboratory, imaging and other pathology-based studies used in the diagnosis and management of common infectious diseases, autoimmune, immunologic and rheumatologic problems

- A. Discuss the meaning of values and the utility of the following laboratory tests
1. Complete blood count & differential, and
    - a. discuss how samples are obtained and how the test is performed
    - b. Discuss the significance of leukocytosis, neutrophilia and bandemia
    - c. Discuss the significance of atypical lymphocytes
    - d. Discuss the significance of eosinophilia
    - e. Define and discuss the significance of lymphopenia and absolute neutropenia
    - f. Define and discuss the diagnosis of SCID
  2. Immunoglobulin assays
    - a. discuss how samples are obtained and how the tests is performed
    - b. Define and discuss the diagnosis of CVID, multiple myeloma, waldenstroms macroglobulinemia
  3. Urinalysis with urine microscopy, and
    - a. discuss how samples are obtained and how the test is performed
    - b. Discuss the significance of pyuria, bacteriuria, + nitrites
    - c. Discuss the significance of sterile pyuria
  4. Stool culture, stool Giardia antigen, stool ova and parasite, clostridium difficile toxin assay, first step IBD panel
    - a. discuss how samples are obtained and how the tests are performed
    - b. describe the significance of positive tests, the sensitivity, specificity, positive and negative predictive values of the tests
  5. Skin scraping
    - a. discuss how samples are obtained and how the test is performed
    - b. describe the significance of scrapings with fungal elements
    - c. describe the significance of scrapings with a positive tzanck preparation
  6. CRP, ESR, RF and ANA
    - a. discuss how samples are obtained and how the test is performed
    - b. discuss the significance of elevated CRP and ESR in patients with rheumatologic disease, bone and joint infections
    - c. discuss the significance of elevated RF and ANA titer in patients with rheumatologic disease (rheumatoid arthritis and SLE)
  7. Rapid Strep, throat culture and monospot
    - a. discuss how samples are obtained and how the tests are performed
    - b. discuss the significance of positive tests, the sensitivity, specificity, positive and negative predictive values of the test
  8. Viral respiratory panel
    - a. discuss how samples are obtained and how the test is performed
    - b. list which viruses are included in the VRP and discuss the sensitivity, specificity, positive and negative predictive values of the test

9. Sputum gram stain and culture
  - a. discuss how samples are obtained and how the test is performed
  - b. discuss criteria which distinguish between adequate and inadequate samples
  - c. differentiate between cultures with normal respiratory flora and respiratory pathogens
10. KOH preparation
  - a. discuss how samples are obtained and how the test is performed
  - b. discuss the significance of preparations which reveal evidence of fungal elements
11. Wet preparation with evidence of flagellated parasites
  - a. discuss how samples are obtained and how the test is performed
  - b. discuss the significance of preparations which reveal evidence of flagellated parasites
  - c. discuss the significance of a positive whiff test
12. Urine LCR, RPR, FTA, HIV: ELISA, western blot and PCR
  - a. discuss how samples are obtained and how the test is performed
  - b. discuss the significance of positive tests for *Neisseria gonorrhoea*, *Chlamydia trachomatis*, *Treponema pallidum*, and HIV
13. Arterial Blood Gas (ABG), and
  - a. discuss how samples are obtained and how the test is performed
  - b. Demonstrate ability to differentiate between and discuss common causes of the following
    - (1) respiratory acidosis
    - (2) respiratory alkalosis
14. Describe the approach to reading
  - a. plain chest radiographs, and
    - (1) describe the lung parenchyma, hila and pleura/pleural space for normal CXRs in children and adults
    - (2) Compare and contrast normal chest radiographs and CXR examples of the following: Lobar Pneumonia, Atypical Pneumonia, Pleural Effusion, Lung Mass, Pulmonary Tuberculosis
  - b. Discuss the different imaging modalities utilized in evaluating the head, chest, abdomen, pelvis and limbs in the context of common infectious, autoimmune, and rheumatologic diseases, including
    - (1) CT, MRI, ultrasound (including echocardiography), nuclear medicine (e.g. tagged white blood cell scans and bone scans) and plain radiographs

8. Understand appropriate strategies for disease prevention for children, adults and special populations with particular emphasis on vaccine recommendations for these groups

- A. Discuss the importance of hand hygiene and clean water in the prevention of disease
- B. Discuss vaccination recommendations for:
  - 1. Infants 0-24 months
  - 2. Children 2-5 years
  - 3. Adolescents
  - 4. Adults with chronic conditions (diabetes, chronic obstructive pulmonary disease, HIV)
  - 5. Travelers
- C. Discuss vaccine contraindications, relative contraindications and common side effects

## Medical Arts Objectives

### 1. History of Medicine, Medicine and Society

- A. Discuss highlights of the history of microbiology, in part to show an appreciation of the recent development of this field, for example:
  - 1. Johann Miescher discovers DNA in pus (1869)
  - 2. Louis Pasteur validates germ theory of disease, creates first vaccines (1880s)
  - 3. Robert Koch develops postulates that link specific microbes to disease (1880s)
  - 4. Ronald Ross demonstrates that mosquitoes carry malaria (1897)
  - 5. Peyton Rous demonstrates that an infectious agent can cause cancer (1909)
  - 6. Oswald Avery demonstrates that DNA is the genetic material when he transfers virulence from one strain of *Streptococcus* to another by DNA transformation (1944)
  - 7. Barry Marshall and Robin Warren demonstrate that *H. pylori* infection can cause gastritis and peptic ulcer disease (1980s)
  - 8. Stanley Prusiner demonstrates that proteins (prions) can be infectious agents (1980s)
- B. Discuss the impact of the discovery and epidemic of HIV/AIDS on American and international cultures.
- C. Discuss the role that plagues have played in culture and the arts across history.

### 2. Professionalism

- A. Demonstrate the ability to act professionally toward patients and colleagues in educational and clinical settings.
- B. Demonstrate the ability to act professionally toward patients when discussing sexual history and sexually transmitted diseases.

### 3. Ethics

- A. Demonstrate understanding of the major ethical principles related to the following: testing and providing treatment for STIs/HIV in minors, conducting HIV/AIDS research in developing countries, the Tuskegee Syphilis Study
- B. Discuss the following:
  - 1. Resource Allocation: Inadequate resources and distributive justice – the law.
  - 2. Theories and criteria for equitable health care: needs, rights, utility, efficiency, desert, autonomy
  - 3. Debates about rationing: personal, local, national and international perspectives. Markets and ethical differences between competing health care delivery systems
  - 4. Boundaries of responsibility of individuals for their own illness and ethical implications.

#### 4. Communication Skills

- A. Describe the importance of interpersonal communication in the field of medicine.
- B. Communicate effectively with patients, families and medical colleagues across a broad range of socioeconomic and ethnic backgrounds to assure comprehensive patient care.
- C. Demonstrate effective communication in the following situations: delivering bad news (e.g. HIV or other STI diagnosis), communicating vaccine safety to patients/families.

#### 5. Doctor-Patient Relationship

- A. Describe the important aspects of the doctor patient relationship in the practice of medicine.
- B. Demonstrate understanding of patient confidentiality and protected health information.

#### 6. Physician Development

- A. Describe the various aspects of personal development in the practice of medicine, including self-reflection, independent learning, and an appreciation of the unique aspects of caring for patients.

#### 7. Medical Economics

- A. Recognize the business aspects of practice management and the complex nature of practicing cost-effective health care and resource allocation without compromising quality of care.
- B. Discuss the medical economics of antibiotic resistance, vaccine cost effectiveness, organ donation/transplantation.
- C. Discuss major differences between public and private payers of health insurance (e.g. Medicaid/Medicare v. BlueCross/BlueShield)

#### 8. Medical Systems

- A. Describe the impact of medical informatics on the delivery of medical care
- B. Identify and demonstrate ability to access resources which assist physicians in providing evidence based, cost effective health care to patients (e.g. antibiograms, antibiotic cost databases, respiratory virus surveillance program).

#### 9. Medical Humanities

- A. Describe the role of the humanities in developing a larger sociocultural understanding of the development and current practice of medicine.

Learning modalities may include lecture, case discussions, clinical experiences, mentorship, and modeling targeted to meet individual learning objectives.

## Medical Sciences Objectives

1. Understand the classification and basic biology of common bacteria, viruses, fungi, parasites, and prions that cause human disease. Be able to:

- A. Define the following terms:
  1. Carrier state
  2. Indigenous (normal) flora
  3. Infection vs. colonization
  4. Opportunistic infection
  5. Parasite
  6. Pathogen
  7. Pathogenesis
  8. Suppurative
  9. Transmission
  10. Virulence
- B. List the main types of infectious agents and describe their general features (size, composition, genome structure, presence of nuclear envelope, lifestyles and reproductive strategies, cell wall or capsid structure)
  1. Prions
  2. Viruses
  3. Bacteria and their mobile elements (phages, plasmids, transposons)
  4. Chlamydiae, Rickettsiae, Mycoplasmas
  5. Fungi
  6. Protozoa
  7. Helminths
  8. Insects & arachnids
- C. Describe the genetic mechanisms available to microorganisms that contribute to their ability to become resistant to chemical therapeutics
  1. Mutation and selection
  2. Conjugation and plasmids
  3. Transposons
  4. Phage transduction
  5. DNA transformation
- D. Explain the evolutionary framework underlying basic features of host-pathogen interactions, for example:
  1. The role symptoms play in host defenses and pathogen success
  2. Virulence changes in pathogen populations
  3. The role of vectors (e.g. mosquitoes or hospital staff) in transmission and virulence

- E. Describe examples from the history of antibiotic introduction and subsequent appearance of resistance and its spread
- F. Describe the classical techniques used to identify infectious agents and how they work
  - 1. Gram stain
    - a. Gram-positive or gram-negative
    - b. Cell shape
    - c. Cell anatomy
    - d. Cell grouping
    - e. Relationship to host cells
  - 2. Other stains
  - 3. Culture
- G. Describe molecular techniques currently useful, and those under development, for identification and epidemiological study of infectious agents
  - 1. Hybridization probes, PCR, sequencing
  - 2. Microarrays
  - 3. Antibodies
- H. Describe the problems presented by the host's normal flora for pathogen identification and how this can be overcome

**2. Understand the pathophysiology and treatment of common bacterial, viral, fungal, parasitic, and prion causes of disease. Be able to:**

- A. Describe the basic ways that pathogens cause disease
  - 1. Attach to cells and invade the body
    - a. Viruses: alter transcription/translation, insert genetic material in host DNA
    - b. Microbes and parasites
      - (1) Circumvent epithelial barriers
      - (2) Enter cells, modify biochemistry, capture cytoskeleton
  - 2. Kill cells directly
  - 3. Release factors, toxins and/or enzymes, that produce cellular and tissue damage
  - 4. Induce harmful host responses
- B. Describe the host barriers to infection and how they are commonly breached (see next item for immune system evasion)
  - 1. Skin
    - a. Barrier features
      - (1) Low pH
      - (2) Lipid coating
      - (3) Physical barrier of keratin and keratinocytes
      - (4) Defensins
    - b. Normal flora
    - c. Breaches
      - (1) Wounds (staph & fungal invasion)
      - (2) Bites (insect & animal)
      - (3) Burns (Pseudomonas)
      - (4) Sores (multiple infections)
      - (5) Medical devices, e.g. catheters
      - (6) IV drug use (HIV, Hepatitis)
  - 2. GI tract
    - a. Barrier features
      - (1) Stomach acid, bile, hydrolytic enzymes
      - (2) Mucous
      - (3) Normal flora
      - (4) IgA
      - (5) Defensins
    - b. Normal flora
    - c. Breaches
      - (1) Mass invasion (sanitation/public health failure)
      - (2) Loss of barrier features (antibiotics kill normal flora, drugs that reduce mucous production)
      - (3) Obstructions
  - 3. Respiratory system
    - a. Barrier features
      - (1) Mucous and cilia
      - (2) Macrophages and PMNs
    - b. Normal flora
    - c. Breaches
      - (1) Physical insults (smoking, aspirated fluids)

- (2) Size (small particles ( $<5\mu$ ) get past mucous to alveoli)
- 4. Urogenital tract
  - a. Barrier features
    - (1) Regular flushing with urine
    - (2) Length of urethra (males vs. females)
    - (3) Low pH in vagina
  - b. Normal flora
  - c. Breaches
    - (1) Obstruction and reflux
    - (2) Short urethra in women
    - (3) Sexual transmission
- C. Describe the mechanisms used by pathogens to evade the host's immune system
  - 1. Colonizing inaccessible sites (e.g. intracellular parasites and viruses)
  - 2. Suppressing or avoiding innate immune defenses
    - a. Subverting signaling
    - b. Subverting or avoiding chemical and phagocytic attack
  - 3. Suppressing or avoiding acquired immune defenses
    - a. Surface antigen variation
    - b. Antigen shedding
    - c. Subverting antigen presentation
- D. Describe general features of pathogen growth, spread, and release
  - 1. Growth at or near site of entry (many IDs of skin, lungs, gut, UTI)
  - 2. Interior spreading mechanisms
    - a. Through connective tissues (Staph)
    - b. Through lymph and/or blood and internal organs, such as liver (malaria)
    - c. Via nerves (rabies, Herpes)
    - d. Via the placenta
  - 3. Release mechanisms
    - a. Skin shedding
    - b. Respiratory tract: sneezing, coughing
    - c. Fecal/oral: major route with bad or no public health
    - d. Sexual transmission
- E. Describe the consequences of immunosuppression on host response to infection
  - 1. Inherited deficiencies
  - 2. Acquired deficiencies, specifically HIV
  - 3. Secondary effects of other diseases, such as cystic fibrosis
  - 4. Therapeutic immunosuppression, as for organ transplantation
- F. Describe the major types of host responses to infection
  - 1. Suppurative inflammation
  - 2. Mononuclear/granulomatous inflammation
  - 3. Cytopathic-cytoproliferative inflammation
  - 4. Necrotizing inflammation

## 5. Chronic inflammation and scarring

### G. Describe significant features of the following pathogens, including:

- Characteristics of important species, strains, etc.
  - Identifications
  - Pathogenesis and diseases
  - Common patient presentations
  - Epidemiology
  - Treatment
  - Prevention
1. **Viruses** that produce transient infections (life may become transient, as well)
    - a. Rhinovirus
    - b. Coronavirus
    - c. Adenovirus
    - d. Hantavirus
    - e. Influenza viruses
    - f. RSV
    - g. Paramyxoviruses
      - (1) *Rubeola*: measles
      - (2) *Rubula*: mumps
      - (3) Parainfluenza viruses PIV 1 – 4
    - h. Rotaviruses
    - i. Noroviruses
    - j. *Rubella* German measles
    - k. Parvovirus B-19
    - l. Poliovirus (Picorna virus family)
    - m. West Nile virus
    - n. Viral hemorrhagic fever viruses
    - o. Rabies virus
  2. **Herpes Viruses**
    - a. Herpes Simplex Viruses (HSV-1, HSV-2)
    - b. Cytomegalovirus (CMV)
    - c. Varicella-Zooster virus (VZV)
    - d. Epstein-Barr Virus (EBV)
    - e. HHV-6, HHV-7, HHV-8
  3. **Papovaviruses**
    - a. Papaloma virus (HPV)
    - b. Polyoma and SV-40 viruses (historical interest)
  4. **Hepatitis Viruses** A, B, C, delta, E, G
  5. **Human T-cell Lymphotropic Viruses** (HTLVs)
    - a. HIV 1
  6. **Gram positive bacteria**
    - a. Staphylococci
    - b. Streptococci
    - c. *C. diphtheria*

- d. *Listeria monocytogenes*
- e. *Bacillus anthracis*
- f. *Nocardia*
- 7. **Gram negative bacteria**
  - a. Enterobacteriaceae
  - b. *Bordetella pertussis*
  - c. *Yersinia pestis*
  - d. *Hemophilus ducreyi*
  - e. *Calymmatobacterium donovani*
  - f. *Salmonellae*
  - g. *Campylobacter*
  - h. *Helicobacter*
  - i. *Vibrio cholerae*
  - j. *Pseudomonas* and related non-fermenters
  - k. *Neisseria*
- 8. **Anaerobic bacteria**
  - a. *Clostridium* species
  - b. *Bacteroides*
  - c. *Fusobacterium* species
  - d. *Peptococcus* and *peptostreptococcus*
- 9. **Mycobacteria**
  - a. *M. tuberculosis*
  - b. *M. avium-intracellulare* complex (MAC)
  - c. *M. leprae*
- 10. **Spirochetes**
  - a. *Treponema pallidum*
  - b. *Borrelia recurrentis* and related species
  - c. *Borrelia burdorferi*
- 11. **Obligate intracellular bacteria**
  - a. *Chlamydia trachomatis*
  - b. *Rickettsia* species
- 12. **Yeasts and molds**
  - a. *Candidia* species
  - b. *Cryptococcus neoformans*
  - c. *Pneumocystis jirovecii*
  - d. *Histoplasma capsulatum*
  - e. *Coccidioides immitis*
  - f. *Aspergillus* species
  - g. *Zygomycetes* species
  - h. Saprophytic fungi
- 13. **Protozoa**
  - a. *Plasmodium* sp. **Malaria will also be discussed in CircResp**
  - b. *Babesia microti*
  - c. *Leishmania* species
  - d. *Trypanosoma* species

- e. *Entamoeba histolytica*
  - f. *Giardia lamblia*
  - g. *Cryptosporidium* species
  - h. Free living amoebae (*Acanthamoeba*, *Balamuthia*, *Nagleria*)
14. **Helminths**
- a. Threadworms and hookworms
  - b. Tapeworms, *Taenia solium*, *Echinococcus* species
  - c. *Trichinella spiralis*
  - d. *Ascaris* species
  - e. *Schistosoma* species
  - f. *Wuchereria bancrofti* and *Brugia malayi*
  - g. *Onchocerca volvulus*
  - h. Pinworms, *Enterobius* species
  - i. *Toxocara* species
  - j. *Dirofilaria*
15. **Arthropods**
- a. Insects, e.g. *Pediculus humanus capitis* (head louse)
  - b. Arachnids, e.g. *Loxosceles reclusa* (brown recluse spider)
16. **Prion-mediated** diseases
- a. Creutzfeldt-Jacob disease
  - b. Mad cow disease
- H. Describe the agents likely to be used as weapons by bioterrorists (CDC)
1. Category A agents: High mortality, readily transmissible, cause major social disruption
    - a. Bacteria: smallpox, anthrax, plague, botulism, tularemia
    - b. Viral: Ebola, Lassa fever, other hemorrhagic fever viruses
  2. Category B agents: Moderate morbidity, readily transmissible by food and water
    - a. Bacteria: *Salmonella* sp, Brucellosis, etc.
    - b. Viruses: several encephalitis viruses
  3. Category C agents: potential weapons produced from agents that are emerging as disease threats with high potential for morbidity and social disruption
    - a. Hantavirus

3. Understand principles of antipyretic, anti-inflammatory, antimicrobial agents, and immunomodulatory agents including: indications, contraindications, mechanisms of action, drug distribution, metabolism, side effects, and common drug-drug interactions. Be able to:

A. Describe the significant features of each of the main classes and subclasses of commonly used antibiotics, including

- The prototype drug(s)
- Characteristic chemical structures
- Known mechanisms of action
- Clinically useful antimicrobial spectrum
- Absorption, distribution, metabolism, and excretion
- Toxicities and side effects
- Important interactions with other drugs
- Major therapeutic indications and contraindications
- Major clinical problems for the drug class and significant specific members

1. Penicillins, cephalosporins, and additional beta-lactam antibiotics
2. Tetracyclines and chloramphenicol
3. Aminoglycosides and macrolides
4. Macrolides
5. Sulfonamides and trimethoprim
6. Oxazolidinones, including linezolid
7. Streptogramins, including quinupristin/dalfupristin

B. Describe the significant features of the antibiotics and analgesics used to treat the following infections, including

- Characteristic chemical structures
- Known mechanisms of action
- Clinically useful antimicrobial or antiviral spectrum
- Absorption, distribution, metabolism, and excretion
- Toxicities and side effects
- Important interactions with other drugs
- Major therapeutic indications and contraindications
- Major clinical problems for the drug class and significant specific members

1. Urinary tract infections
  - a. Methenamine
  - b. Nitrofurantoin
  - c. Phenazopyridine
  - d. Fluoroquinolones
2. Topical fungal infections
3. Systemic fungal infections
4. Tuberculosis

## 5. Viral infections

- C. Describe the significant features of drugs used to treat symptoms and conditions associated with activities of the immune system, including
- The prototype drug(s)
  - Characteristic chemical structures
  - Known mechanisms of action
  - Clinically useful spectrum
  - Absorption, distribution, metabolism, and excretion
  - Toxicities and side effects
  - Important interactions with other drugs
  - Major therapeutic indications and contraindications
  - Major clinical problems for the drug class and significant specific members
1. Anti-inflammatory agents
  2. Antipyretics and antihistamines
  3. Immunomodulatory agents
  4. Drugs used to treat acquired disorders of immune responsiveness
  5. Drugs stimulating leukocyte production (e.g. G-CSF, GM-CSF)
- D. Describe the clinical relevance of pharmacogenetics and pharmacogenomics for anti-inflammatory, antimicrobial agents, and immunomodulatory agents, for example
1. Isoniazid:NAT2 (antituberculosis)
  2. 6-mercaptopurine:thiopurine-S-methyltransferase (immunosuppressant, anti-leukemia and lymphoma) **(likely better discussed in several other sections, Metab&Repro, SBJ, Circ&Resp)**
  3. Corticosteroids:ABCB1 (anti-inflammatory, immunosuppressant)

4. Understand the normal development of the human immune system, abnormalities of immune regulation, and immunodeficiencies. Be able to:

- A. Compare the innate and acquired arms of the immune system, especially with respect to
  - 1. Cells involved
  - 2. Antigen receptors
  - 3. Effector functions
  - 4. The role of clonal selection of acquired cells
  - 5. Cooperative interactions between innate and acquired elements
- B. Describe the components and functions of the innate immune system
  - 1. Cells
    - a. Epithelial barriers
    - b. Phagocytes
      - (1) PMNs
      - (2) Monocytes & macrophages
    - c. NK cells
    - d. Mast cells (and basophils?)
    - e. Eosinophils
  - 2. Soluble effector factors
    - a. Complement system
    - b. Pattern recognition proteins
      - (1) Mannose-binding lectin
      - (2) C reactive protein
  - 3. Activators
    - a. Chemokines and their receptors
    - b. Toll-like receptors and their ligands
    - c. Other receptor systems
- C. Describe the components, functions, and development of the acquired immune system
  - 1. B cells
    - a. B cell antigen receptor
    - b. Antibody structure
    - c. B cell maturation and Ig gene rearrangements
  - 2. T cells
    - a. T cell antigen receptor
    - b. T cell maturation and receptor gene rearrangements
  - 3. Antigen processing and presentation
    - a. B cell antigen presentation
    - b. T cell antigen presentation: the MHC locus
    - c. Dendritic and monocyte regulatory cells
  - 4. Lymphocyte development and tolerance education
    - a. T cells and the thymus
      - (1) Positive selections

- (2) Negative selections, clonal elimination
      - (3) Anergy
    - b. B cells
  - 5. Regulation of the immune response
    - a. Treg cells
- D. Describe the consequences of deficiencies of the acquired immune system
- 1. Primary immunodeficiencies
    - a. B cell immunodeficiency diseases
      - (1) X-linked agammaglobulinemia
      - (2) Common variable immunodeficiency
      - (3) Isolated IgA deficiency
    - b. T cell immunodeficiency diseases
      - (1) Hyper-IgM syndrome
      - (2) DiGeorge syndrome
      - (3) Severe combined immunodeficiency diseases SCID
      - (4) Wiskott-Aldrich syndrome
  - 2. Acquired immunodeficiencies: AIDS
    - a. Clinical features
    - b. Epidemiology
    - c. Mechanisms of immunodeficiency

5. Understand the role of the immune system in response to common infections, tissue damage, and cancer, and its role in autoimmune and rheumatologic diseases. Be able to:

- A. Describe the immune response to pathogenic bacteria
  - 1. Innate immune system responses and reactions
    - a. Phagocytosis
    - b. Complement
  - 2. Acquired immune system responses and reactions
    - a. Antibody production
  - 3. Cooperative interactions
    - a. Antibody opsonization stimulation of phagocytosis
    - b. T cell involvement in Delayed Type Hypersensitivity reactions
    - c. Mucosal immunity
  - 4. Immune system problems generated by bacteria
    - a. Septic shock reactions
    - b. Super antigens
- B. Describe the immune response to pathogenic viruses
  - 1. Innate system responses and reactions
    - a. Cytokine (Type 1 INF) secretion by infected cells
    - b. NK cells
  - 2. Acquired immune system responses and reactions
    - a. Antibody neutralization of viruses
    - b. Antibody dependent cellular cytotoxicity (ADCC) and NK cells
    - c. Immune surveillance by cytotoxic T cells
- C. Describe the immune response to parasitic infections
  - 1. Innate system responses and reactions
    - a. Phagocytosis (if small enough)
    - b. Eosinophil factors cytotoxic for worm larvae
    - c. Complement mediated lysis
  - 2. Acquired immune system responses and reactions
    - a. IgE antibody production
    - b. Helper T cell cytokine production
- D. Describe the immune response to tumors (discuss how to move to Molecules, Cells, & Cancer section that precedes this section)
  - 1. Tumors induced by viruses, EBV and HPV
  - 2. Possible roles of immune surveillance in other tumors
  - 3. Possible roles of anti-tumor cell antigen antibodies
- E. Describe the role of the recognition of damage associated molecular patterns (DAMPs) and free radical and redox changes released from injured cells in initiating acquired

immune responses and subsequent inflammatory reactions. (orchestrate contributions by Immunology & Pathology)

- F. Describe the mechanisms that are or could be responsible for the appearance of the *hypersensitivity reactions* (orchestrate contributions by Immunology & Pathology)
1. Immediate hypersensitivities (Type 1) or allergies
    - a. Direct players: Mast cells and IgE
    - b. Mediators
      - (1) Primary mediators
      - (2) Secondary mediators
    - c. Development of reaction
    - d. Local reactions
    - e. Systemic anaphylaxis
  2. Antibody-mediated hypersensitivities (Type 2)
    - a. Antibody targets
      - (1) Cell surface or ECM molecules (cross-reactions)
      - (2) Exogenous molecules on cells or ECM
    - b. Effectors
      - (1) Complement
      - (2) ADCC
    - c. Results
      - (1) Local inflammation
      - (2) Functional disruption
        - (a) Pemphigus vulgaris
        - (b) Graves disease
  3. Immune complex-mediated hypersensitivities (Type 3)
    - a. Caused by inflammatory response to Ag:Ab complexes
    - b. Antigens involved
      - (1) Exogenous (e.g. bacteria)
      - (2) Endogenous (e.g. DNA in SLE)
    - c. Disease examples
      - (1) Acute glomerulonephritis
      - (2) Serum sickness (historical example)
      - (3) Systemic lupus erythematosus (SLE) (see G. 1. below)
      - (4) Arthus reaction
  4. (T) Cell-mediated hypersensitivities (Type 4)
    - a. Delayed Type Hypersensitivity (helper T cell-mediated)
      - (1) Tuberculin reaction
    - b. Direct or cytotoxic T cell-mediated cytotoxicity
      - (1) Immune surveillance against viral infections
      - (2) Transplant rejection
- G. Describe how chronic inflammation can suppress the innate and adaptive immune system by inhibiting effector cell functions.
- H. Describe the mechanisms that are or could be responsible for the appearance of **autoimmune diseases** (orchestrate contributions by Immunology & Pathology)
1. Association of MHC alleles with autoimmune disease suggests a role for specific MHC types in development of immune tolerance
  2. Evidence for defects in other components of immune tolerance, for example

- a. AIRE
  - b. Fas and FasL
  - c. Foxp3
3. Infection
    - a. Cross-reactions to pathogen antigens
    - b. Mis-regulation of antigen presentation of self-antigens
    - c. Enhanced release and/or modification of self-antigens
- I. Describe significant features of **autoimmune** diseases, for example
    - Characteristics
    - Identification
    - Pathogenesis and diseases
    - Common patient presentations
    - Epidemiology
    - Diagnosis and Treatment
    1. Systemic lupus erythematosus (SLE)
    2. Sjögren syndrome (likely better discussed in SkinBoneJoint section)
    3. Rheumatoid arthritis
    4. Ankylosing spondylitis
    5. Scleroderma (likely better discussed in SBJ)
    6. Dermatomyositis and polymyositis (likely better discussed in SBJ)
- J. Describe manipulations of the immune system used to facilitate organ transplantation (We're not certain how much detail should be presented here (H&D) and how much in sections that discuss organ transplantation)
    1. HLA matching
    2. Immunosuppressive therapies
- K. Describe the influence of aging on activities of the immune system (likely to be moved to Life Cycle, the next section in the first year)
- L. Describe the influence of gender on activities of the immune system

6. Understand the biology of tissue response to stress, damage, and disease, including inflammation, wound healing, hemostasis and tissue repair. Be able to:

A. Define the following terms:

1. Etiology
2. Clinical findings
3. Morphologic findings
4. Iatrogenic
5. Morbidity
6. Mortality
7. Pathogenesis
8. Pathognomonic
9. Sign
10. Symptom
11. Syndrome

B. Describe the response of cells to stress and/or stimulation

1. Hyperplasia
2. Hypertrophy
3. Atrophy
4. Metaplasia
5. Dysplasia

C. Describe the general causes of cell injury and death

1. Hypoxia
2. Environmental stress (e.g. mechanical damage, temperature)
3. Chemicals (e.g. poisons, free radicals)
4. Infectious agents
5. Immune reactions
6. Genetic defects
7. Nutritional imbalances

D. Describe mechanisms and processes involved in cell injury and cell death

1. Reversible cell injury
2. Necrotic cell death
  - a. Causes
    - (1) Hypoxic damage
    - (2) Ischemic injury
    - (3) Reperfusion injury
    - (4) Chemical injury
  - b. Types
    - (1) Coagulative

- (2) Liquefactive
  - (3) Fat
  - (4) Caseous
  - (5) Gangrenous
3. Apoptosis
    - a. Description of process
    - b. Initiating signals and events
      - (1) Mitochondrial (intrinsic) pathway (Bcl family)
      - (2) Membrane signaling (extrinsic) pathway (TNF, Fas)
      - (3) Caspase cascade
      - (4) Phagocytosis
    - c. Physiological and developmental causes
    - d. Examples
      - (1) Growth factor depletion
      - (2) DNA damage
      - (3) TNF signaling
      - (4) Cytotoxic T cell signaling
- E. Describe organelle responses or contributions to injury
1. Lysosomes
    - a. Storage diseases **(likely better discussed in Metabolism & Reproduction)**
  2. Endoplasmic reticulum
    - a. SER: cytochrome p450 oxidation
    - b. RER: unfolded protein response
  3. Mitochondria **(better topic for SkinBone&Joint)**
    - a. Myopathies
  4. Cytoskeleton **(folks wanted this moved, but to where??)**
    - a. Microfilaments: mushroom toxin target (phalloidin)
    - b. Intermediate filaments
      - (1) Mallory bodies
      - (2) Alzheimer's disease & neurofibrillary tangles
    - c. Microtubules: Kartagener's syndrome **(Resp, Circ, Urinary?)**
- F. Describe intracellular accumulations associated with injury **(briefly mentioned in H&D with the bulk of the discussion coming in Circ&Resp and Metab&Repro)**
1. Steatosis, fatty change
    - a. Liver
    - b. Heart
  2. Cholesterol
    - a. Atherosclerosis
    - b. Xanthomas
  3. Glycogen storage diseases
  4. Pigments
    - a. Lipofuscin & free radical damage
    - b. Anthracosis
    - c. Iron pigments
  5. Proteins

- G. Describe pathologic calcification of tissues
1. Dystrophic calcification
  2. Metastatic calcification
- H. Describe the effects of aging on cells (move to Life Cycle)
1. General molecular changes
    - a. Oxidation
    - b. Glycation
  2. Cellular senescence
    - a. Telomerase and telomere shortening
    - b. DNA repair and Werner syndrome
  3. Genetic programs
- I. Describe the general signs and features of inflammation (**orchestrate contributions by Immunology & Pathology on the topic of inflammation**)
1. Physical signs: rubor, tumor, calor, dolor, (loss-of-function)or
  2. Laboratory signs
    - a. Left shift: increase PMN band form
    - b. RBC sedimentation
    - c. C-reactive protein
    - d. Biomarker release
- J. Describe acute inflammation
1. List the Stimuli
    - a. Infection
    - b. Trauma and temperature
    - c. Chemicals
    - d. Necrosis
    - e. Foreign bodies
    - f. Hypersensitivity reactions
  2. Describe the vascular changes
    - a. Vasodilation
    - b. Leakage, edema
  3. Describe leukocyte recruitment and activities
    - a. Cells involved: granulocytes, mast cells, macrophages, lymphocytes
    - b. Adhesion
    - c. Diapedesis
    - d. Chemotaxis
    - e. Activation
    - f. Recognition & phagocytosis (PMNs and macrophages)
    - g. Killing
    - h. Termination of response
  4. Describe the chemical mediators of inflammation and their interactions
    - a. Vasoactive amines: histamine & serotonin
    - b. Autocoids: prostaglandins, leukotrienes, lipoxins
    - c. Plasma proteins

- (1) Complement
      - (2) Kinin cascade
      - (3) Clotting cascade
    - d. Platelet-activating factor
    - e. Cytokines and chemokines
    - f. Nitric oxide
    - g. Leukocyte lysosomal (granule) products
    - h. Neuropeptides
  5. List the types of acute inflammation related to bacterial infections
    - a. Systemic inflammatory response syndrome (SIRS)
      - (1) Fever
      - (2) Acute phase proteins
      - (3) Leukocytosis with left shift
    - b. Sepsis
    - c. Severe sepsis
    - d. Septic shock
    - e. Multiorgan dysfunction syndrome (MODS)
    - f. Toxic shock
  6. List the main histologic inflammatory patterns displayed by acute infections
    - a. Serous
    - b. Fibrinous
    - c. Suppurative (purulent)
    - d. Ulceration
  7. Describe the outcomes of acute inflammation
    - a. Complete resolution
    - b. Fibrosis
    - c. Transition to chronic inflammation
  8. Describe some familiar acute inflammations
    - a. Acute pneumonia
    - b. Acute appendicitis
- K. Describe the process of chronic inflammation
1. List signs of chronic inflammation
    - a. Prolonged duration
    - b. Active inflammation
    - c. Tissue loss
    - d. Repair
  2. List causes of chronic inflammation
    - a. Infection by microbes that produce delayed-type hypersensitivity (Type 4)
    - b. Prolonged toxin exposure
      - (1) Silica and silicosis
      - (2) Lipid deposits and atherosclerosis
    - c. Autoimmune diseases
  3. Describe the cells involved in chronic inflammation
    - a. Macrophages: main player
    - b. Lymphocytes
    - c. Eosinophils

- d. Mast cells
- 4. Describe granulomatous inflammation
  - a. Cells involved
    - (1) Epithelioid macrophages (and giant cells formed from epithelioid macrophages)
    - (2) Lymphocytes and plasma cells
  - b. Types of granulomas
    - (1) Foreign body
    - (2) Immune
      - (a) Tuberculosis: central caseous necrosis
      - (b) Leprosy: non-caseating
- L. Describe known and suspected consequences of abnormal regulation of inflammation
  - 1. Reduced or defective inflammation
    - a. Increased rates of infection
    - b. Decreased rates of tissue repair
  - 2. Increased inflammation (this gets a brief mention here, at best, and then picked up in the various sections with specific examples)
    - a. Allergies and autoimmune diseases
    - b. Cancer
    - c. Atherosclerosis
    - d. Neurodegenerative diseases
    - e. Metabolic syndrome and diabetes
- M. Describe the cells, signals, and activities involved in wound healing and tissue repair
  - 1. Cells
    - a. Stem cells and their biology
    - b. Tissues with stem cells: epithelia, bone marrow, skeletal muscle
    - c. Cells capable of reentering cell cycle: fibroblasts, smooth muscle, osteoblasts, hepatocytes
    - d. Cells that generally are not replaced: neurons, cardiac myocytes
  - 2. Growth factors involved in tissue repair
    - a. EGF family
    - b. FGF family
    - c. VEGF family
    - d. PDGF family
    - e. TGF- $\beta$  family
    - f. Cytokines
  - 3. Angiogenesis
    - a. Source of cells
    - b. Signaling
    - c. Role of extracellular matrix
  - 4. Repair of skin wounds, an example
    - a. Healing by primary intention (wound edges in contact)
      - (1) Clot formation
      - (2) Epithelial cell death
      - (3) Inflammation, PMNs and macrophages
      - (4) Signaling by all the factors listed in M.2 above
      - (5) Epithelial cell proliferation and spreading

- (6) Fibroblasts and myofibroblasts proliferate and replace clot with granulation tissue, a primitive CT, pericytes and endothelial cells invade granulation tissue, which becomes a small scar
- (7) Eventual restoration of normal dermal architecture replacing the scar can take months
- b. **Healing by secondary intention (wound edges separated)**
  - (1) Larger clot, more inflammation
  - (2) Larger granulation tissue
  - (3) Often get a large contraction of the wound by myofibroblasts
  - (4) Large scar formation covered with thinner epithelium
- 5. **Problems in tissue repair**
  - a. Excess connective tissue production: hypertrophic scars and keloid
  - b. Insufficient connective tissue production: wound dehiscence and ulceration
  - c. Excessive wound contraction: contracture
  - d. Fibrosis: excess production of connective tissue produced by chronic inflammation is a problem in many organs, such as liver, lung, kidneys, pancreas
- 6. **Other examples of repair (this gets a brief mention here, at best, and then picked up in the various sections with specific examples)**
  - a. **Liver**
    - (1) HGF and normal repair
    - (2) Fibrosis and cirrhosis
  - b. **Heart**
    - (1) Granulation and scarring, no regeneration: aneurysm
    - (2) Rupture of wall
  - c. **Kidney**
    - (1) Cortical tubules regenerate well, medullary tubules less well
    - (2) Glomeruli do not regenerate and are replaced with small scars
  - d. **Brain**
    - (1) Strokes cause liquefactive necrosis and a resulting space
    - (2) Glia by astrocytes fills space, no granulation tissue formed
    - (3) Usually little recovery by CNS neurons, some regeneration of connections in PNS
  - e. **Lung**
    - (1) Extensive alveolar destruction
      - (a) Scar tissue and cysts replace alveoli
      - (b) Excessive loss of alveoli = emphysema
    - (2) Less extensive parenchymal damage
      - (a) After inflammation is cleared from alveoli, normal alveoli may be restored. Type II pneumocytes divide to replace type I
      - (b) If damage is to bronchioles, the regeneration may produce reduced function with pneumonia-like symptoms (BOOP)
  - f. **Serosal membranes: pleura, peritoneum, pericardium**
    - (1) Clots formed after surgery can transform into adhesions
      - (a) Intestines can become obstructed and necrotic if blood supply is compromised
      - (b) Adhesion of the pericardium can interfere with chamber filling: constrictive pericarditis
- N. **Describe the events of normal hemostasis (sections N – V are mentioned briefly here (H&D) as space permits in the context of normal hemostasis/wound repair/response to injury; to be covered in detail in Circ&Resp)**
  - 1. Normal sequence: transient vasoconstriction, platelet activation and temporary haemostatic plug formation, thrombin activation and fibrin formation, permanent plug formation and shutdown of activities
  - 2. Endothelial cell roles
    - a. Antithrombotic

- b. Prothrombotic
  - 3. Platelet roles
    - a. Adhesion to von Willebrand factor
    - b. Secretion of factors from granules
    - c. Aggregation and contraction
  - 4. Coagulation cascade
    - a. Intrinsic and extrinsic pathways
    - b. Common pathway
- O. Describe common disorders that affect normal hemostasis
  - 1. Platelet disorders
  - 2. Clotting factor disorders
- P. Describe the abnormal events of hemostasis that produce inappropriate thrombosis
  - 1. Endothelial injury
  - 2. Blood flow alterations, turbulence and stasis
  - 3. Hypercoagulability
- Q. Describe the common sites of thrombus formation and their risk factors
  - 1. Deep leg veins
  - 2. Arteries
- R. Describe causes, treatments, and diagnostic tests for Disseminated Intravascular Coagulation (DIC)
- S. Describe causes, treatments, and diagnostic tests for Thrombotic Microangiopathies: TTP and HUS
- T. Describe causes, treatments, and diagnostic tests for Atherosclerosis
  - 1. Risk factors and prevention
  - 2. Relationship to Metabolic Syndrome
  - 3. Atheroma formation
  - 4. Local effects
  - 5. Related changes in arterioles
    - a. Hyaline arteriosclerosis in kidney
    - b. Mönckeberg's arteriosclerosis
- U. Describe the common types of emboli
  - 1. Pulmonary thromboembolism
  - 2. Systemic thromboembolism
  - 3. Fat embolism
  - 4. Air embolism
  - 5. Amniotic fluid embolism
- V. Describe the common features of infarction
- W. Describe the causes, presentations, and treatments for septic shock

- X. Describe the injuries, fatalities, and diseases commonly associated with a person's environment (Where should this stuff go?)
1. Forensics
  2. Accidental trauma
  3. Workplace exposures
  4. Personal exposures
  5. Nutrition

## CLINICS

### I. Subspecialty Clinics

- A. ID: (Ped, Adult -- general ID, HIV clinics, Public health dept: STD/TB clinics, Travel Clinic)
- B. Heme/Onc: (Peds, Adult at PCMC, HCI; Thrombosis Clinic UUMC, Blood bank/heme-path – [more for a lab experience?](#))
- C. Transplant: BMT Unit, liver/renal transplant clinics
- D. Allergy/Immunology: (PCMC, Dr. Hill, community sites)
- E. Rheumatology (ped, adult, with focus on autoimmune d/o – [not sure if that is even possible](#))
- F. Inpatient opportunities if need additional sites?
- G. Focus on ID, Heme, transplant patients

### II. Other clinical learning opportunities

- A. Phlebotomy experiences
- B. computer based modules, independent/self study – examples:
  - 1. Clinical lab modules/experiences and/or tutorials:
    - a. blood smears, flow cytometry, coagulation, gram stains, cultures, wet mounts, molecular testing, serum proteins and autoantibodies, quality controls
    - b. physical exam/online modules that give visual examples of – mastitis, prostatitis, purulent vaginal d/c and urethral d/c, genital lesions characteristic of STDs (HSV, GC, CT, syphilis, chancroid, trichomonas)
  - 2. Imaging modules: to address basic radiology, diagnostic utility of
    - a. plain radiographs, ultrasound, CT/MRI, Nuclear Medicine