

## Session 6 – The Host-Parasite Relationships

Text:	Chapters 14, 15, 16, 17, 18, 19, 20
Anticipated time:	7 class periods
Basic Objectives:	You should become effortlessly fluent in the language and intimately familiar with the concepts of the host-parasite relationship. You should understand the language and concepts of epidemiology. You should be able to discuss the basic functions (i.e. homeostasis, surveillance and defense); the basic organization (i.e. molecules, cells, tissues and organs); and the basic responses (i.e. how the components of the system work together to accomplish the functions) of the immune system. You should become familiar with some basic clinical aspects of the immune system (i.e. manipulation of the system for our benefit and disorders of the system that result in disease). You should understand the principles of antimicrobial chemotherapy, including standard targets of chemotherapy. This is the most important part of our entire course. You cannot truly understand infectious diseases if you do not first understand the basic principles of The Host-Parasite Relationship. We will progress through the large volume of material in the order given in the Lecture Outline!
Slides to Copy:	3, 6, 13, 14, 18, 19, 21, 22, 23, 30, 31, 32, 33, 35, 36, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 63, 64, 65, 66, 68, 70, 72, 75, 76, 77, 78, 82, 84, 88, 91, 93

### Part I – The Parasite

#### Chapter 16 - Host-Microbe Interactions

This chapter is all about concepts especially as regards the diverse nature of host-parasite relationships. There is a good deal of language which embeds the important concepts. There is nothing difficult here, but it is very important to know the concepts, including relevant examples, so that you can understand specific infectious diseases when we discuss them. It is easier to understand specific diseases when you already know the concepts and language. This may be the most important chapter in this text for our purposes in this class.

Introduction	<i>Read carefully</i> , including all the terms in the Key Terms box. Define: Pathogen.
16.1 The Anatomical Barriers as Ecosystems	
Introduction	<i>Read very carefully</i> . Define: Symbiosis. Differentiate: Mutualism, commensalism and parasitism.
16.2 The Normal Microbiota	
Introduction	<i>Read very carefully</i> . Define: Normal, resident & transient microbiota. <i>Review</i> Fig 16.1.
The Protective Role	<i>Read</i> .
The Dynamic Nature	<i>Read</i> .
16.3 Principles of Infectious Disease	
Introduction	<i>Read very carefully</i> . Understand the language.
Pathogenicity	<i>Read very carefully</i> . Differentiate: Pathogenicity and Virulence. Define: Opportunist.
Characteristics	<i>Read carefully</i> and understand the language. <i>Review</i> Fig 16.2.
16.4 Establishing the Cause of Infectious Disease	
Introduction	<i>Read</i> .
Koch's Postulates	<i>Read</i> , including Fig 16.3 and understand the logic.
Molecular Postulates	<i>Read</i> and understand why these are necessary for some agents of disease.
Mechanisms	<i>Read very carefully</i> , without memorizing the specific examples.
16.5 Establishment of Infection	
Introduction	<i>Read</i> .
Adherence	<i>Read carefully</i> . <i>Review</i> Fig 16.4.
Colonization	<i>Read carefully</i> .
Effector Proteins	<i>Read</i> , and <i>Review</i> Fig 16.5.

## 16.6 Invasion-Breaching the Anatomical Barriers

Introduction *Read.*

Penetrating Skin *Read.*

Mucous Membranes *Read* paragraph 1, and *Review* the rest of the section, including Fig 16.7.

## 16.7 Avoiding the Host Defenses

Introduction *Read.*

Hiding in a Host Cell *Read.*

Avoiding Killing *Read* for concepts. But this will make more sense later.

Avoiding Destruction *Read*, including Fig 16.9, but this will make more sense later.

Avoiding Antibodies *Read*, including Fig 16.10. OK- this will make more sense later.

## 16.8 Damage to the Host

Introduction *Read.*

Exotoxins *Read very carefully. Read carefully* (but don't even think about memorizing) Tab 16.1.

Yes-we will cover most of the toxins in this table when we get to specific diseases.

Understand Fig 16.11. Become familiar with the language and the concepts.

Endotoxin *Read very carefully. Read* Tab 16.2 and be able to contrast endo-and exo- toxins.

Damaging Effects *Read very carefully.*

## 16.9 Mechanisms of Viral Pathogenesis

Introduction *Read.*

Binding to Host Cells *Read.*

Avoiding Responses *Read.*

## 16.10 Mechanisms of Eukaryotic Pathogenesis

Introduction *Read.*

Fungi *Read carefully.*

Eucaryotic Parasites *Read carefully.*

Future Challenges 16.1 *Read.*

## Part II – The Host

### Chapter 14 – The Innate Immune Response

This chapter introduces the very important topic of innate (“first and second line”) defense mechanisms. There is also important information about the cells and substances of both the innate and the adaptive, specific immune system. Lastly, the chapter includes several important mechanisms of innate defenses. You should move immediately into chapter 16, as we will discuss this information together and all at once.

- Introduction *Read very carefully.* Differentiate: Specific (i.e. adaptive) from non-specific (i.e. innate) defense mechanisms. The language in Key Terms is important.
- 14.1 Overview of the Innate Defenses *Read carefully,* including Fig 14.1. Understand the language.
- 14.2 First-Line Defenses
- Introduction *Read,* including Fig 14.2.
  - Physical Barriers *Read carefully,* including Fig 14.3.
  - Antimicrobial *Read carefully,* including Fig 14.4.
  - Normal Microbiota *Read.*
- 14.3 The Cells of the Immune System
- Introduction *Read,* including Fig 14.5. *Read carefully* Tab 14.1 and understand the immune functions of the cells. Define: hematopoiesis.
  - Granulocytes *Read,* especially the section on Neutrophils.
  - Mononuclear Cells *Read carefully.* Review Fig 14.6.
  - Dendritic Cells *Read.*
  - Lymphocytes *Read carefully.*
- 14.4 Cell Communication
- Introduction *Read carefully.*
  - Surface Receptors *Read.*
  - Cytokines *Read carefully,* including Tab 14.2, and understand the various functions of the classes of cytokines (e.g. Interferons alpha and gamma, IL-1 and IL-2, and TNF's)
  - Adhesion Molecules *Read.*
- 14.5 Pattern Recognition Receptors
- Introduction *Read.*
  - Toll-Like Receptors *Review.*
  - NOD-Like Receptors *Summarize.*
  - RIG-Like Receptors *Review,* but Understand Fig 14.9.
- 14.6 The Complement System
- Introduction *Read,* including Fig 14.10.
  - Activation *Summarize.*
  - Effector Functions *Read,* including Fig 14.10, and understand the 3 major functions (i.e. opsonization, lysis and inflammation) of the complement system.
  - Regulation *Summarize.*
- 14.7 Phagocytosis
- Introduction *Read.*
  - The Process *Read very carefully,* including Fig 14.13.
  - Macrophages *Read.*
  - Neutrophils *Read.*
- 14.8 The Inflammatory Response
- Introduction *Read carefully.*
  - Factors *Read.*
  - Inflammatory Process *Read very carefully,* including Fig 14.14. Understand the humoral, cellular and vascular changes that determine the sequence and outcomes of the response.
  - Effects *Read.*
  - Cell Death *Read.* Define: Apoptosis.
- 14.9 Fever *Read carefully.*
- Perspective 14.1 *Review.*

## Chapter 15 – The Adaptive Immune Response

This chapter introduces the very important topic of adaptive, acquired (“third line”) defense mechanisms. Later we will apply these important details and concepts as we study immunity to specific diseases.

- Introduction *Read carefully.* When you are done with the introduction *Review* Fig 15.21 to see what we are working towards understanding.
- 15.1 Strategy of the Adaptive Immune Response  
Introduction *Read very carefully.* Work on understanding Figs 15.1 & 15.2.  
Humoral Immunity *Read very carefully.* Understand function of B cells.  
Cellular Immunity *Read very carefully.* Understand function of T cells.
- 15.2 Anatomy of the Lymphatic System  
Introduction *Read,* including Fig 15.3.  
Lymphatic Vessels *Read.*  
Secondary Organs *Read carefully.* *Review* Fig 15.5.  
Primary Organs *Read carefully.*
- 15.3 The Nature of Antigens  
*Read carefully.* Define: Antigen, epitope and antigenic determinant. *Read* Fig 15.6.
- 15.4 The Nature of Antibodies  
Introduction *Read carefully,* and note the different classes of immunoglobulins in Tab 15.1.  
Structure of Antibodies *Read,* including Fig 15.7, and understand conceptually the structure of an antibody.  
Protective Outcomes *Read carefully,* including Fig 15.8, and understand the basic functions of antibodies.  
Immunoglobulins *Read,* and note the functions of IgG, IgM, IgE and IgA. Skip IgD. *Read* Fig 15.9.
- 15.5 Clonal Selection and Expansion of Lymphocytes  
*Read carefully* and understand the concept of Clonal Selection in Fig 15.10.
- 15.6 B Lymphocytes and the Antibody Response  
Introduction *Read.*  
B-Cell Activation *Read.* *Review* Fig 15.11.  
Primary Response *Read.* *Review* Fig 15.12, 15.13 & 15.14.  
Secondary Response *Read.* *Review* Fig 15.10.  
T-Independent Ags *Review,* including Fig 15.16.
- 15.7 T Lymphocytes: Antigen Recognition and Response  
Introduction *Read* for concepts. *Read* Tab 15.2.  
T Cells *Read.* *Review* Figs 15.17, 15.18 & 15.19.  
Activation of T Cells *Read* for concepts, including Fig 15.20.  
Functions of Tc Cells *Read* for concepts, and *Review* Fig 15.21.  
Functions of Th Cells *Read* for concepts, and *Review* Fig 15.22.  
Subsets of Cells *Read.*
- Perspective 15.1 *Review* for interest.
- 15.8 Natural Killer (NK) Cells  
*Read.* Why are these cells needed/important? *Review* Fig 15.23.
- 15.9 Lymphocyte Development  
Introduction *Read,* including Fig 15.24. Does it make sense now?  
Generation of Diversity *Skip.*  
Negative Selection... *Skip.*  
Positive Selection... *Skip.*

## Chapter 17 – Immunological Disorders

The Immune System is not perfect.

- Introduction *Read carefully*, including Tab 17.1. Define: Hypersensitivity.
- 17.1 Type I Hypersensitivities: Immediate IgE-Mediated  
Introduction *Read carefully*, including Fig 17.1. Understand the mechanism.  
Localized Allergies *Read carefully*.  
Systemic Anaphylaxis *Read carefully*.  
Treatment *Read*, including Fig 17.3, and understand the logic (or magic?) of this therapy.
- 17.2 Type II Hypersensitivities: Cytotoxic  
Introduction *Read carefully*. Understand the mechanism.  
Transfusion Reactions *Review*  
Hemolytic Disease *Review*, including Fig 17.4.
- 17.3 Type III Hypersensitivities: Immune Complex-Mediated  
*Read carefully*, including Fig 17.5 and understand the mechanism.
- 17.4 Type IV Hypersensitivities: Delayed-Type Cell-Mediated  
Introduction *Read carefully*, including Fig 17.8. Understand the mechanism.  
Tuberculin Skin Test *Read carefully*.  
Delayed-Type HS *Read*.  
Contact HS *Read*.
- 17.5 Rejection of Transplanted Tissues  
Introduction *Read carefully*. Define: Immunosuppression.
- Perspective 17.1 *Read for interest*.
- 17.6 Autoimmune Disease  
Introduction *Read*. Define: Autoimmunity.  
Spectrum of Diseases *Read carefully*, including Tab 17.3 for important examples.  
Treatment of AI *Read carefully*.
- 17.7 Immunodeficiency Disorders  
Introduction *Read*, including Tab 17.4. Define: Immunodeficiency.  
Primary *Read carefully*.  
Secondary *Read carefully*.
- Future Challenges *Read*.

## Chapter 18 – Applications of Immune Responses

This chapter introduces the major ways in which we have manipulated, for our benefit, the immune system, and how we use the immune system in diagnostics.

Introduction	<i>Read.</i>
Immunization	
18.1 Principles of Immunization	
Introduction	<i>Read</i> , including Fig 18.2. Differentiate: Active & passive, and, natural & artificial acquired immunity.
Active Immunity	<i>Read.</i>
Passive Immunity	<i>Read.</i>
18.2 Vaccines and Immunization Procedures	
Introduction	<i>Read</i> , including Tab 18.1.
Attenuated Vaccines	<i>Read</i> , including Tab 18.2
Inactivated Vaccines	<i>Read.</i>
Vaccination Strategy	<i>Read</i> , including Tab 18.3, for background.
Childhood Vaccination	<i>Read.</i>
Current Progress	<i>Read. Review</i> Tabs 18.4 for perspective.
Immunologic Testing	<i>Read.</i>
18.3 Principles of Immunological Testing	
Introduction	<i>Read.</i>
Obtaining Antibodies	<i>Skip.</i>
Quantifying Reactions	<i>Skip.</i>
Perspective 18.1	<i>Review.</i>
18.4 Observing Antigen-Antibody Aggregations	
Introduction	<i>Read.</i>
Precipitation Rxns	<i>Skip.</i>
Agglutination Rxns	<i>Skip.</i>
18.5 Using Labeled Antibodies to Detect Antigen-Antibody Interactions	
Introduction	<i>Read. Review</i> Fig 18.9 for concepts.
Fluorescent Ab Tests	<i>Read and Review</i> Fig 18.10.
Enzyme-Linked Tests	<i>Read</i> , and <i>Review</i> Fig 18.11, and understand usefulness of ELISA (see Fig 18.12).
Western Blotting	<i>Skip.</i>
FACS	<i>Review.</i>
Future Challenges 18.1	<i>Read.</i>

## Part III – Epidemiology

### Chapter 19 – Epidemiology

This chapter is all about language and the concepts the language supports. There is nothing difficult here, but it is still very important to understand the language and use it correctly. We will use the language extensively when we get to specific infectious diseases.

Introduction *Read*

#### 19.1 Principles of Epidemiology

Introduction *Read carefully. Read Fig 19.1.*

Rate of Disease *Read carefully, and understand the language. Differentiate: Morbidity and mortality rates. Differentiate: Epidemic, endemic and pandemic.*

Reservoirs *Read carefully. Define: Reservoir, carrier (symptomatic vs asymptomatic), animal reservoirs & zoonoses, & environmental reservoirs.*

Portals of Exit & Entry *Read carefully.*

Transmission *Read carefully.*

Portals of Entry *Read carefully.*

Pathogen Factors *Read carefully.*

Host Factors *Read carefully.*

#### 19.2 Epidemiological Studies

Introduction *Read carefully.*

Descriptive Studies *Review.*

Analytical Studies *Review.*

Experimental Studies *Review.*

#### 19.3 Infectious Disease Surveillance

Introduction *Review, including Tab 19.1.*

National Surveillance *Review.*

World Surveillance *Review.*

Disease *Review.*

#### 19.4 Emerging Infectious Diseases

*Read. Define: Emerging Disease.*

#### 19.5 Healthcare-Associated Infections

Introduction *Read carefully. Review Fig 19.13. Read Tab 19.2. Define: Nosocomial.*

Reservoirs *Read.*

Transmission *Read.*

Preventing Infections *Read.*

Perspective 19.1. *Read*

## Part IV – Antimicrobial Chemotherapy

### Chapter 20 - Antimicrobial Medications

Work on understanding the major concepts. Don't try to memorize all the details or drugs. Back up the concepts with a few good examples of drugs that you are interested in or have heard of in the past.

- Introduction *Read.*
- 20.1 History and Development of Antimicrobial Drugs
- Introduction *Review, but Read Key Terms for important language.*
  - Discovery of Drugs *Review.*
  - Discovery of Antibiotics *Review.*
  - Development *Review.*
- 20.2 Features of Antimicrobial Drugs
- Introduction *Read. Define: Semisynthetic antibiotics.*
  - Selective Toxicity *Read carefully. Define: Selective toxicity and Therapeutic index.*
  - Antimicrobial Action *Read carefully.*
  - Spectrum of Activity *Read carefully.*
  - Effects *Read carefully.*
  - Tissue Distribution *Read carefully.*
  - Adverse Effects *Read carefully.*
  - Resistance *Read carefully.*
- 20.3 Mechanisms of Action of Antibacterial Drugs
- Introduction *Read carefully, and understand Fig 20.2. Review Tab 20.1.*
  - Cell Walls *Read, the first paragraph and Figs 20.3 and 20.4. Review! Penicillins through Bacitracin.*
  - Protein Synthesis *Read the 1<sup>st</sup> paragraph & Fig 20.7. Review!, Aminoglycosides through Chloamphenicol.*
  - Nucleic Acids *Read the 1<sup>st</sup> paragraph and Review the rest of the section.*
  - Metabolic Pathways *Read the 1<sup>st</sup> paragraph and Review the rest of the section including Fig 20.8.*
  - Cell Membranes *Read.*
  - Mycobacterium sp.* *Read.*
- 20.4 Determining the Susceptibility of a Bacterial Strain to an Antimicrobial Drug
- Introduction *Read. Skip the rest of this section.*
- Perspective 20.1 *Skip.*
- 20.5 Resistance to Antimicrobial Drugs
- Introduction *Read, including Fig 20.13.*
  - Mechanisms *Read, and Review Fig 20.14.*
  - Acquisition *Read.*
  - Examples *Review for concepts.*
  - Slowing Resistance *Review for concepts.*
- 20.6 Mechanism of Action of Antiviral Drugs
- Introduction *Read, including Fig 20.15 and Tab 20.2.*
  - Viral Entry *Read.*
  - Viral Uncoating *Read.*
  - Nucleic Acid Synthesis *Read.*
  - Integration *Read.*
  - Assembly & Release *Read.*
- 20.7 Mechanism of Action of Antifungal Drugs
- Introduction *Read, including Tab 20.3 and Fig 20.16.*
  - Plasma Membrane *Read paragraph 1.*
  - Cell Walls *Read.*
  - Cell Division *Read.*
  - Nucleic Acid Synthesis *Read.*
- 20.8 Mechanism of Action of Antiprotozoan and Antihelminthic Drugs
- Read, and Review Tab 20.4.*
- Future Challenges 20.1 *Read.*