

Session 2 - Microbial Anatomy, Physiology and Growth

Text:	Chapter 3, 4, 5, 6
Anticipated time:	4 class periods
Basic Objectives:	You should be able to discuss the basic chemical structure and detailed functional anatomy of procaryotic cells. Focus on comparing eucaryotic cell structure with procaryotic anatomy. You should be able to discuss the basic principles of microbial metabolism and growth, in particular those aspects that relate to procaryotic biology (i.e. differ from eucaryotic organisms). You should understand how mo's grow and the environmental factors that effect growth. You should understand how physical and chemical agents can be used to control the growth of microorganisms.
Slides to Print:	1, 4, 5, 12, 16, 27, 29, 34, 36, 37, 41, 42, 43, 45, 46, 47, 48, 49, 50, 51, 53, 55, 56, 60, 62, 63, 64, 65, 66, 67

Chapter 3 – Microscopy and Cell Structure

Introduction	<i>Read.</i> Define: All the Key Terms.
3.3 Morphology of Procaryotic Cells	
Introduction	<i>Read.</i>
Shapes	<i>Read,</i> including Fig 3.20.
Groupings	<i>Read,</i> including Fig 3.22.
Multicellular...	<i>Read.</i> What are Biofilms?
The Prokaryotic Cell	<i>Read very carefully,</i> including Fig 3.23 and Tab 3.3.
3.4 The Cytoplamic Membrane	
Introduction	<i>Read.</i>
Structure	<i>Read very carefully,</i> including Fig 3.24.
Permeability	<i>Read.</i> Define: Selective permeability and diffusion. <i>Review</i> Fig 3.25a.
Role	<i>Read carefully.</i> <i>Review</i> Fig 3.27.
3.5 Directed Movement of Molecules Across the Cytoplasmic Membrane	
Introduction	<i>Read,</i> including Tab 3.4.
Transport Systems	<i>Read.</i> Understand mechanisms of transport. <i>Review</i> Figs 3.28 & 3.29.
Secretion	<i>Read.</i> <i>Review</i> Fig 3.30.
3.6 Cell Wall	
Introduction	<i>Read.</i>
Peptidoglycan	<i>Read very carefully,</i> and understand conceptually the chemistry of peptidoglycan. You do not need to memorize chemical structures. <i>Read carefully</i> Fig 3.31 and Tab 3.5.
Gram-Positive	<i>Read carefully,</i> including Fig 3.32. Differentiate gram positive and negative bacteria.
Gram-Negative	<i>Read carefully,</i> including Fig 3.33. Understand Tab 3.5. What is lipopolysaccharide?
Antibacterial	<i>Read carefully</i> and understand actions of penicillin and lysozyme.
Cell Wall Type	<i>Read.</i>
Lack Cell Wall	<i>Skip.</i>
Archea	<i>Skip.</i>
3.7 Capsules and Slime Layers	<i>Read.</i> Define: Capsule and biofilms. <i>Review</i> Fig 3.35.
3.8 Filamentous Protein Appendages	
Introduction	<i>Read.</i>
Flagella	<i>Read.</i> <i>Review</i> Fig 3.36. Define: Chemotaxis. <i>Review</i> Fig 3.38.
Pili	<i>Read.</i> <i>Review</i> Fig 3.40.

3.9 Internal Structures

Introduction
The Chromosome
Plasmids
Ribosomes
Cytoskeleton
Storage Granules
Gas Vesicles
Endospores

Read.
Read. Review Fig 3.41.
Read carefully. Define: Plasmid.
Read carefully.
Read.
Review.
Review.
Read carefully. Review Fig 3.44.

The Eucaryotic Cell Introduction

Read very carefully, including Fig 3.46a and Tab 3.6. Understand the basic functional anatomy of eucaryotic cells. *Read* Tab 3.7 and contrast procaryotic and eucaryotic functional anatomy.

3.10 – 3.13

Review, if needed. This should be material you already know! We will not cover this in class.

Perspective 3.1

Read.

Future Challenges 3.1

Review

Chapter 4 – Dynamics of Prokaryotic Growth

Introduction

Read

4.1 Principles of Prokaryotic Growth

Read. Define: Generation time and binary fission (skip the math). Understand Fig 4.1.

4.2 Prokaryotic Growth in Nature

Introduction

Review.

Biofilms

Read carefully. Review Figs 4.2 & 4.3.

Interactions

Skip.

4.3 Obtaining a Pure Culture

Introduction

Read. Define: Pure culture.

Growing MO's

Read.

Streak-Plate Method

Skip.

Maintaining Stocks

Skip.

4.4 Bacterial Growth in Laboratory Conditions

Introduction

Read.

The Growth Curve

Read carefully, including Fig 4.6. Understand the phases of growth.

Colony growth

Skip.

Continuous Culture

Skip.

4.5 Environmental Factors that Influence Microbial Growth

Introduction

Read, including Tab 4.2. Understand the basic language.

Temperature

Read. Review Fig 4.8.

Oxygen

Read.

pH

Read.

Water Availability

Read.

4.6 Nutritional Factors that Influence Microbial Growth

Introduction

Read.

Required Elements

Read, including Tab 4.4.

Growth Factors

Read. Define: Growth Factor.

Energy Sources

Read.

Nutritional Diversity

Read, including Tab 4.5 and understand sources of carbon and energy.

Perspective 4.1

Read.

4.7 Cultivating Prokaryotes in the Laboratory

Introduction

Read.

Culture Media

Read. Differentiate complex and defined media. Review Tab 4.7.

Special Media

Read. Differentiate selective and differential media. Read Tab 4.6.

Atmospheric Conditions

Read. Define: aerobes and anaerobes.

Enrichment Cultures

Review.

4.8 Methods to Detect and Measure Bacterial Growth

Skip the entire section.

Future Challenges 4.1.

Review.

Chapter 5 – Control of Microbial Growth

- Introduction *Read.* Define: Antiseptic vs disinfectant, aseptic technique, -cidal vs -static, pasteurization and sterilization.
- 5.1 Approaches to Control
- Introduction *Read*
 - Principles of Control *Read*, including Tab 5.1. Work on the major concepts/language.
 - Considerations *Read.* Define: Nosocomial.
- 5.2 Selection of an Antimicrobial Procedure
- Introduction *Read.*
 - Type of MO's *Review.*
 - Numbers of MO's *Review*, including Fig 5.2. Note that death is logarithmic.
 - Environment *Review.*
 - Risk of Infection *Review.*
 - Composition *Review.*
- 5.3 Using Heat to Destroy Microorganisms and Viruses
- Introduction *Read*, including Tab 5.1.
 - Moist Heat *Read.* Define: Autoclaving, Pasteurization. *Review* Tab 5.1.
 - Dry Heat *Read.*
- 5.4 Using Other Physical Methods to Remove or Destroy Microbes
- Introduction *Read.*
 - Filtration *Review.*
 - Radiation *Read.* Differentiate ultraviolet and ionizing radiation.
 - High Pressure *Skip.*
- 5.5 Using Chemicals to Destroy Microorganisms and Viruses
- Introduction *Read.*
 - Potency *Review* for perspective.
 - Selecting a Germicide *Review* for perspective.
 - Classes of Germicides *Read carefully*, including Tab 5.2. Understand the mechanism of action and the target molecule for each of the various classes of chemicals.
- Perspective 5.1 *Read very carefully.*
- 5.6 Preservation of Perishable Products
- Introduction *Read.*
 - Chemical Preservatives *Review.*
 - Low-Temperature *Review.*
 - Water Availability *Review.*
 - Future Challenges *Review.*
- Future Challenges *Review.*

Note: It is important to know the major target molecule in cells and the basic mechanism of action of the various chemical and physical agents. Don't try to learn every antimicrobial and every target molecule. We will cover this in class and try to reduce the volume of this information to the important details..

Chapter 6 – Metabolism: Fueling Cell Growth

Introduction	<i>Read.</i> Define: Metabolism.
6.1 Principles of Metabolism	
Introduction	<i>Read</i> , including Fig 6.1. Differentiate: Catabolism and anabolism.
Harvesting Energy	<i>Read</i> , including Fig 6.3.
Components	<i>Read very carefully.</i> Understand Figs 6.4 to 6.6 & 6.8, and Tab 6.1.
Precursor Metabolites	<i>Review.</i>
Overview	<i>Read very carefully</i> , including Fig 6.10. Understand the basic outline of metabolism. Understand outline of glycolysis, TCA cycle, aerobic respiration and fermentation.
6.2 Enzymes	
Introduction	<i>Read.</i>
Mechanisms	<i>Read carefully</i> and understand Fig 6.11a.
Cofactors	<i>Read</i> , including Fig 6.12 and understand role of coenzymes.
Environmental Factors	<i>Skip.</i>
Allosteric Regulation	<i>Skip</i>
Enzyme Inhibition	<i>Skip.</i>
6.3 The Central Metabolic Pathways	
Introduction	<i>Read.</i>
Glycolysis	<i>Review</i> only. What goes in, what comes out, and what is recycled?
Pentose Pathway	<i>Skip.</i>
Transition Step	<i>Review</i> only. What goes in, what comes out, and what is recycled?
TCA Cycle	<i>Review</i> only. What goes in, what comes out, and what is recycled?
6.4 Respiration	
Introduction	<i>Read.</i>
Electron Transport	<i>Review</i> only. What goes in, what comes out, and what is recycled?
ATP Synthase	<i>Skip.</i>
ATP Yield	<i>Skip.</i>
6.5 Fermentation	<i>Read</i> only the first 3 paragraphs and Figs 6.22 & 6.23.
6.6 Catabolism of Organic Compounds Other than Glucose	<i>Read</i> only the Introduction. <i>Review</i> Fig 6.24.
6.7 Chemolithotrophs	<i>Skip.</i>
Perspective 6.1	<i>Review.</i>
6.8 Photosynthesis	<i>Skip.</i>
6.9 Carbon Fixation	<i>Skip.</i>
6.10 Anabolic Pathways – Synthesizing Subunits from Precursor Molecules	
Introduction	<i>Read</i> and understand the concepts in Fig 6.28.
Lipid Synthesis	<i>Skip.</i>
Amino Acid Synthesis	<i>Skip.</i>
Nucleotide Synthesis	<i>Skip.</i>
Future Challenges	<i>Summarize.</i>

Note: We will cover this chapter superficially and not spend any time on the fine details of metabolism. Metabolism is, in fact, very important topics for students of the biomedical sciences. Unfortunately, we are not afforded the time to cover metabolism in any detail in this course. We will try to cover important generalizations of metabolism, and note some of the unique metabolic capabilities of bacteria.