

## Session 3 - Microbial Genetics

Text:	Chapters 7, 8 and 9
Anticipated time:	2-3 class periods
Basic Objectives:	You should be able to discuss the structure and function of genetic material in bacteria, and the flow of information in procaryotic cells. Understand mutations and structure and function of plasmids, the various mechanisms of genetic recombination in procaryotes, and the use of microorganisms in genetic engineering.
Slides to copy:	1, 2, 3, 7, 8, 11, 15, 17, 18, 20, 21, 22, 23, 24, 25

### Chapter 7 – The Blueprint of Life, from DNA to Protein

Introduction	<i>Read.</i>
7.1 Overview	
Introduction	<i>Read.</i> Define: Gene, replication, transcription, and translation. Understand the Central Dogma of information flow. Understand Fig 7.1.
Characteristics of DNA	<i>Read.</i> Understand: Complementary. Understand Fig 7.3.
Characteristics of RNA	<i>Read.</i> Understand the forms of RNA.
Regulating Expression...	<i>Review</i> for concepts.
7.2 DNA Replication	
Introduction	<i>Read.</i> Understand the basic components and the process of DNA replication but do not try to memorize all the details. Understand Fig 7.5. We will review this basic process in class.
Initiation of DNA...	<i>Skip.</i>
The Replication Fork	<i>Skip.</i>
7.3 Gene Expression in Bacteria	
Introduction	<i>Read.</i>
Transcription	<i>Read,</i> especially the introduction. Understand the basic components and the process but do not try to memorize all the details. Understand Fig 7.7. We will review this basic process in class.
Translation	<i>Read,</i> especially the introduction. Understand the basic components and the process but do not try to memorize all the details. Understand Fig 7.9. We will review this basic process in class.
Perspective 7.1	<i>Skip.</i>
7.4 Differences Between Eucaryotic and Procaryotic Gene Expression	<i>Skip.</i>
7.5 Regulation of Bacterial Gene Expression	<i>Skip.</i>
7.6 Regulation of Eucaryotic Gene Expression	<i>Skip.</i>
7.7 Sensing and Responding to Environmental Fluctuations	<i>Skip.</i>
7.8 Genomics	<i>Summarize,</i> if time permits.
Future Challenges	<i>Skip.</i>

Note: This chapter should essentially be material you have covered in previous courses. We will discuss it as needed to accommodate a good understanding of basic genetics and the nature of information flow. You should try to understand the purpose, components and basic! processes involved in information flow, as well as the mechanisms and applications of genetic engineering.

## Chapter 8 – Bacterial Genetics

Introduction	<i>Read.</i> Refer to Key Terms as needed.
8.1 Genetic Change in Bacteria	<i>Read.</i> Define: Mutation, genotype, phenotype and gene transfer.
Gene Mutation as a...	<i>Review,</i> including Fig 8.1.
8.2 Spontaneous Mutations	
Introduction	<i>Read.</i> Define: Spontaneous mutation, mutagen.
Base Substitution	<i>Summarize</i> only if time permits.
Removal or Addition...	<i>Summarize</i> only if time permits.
Transposable Elements	<i>Summarize</i> only if time permits.
8.3 Induced Mutations	
Introduction	<i>Read.</i> Understand the concept of induced mutations.
Chemical Mutations	<i>Review</i> for concepts. Define: Carcinogen
Transposition	<i>Review</i> for concepts.
Radiation	<i>Read.</i> And why is excessive sunlight (and failure to use sun screen) harmful?
8.4 Repair of Damaged DNA	
Introduction	<i>Read.</i> Understand the significance of DNA repair of mutations.
Repair of Errors...	<i>Skip.</i>
Repair of Thymine...	<i>Skip.</i>
Repair of Modified...	<i>Skip.</i>
SOS Repair	<i>Skip.</i>
8.5 Mutant Selection	
Introduction	<i>Review.</i>
Direct Selections	<i>Skip.</i>
Indirect Selection	<i>Skip.</i>
Testing of Chemicals...	<i>Read,</i> including Fig 8.16. What is the utility of the Ames Test?
Gene Transfer as a...	<i>Read.</i> This is a good introduction to the next important topics, and is nicely covered in Tab 8.3.
Perspective 8.1	<i>Read.</i> Understand the experiment in Fig 1.
8.6 DNA-Mediated Transformation	
Introduction	<i>Read carefully</i> and understand Fig 8.19.
Natural Competence	<i>Skip.</i>
Artificial Competence	<i>Skip.</i>
Perspective 8.1	<i>Read carefully.</i>
8.7 Transduction	<i>Read carefully.</i> And understand Fig 8.21
8.8 Conjugation	
Introduction	<i>Read carefully.</i>
Plasmid Transfer	<i>Read carefully</i> and understand Fig 8.23.
Chromosome Transfer	<i>Skip.</i>
F' Donors	<i>Skip.</i>
8.9 The Mobile Gene Pool	
Introduction	<i>Read carefully.</i> Read Tab 8.3.
Plasmids	<i>Read</i> and understand function of R plasmids.
Transposons	<i>Skip.</i>
Genomic Islands	<i>Review</i>
Perspective 8.2	<i>Skip.</i>
Future Challenges	<i>Review.</i>

Note: We will work on developing good working definitions, and an understanding of the mechanisms of the three major types of naturally occurring genetic recombination in bacteria: Transformation, Transduction, and Conjugation. We will understand the role of Plasmids.

Note: Many of the topics included in the sections on DNA damage and mutations are also important in cancer biology and chemotherapy of cancer.

## Chapter 9 – Biotechnology and Recombinant DNA

Introduction

*Read carefully.*

### 9.1 Fundamental Tools Used in Biotechnology

Introduction

*Read.*

Restriction Enzymes

*Review, including Fig 9.1. Define: Restriction Enzymes.*

Gel Electrophoresis

*Review, including Fig 9.2.*

### 9.2 Applications of Genetic Engineering

Introduction

*Read.*

Engineered Bacteria

*Review, including Tab 9.2.*

Engineered Eucaryotes

*Skip.*

### 9.3 Techniques Used in...

*Skip.*

### 9.4 Concerns Regarding DNA...

*Read carefully.*

### 9.5 DNA Sequencing

*Skip.*

### Perspective 9.1

*Review.*

### 9.6 Polymerase Chain Reaction

*Skip.*

### 9.7 Probe Technologies

*Skip.*

Note: As important as these topics are, we will limit ourselves to a superficial review of genetic engineering technologies and applications, but only as time permits.