

Course Guide for Microbial Genetics

I. General Information

A Course Guide for Microbial Genetics

MODULE NAME : Basic Biotechnology

MODULE CODE : Biot-M2071

MODULE NUMBER: 07

COURSE TITLE: **Microbial Genetics**

COURSE CODE : Biot2073

COURSE ECTS : 5

COURSE WEIGHT : 3 C.hr.

II. Course Description

Theory: The course focuses primarily on gene structure and function of prokaryotic systems as a paradigm for processes in eukaryotes. The course also delves extensively into the intricacies of bacterial virus (bacteriophage) molecular genetics. bacterial genome and its elements, extra-chromosomal elements, plasmids and their properties, DNA replication, recombination in bacteria, gene structure of prokaryotes, operons , control of gene expression, transformation, conjugation, transduction, transposition, genetic fine structure and co-linearity, mapping methods, transposable elements, virulent and avirulent phages, mutation, DNA repair.

Practical: Growth curve of bacteria; induction of lytic cycle by U.V; detection of R-plasmids in bacterial strains; detection of transposons in bacterial strains; curing of bacterial plasmids; detection of mutants using replica plating techniques; transfer of genetic markers through conjugation; gene mapping by interrupted mating in bacteria.

III. Course Objectives

At the end of this course students will be able to:

- ✓ Outline the processes of DNA replication, RNA transcription and Protein synthesis
- ✓ Compare elements of bacterial chromosome with extra-chromosomal chromosome
- ✓ Categorize different plasmids based on their features
- ✓ Understand process curing of bacterial plasmids
- ✓ Explain different elements of prokaryotic genes
- ✓ Understand concept of operons and give examples of operons
- ✓ Explain how genes are regulated and its importance
- Give examples of gene regulations in bacterial system
- ✓ Infer the roles that different *elements* of genes play in gene regulation
- ✓ Differentiate the processes of *transformation, transduction, conjugation* and *transposition* and explain the role that each plays in *Genetic engineering*
- ✓ Describe what mutation is and differentiate mutation types
- ✓ Give examples of effects of mutations in bacteria

- ✓ Explain importance of mutations in genetic mapping and genetic analysis
- ✓ Explain genetic fine structure and mapping
- ✓ Describe different mapping methods and apply methods in solving problems
- ✓ Describe virulent and *avirulent* phages
- ✓ Measure growth rate of bacteria
- ✓ Detect bacterial strains using transposons
- ✓ Apply replica plating technique for mutant detection

IV. Assessment Arrangements

- ✓ Test 1 will be given, which weights out of 20%,
- ✓ Test 2 will be given, which weights out of 20%
- ✓ Laboratory Practical Report will be comprise 10%
- ✓ Attendance and assignment- 10%
- ✓ The remaining 40 % will be for final exam.

V. Course Policies

A. Ground Rules

The course is delivered based on the rules and regulations of the university and the following rules must be kept for classroom purpose

- ✓ Attending all class is **a must**
- ✓ Punctuality in class and assignment is mandatory
- ✓ Active participation is required at most
- ✓ Misbehaving at class is highly forbidden
- ✓ Disabling a cellular phone is **a must**

B. Academic honesty policy

Students are responsible for their work only. Students who cheat on exams, by whatever method, or guilty of plagiarism will, or may be given an "F" for course and dismissed permanently from class.

C. Late work

Students may take any missed exam by the consent of the department members. And students are expected to provide their evidence for missing exam since 5 days after the onset of the exam.

D. Disclaimer

This syllabus represent a best plan for the course ,but ,as with most plans, it is subject to changes made necessary by time ,space and personal constraints as the course progresses.

VI. References:

1. Microbial genetics: David Friefelder.
2. Principles of genetics: Snustad, Simmons, Jenkins.

3. Microbiology: sixth edition: Lan Sing, M. Prescott, John Harly & Donald. A. Klein.

VII. Course content

Day	Contents	Reference Materials
1	BACTERIAL REPLICATION AND REPAIR 1.1 chromosome size and morphology 1.2 Chromosome replication and cell division 1.3 DNA repair	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley
2-3	BACTERIAL GENE ORGANIZATION AND EXPRESSION 2.1 Prokaryotic gene organization 2.2 The operon model 2.2.1 <i>Lac</i> operon 2.2.2 <i>Trp</i> operon 2.2.3 Lytic and Lysogenic cycles in Phage λ 2.2.4 Transposable Genetic Elements 2.3 Gene Expression 2.3.1 Transcription 2.3.2 Translation 2.3.3 Post translational Events	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley Larry Snyder, Wendy Champness, Molecular Genetics of Bacteria, ASM press, Washington Tamrin (4th ed) , Principles of Genetics, The McGraw–Hill Companies, 2001
3-4	MUTATION AND VARIATION 3.1 Types of mutations 3.1.1 Point Mutations 3.1.2 Conditional Mutants 3.1.3 Variation due to Chromosomal alterations 3.1.4 Extra-chromosomal agents and horizontal gene transfer 3.2 Recombination 3.3 Mechanism of mutation 3.3.1 Spontaneous mutation 3.3.2 Chemical mutagenes 3.3.3 Ultraviolet irradiation 3.4 Isolation and Identification of Mutants 3.4.1 Mutation and Selection 3.4.2 Replica plating 3.4.3 Isolation of other mutants 3.4.4 Molecular Methods	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley Larry Snyder, Wendy Champness, Molecular Genetics of Bacteria, ASM press, Washington Tamrin (4th ed) , Principles of Genetics, The McGraw–Hill Companies, 200
4-5	REGULATION OF GENE EXPRESSION 4.1 Gene Copy Number 4.2 Transcriptional Control 4.2.1 Promoters 4.2.2 Terminators, attenuators and anti-terminators 4.2.3 Induction and repression: regulatory proteins 4.2.4 Two-component regulatory systems 4.2.5 Global regulatory systems 4.2.6 Quorum sensing 4.3 Translational control 4.3.1 Ribosomal binding 4.3.2 Codon usage 4.3.3 stringent response 4.3.4 Regulatory RNA 4.4 Phase Variation	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley Larry Snyder, Wendy Champness, Molecular Genetics of Bacteria, ASM press, Washington Tamrin (4th ed) , Principles of Genetics, The McGraw–Hill Companies, 2001

6	GENETICS OF BACTERIOPHAGES 5.1 Bacteriophage structure 5.2 Single-strand DNA bacteriophage 5.3 RNA containing bacteriophages 5.4 Restriction and Modification and Bacterial resistance to phage attack 5.5 Complementation and recombination	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley Larry Snyder, Wendy Champness, Molecular Genetics of Bacteria, ASM press, Washington Tamrin (4th ed) , Principles of Genetics, The McGraw–Hill Companies, 2001
6	PLASMIDS 6.1 Phenotypes conferred by Plasmids 6.2 Molecular properties of Plasmids 6.3 Plasmid stability	Tamrin (4th ed) , Principles of Genetics, The McGraw–Hill Companies, 2001
7	GENOMIC PLASTICITY: 7.1 Insertion sequences 7.2 Transposons and mechanism of transposition 7.3 Phase variation	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria, Wiley
8-12	GENETIC METHODS FOR INVESTIGATING BACTERIA 8.1 Complementation 8.2 Reporter genes 8.3 Lysogeny 8.4 Bacterial virulence 8.5 Specific mutagenesis through Antisense RNA and gene replacement GENE MAPPING 9.1 Gene mapping 9.1.1 Gene Sequencing 9.1.2 Physical and Genetic maps	Jeremy W.D., F.P., Simon, Molecular Genetics of Bacteria,

VIII. Approval section

Course Instructor

Name – Dr. Mussa Adal
 Date -3/10/2020
 Signature –

Department head

Name – Tadesse Abate
 Date- -3/10/2020
 Signature