15. Module XV: Genetics

15.1. Module Objectives

On completion of this module, the students will be able to:

- describe the connection between phenotypic and genotypic characteristics, in addition to the vertical and horizontal inheritance in microorganisms (naturally)
- explore and integrate the study of microbial phenotype and genotype in order to manipulate microorganisms as an effort of control or utilizing microorganisms to produce positive outcomes
- work with software to process bioinformatics data
- perform experiments that implement the connection between phenotypic and genotypic characteristics, as well as vertical and horizontal inheritance in microorganisms
- perform experiments involving the manipulation of genetics and expression of proteins in microorganisms
- describe and design the process of science and engineering of microbial genetics
- Gain initiative to voluntarily update on development of studies and data
- expand their networking through online activities

15.2. Module Data

Person in charge	Dr. Ernawati A. Giri-Rachman
Total Credits	5
Course	BM 3106 Micriobial genetic engineering
	BM 3104 Introduction of bioinformatic
Course Examination	Written Test

15.2.1. Sub-module I: Microbial Genetic Engineering

Lecturer	Dr. Ernawati A.Giri-Rachman
Semester	5
Type of submodule / course	Lecture with exercises
Credits	3(1)
Workload	2 hours lectures, 3hours laboratory, 2hours structured activities, 2 hours individual study, 16 weeks per semester, and total 144 hours a semester
Workload Detail	Laboratory work, textbook reading assignment, group discussion, presentation, paper review
Classification within the curriculum:	~~General Studies~~ / Compulsory Course/ ~~Elective Course~~

Type of assessment/examination	Written Test : Midterm exam, Final exam, Quizess, Assignments Presentation
Language	Bahasa Indonesia
Course Target / Outcome	Students will be able to 1. describe isolation methods and characterize genes 2. describe methods of gene expression using expression systems in bacteria and fungi 3. describe methods of gene purification and characterize gene products 4. describe the connection between phenotypic and genotypic characteristics, in addition to the vertical and horizontal inheritance in microorganisms (naturally) 5. explore and integrate the study of microbial phenotype and genotype in order to manipulate microorganisms as an effort of control or utilizing microorganisms to produce positive outcomes 6. perform experiments that implement the connection between phenotypic and genotypic characteristics, as well as vertical and horizontal inheritance in microorganisms 7. perform experiments involving the manipulation of genetics and expression of proteins in microorganisms 8. describe and design the process of science and engineering of microbial genetics
Teaching methods	Interactive Lecture and Interactive Laboratory Practices
Contents (SAP)	
1	Introduction of isolation and characterization genes and properties of nucleic acids
2	The applications of DNA replication and analysis methods (PCR mehods, Real Time and Reverse Transkriptase PCR)
3	DNA protection mechanism and DNA recombinant technology
4	The application of plasmids in DNA recombinant technology
5	The function, process, and application of transposition
6	Natural and artificial transformation in bacteria and yeasts.

7	Mid-Term Test
8	Bacteriophages and Transduction
9	The principles from DNA sequencing methods
10	Mutation, mutagens, and DNA repair
11	DNA recombination in bacteria: concept and application
12	Methods of gene isolation and genomic libraries
13	expression vectors in bacteria and yeasts
14	Techniques in protein identification and purification
15	Study-case persentation
16	Final Test
Literature / Sources	Brown, T. A., (1998), *Genetics : a Molecular Approach*, Stanley Thornes

15.2.2. Sub-module II: Introduction to Bioinformatics

Lecturer	Dr. Adi Pancoro
Semester	5
Type of submodule / course	Laboratory work
Credits	2 (1)
Workload	1 hours lectures, 3 hours laboratory, 1 hours structured activities, 1 hours individual study, 16 weeks per semester, and total 96 hours a semester
Workload Detail	Computation work, textbook reading assignment, group discussion, presentation, paper review
Classification within the curriculum:	~~General Studies~~ / Compulsory Course/ ~~Elective Course~~
Type of assessment/examination	Written Test : Midterm exam, Final exam, Quizess, Assignments Presentation
Language	Bahasa Indonesia
Course Target / Outcome	1. Students will be able to work with with software to process bioinformatics data 2. Gain initiative to voluntarily update on development of studies and data 3. Be able to expand their networking through online activities
Teaching methods	Interactive Lecture and Interactive Computational Practices
Contents (SAP)	

1	Introduction to Bioinformatics
2	Database-Genebank : Intoduction to Genebank and Data Search in Genebank
3	Database-Genebank : Retrieve DNA sequence and BLAST
4	Data Analysis I : Database of nucleotide sequence and protein
5	Data Analysis I : Single DNA sequence and protein
6	Mid-Term Test
7	Data Analysis II : Similarity of Sequences in Database
8	Data Analysis II : Comparison of Two Sequences in Database
9	Data Analysis II : Building multiple alignment sequencing
10	Data Analysis II :Analysis of Multiple alignment sequencing
11	Data Analysis III : 3D Protein structure
12	Data Analysis III : Working with RNA
13	Data Analysis III : Building a phylogenetic tree
14	Aplication of Bioinformatics : Procaryote genome project
15	Aplication of Bioinformatics: Eukaryote genome project
16	Final Test
Literature / Sources	Claverie, J. M., Notredame, C., (2007) *Bioinformatics for Dummies 2nd edition*., Wiley Publishing, Inc. Indianapolis – US Xiong J., (2006) Essetial Bioinformatics, Cambridge University Press