MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

SUBJECT OUTLINE DETAILS

1. Subject: Plant Molecular Biology

- **Code:** BB856C
- **Credits: 02**
- **Hours:** 30 theory hours, 60 self-study hours.

2. Management Unit:

- **Department:** Molecular Biotechnology
- **Faculty/School/Institute/Center/Department:**

Biotechnology Research and Development Institute, Can Tho university

3. Prerequisites: General Biology I (BS110C); Molecular Biology (BB801C).

4. Subject objectives:

The purpose of this subject is to i). provide students with a solid understanding of the relationship between structure and function of macromolecules that carry and express genetic information; ii). Foster the development of critical thinking in considering methods of scientific inquiry and assessment of results; familiarize students with the utilization of bioinformatics resources.

4.1. Knowledge:

Students will develop knowledge and understanding of:

4.1.1. the different components of the cell machinery that maintain and express the genetic information stored in cells of living organisms.

4.1.2. identifying the basic methods and approaches used in molecular biology.

4.1.3. explaining the role played by the molecular components of the genetic machinery.

4.1.4. Using their knowledge of structure and function of macromolecules to interpret biological phenomena such as growth, development and responses to biotic and abiotic stimuli.

4.2. Skill:

4.2.1. Ability to understand plant Molecular biology.

4.2.2. Apply investigative and problem-solving skills.

4.3. Attitude:

4.3.1. Students are encouraged to develop positive values and informed critical attitudes.

4.3.2. Being hard-working student.

5. Brief description of subject content:

Molecular Biology is the branch of biology that studies the structure and function of macromolecules that encode and regulate the flow of genetic information used by living organisms. This subject will focus on the structure and content of the three genomes found in plant cells, gene structure, expression, and regulation. Other topics addressed in this class are transposable elements, and plant transformation procedures. A brief introduction to bioinformatics is also included.

6. Subject content structure:

6.1. Theory

Contents	Hours	Objective
Chapter 1. Nuclear architecture Overview and Genome in plants 1.1. Nulcear architecture 1.1.1. Double membrane envelope 1.1.2. Nulcear envelope has spores 1.1.3. many nuclear proteins have nuclear localization signals (NLS) 1.2. Nulcear Genome 1.2.1. DNA organized in chromosomes & replicated as in other systems 1.2.2. Euchromatin and Heterochromatin 1.2.3. DNA package by histone into nucleosomes 1.2.4. DNA also attached to nulcear matrix 1.3. Genomes & The tree of life 1.4. Genome complexity & how many genes in plants?	**5**	**4.1.1** **4.1.2** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 2. Plant Nulcear Gene Expression and Regulation 2.1. Steps to regulate 2.2. Relative cellular RNA abundance 2.3. Enhancers and Silencers 2.4. Chromatin modification 2.5. Post transcriptional Processes	**3**	**4.1.3** **4.1.4** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 3. Chloroplast Biology 3.1. Structure 3.1.1. Double membrane envelope 3.1.2. Stroma 3.1.3. Thylakoid membrane system 3.1.4. Intrathylakoid space or lumen 3.2. Functions 3.2.1. Many important biochemical (anabolic) pathways 3.2.2. Own genetic system 3.3. Reproduction 3.4. Development 3.5. Chloroplast genetics	**5**	**4.1.3** **4.1.4** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 4. Mitochondrial Biology 4.1. Structure 4.1.1. Outer membrane 4.1.2. Inner membrane	**4**	**4.1.1** **4.1.3** **4.2.1** **4.2.2**

4.1.3. Intermembrane space 4.1.4. Matrix 4.2. Function 4.3. Reproduction 4.4. mtDNA & Genetics 4.5. Size trends in Evolution of mtDNA 4.6. Mitochondria Gene expression 4.7. mtRNA editing		**4.3.1** **4.3.2**
Chapter 5. Plant Transposon Elements 5.1. What is Transposable elements? Ac/Ds elements 5.2. Transposon Common Features 5.3. Molecular Analysis of Transposon 5.4. Molecular bases of the Myriad Effects of Transposon on Gene Expression 5.5. Control of Transposon	**3**	**4.1.3** **4.1.4** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 6. Genetic Engineering of Plants 6.1. What is Genetic Engineering? 6.2. Steps in GE of plants 6.2.1. Get DNA 6.2.2. Two main aproaches 6.2.3. Promoter 6.3. *Agrobacterium tumefaciens* 6.4. Ti plasmid 6.5. *Vir* genes 6.6. Binary vector system	**4**	**4.1.1** **4.1.3** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 7. DNA Repair & Recombination 7.1. DNA structure 7.2. Types of DNA damage 7.3. DNA Repair mechanism 7.3.1. Repair of UV induced dimers in the light 7.3.2. Base Excision repair (BER) 7.3.3. Mismatch repair 7.3.4. Repair of Double-strand breaks (DSBs) 7.3. DNA Recombination	**3**	**4.1.1** **4.1.2** **4.1.4** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 8. Plant adaption to Stress 8.1. Stress Responses & Gene Expression 8.2. Adaptation versus Acclimation 8.3. Types of Stress 8.4. Biotic stress and Plant Defense Responses	**3**	**4.1.1** **4.1.3** **4.1.4** **4.2.1** **4.2.2** **4.3.1** **4.3.2**

7. Teaching method:

- Teaching and explaining each lecture.
- Providing supplements, case studies.

8. Duties of student:

Students have to do the following duties:

- Lecture/Class attendance: not allow to be absent more than 20% of lectures.
- Discussion problems and doing homeworks: mandatory

9. Assessment of student learning outcomes:

9.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Midterm exam	Tests	40%	Evaluating knowledge of half program
2	Final exam	Tests	60%	Evaluating knowledge of whole course

9.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.
- Subject score is the sum of all the components of the evaluation multiplied by the corresponding weight. The subject score is marked on a scale of 10 and rounded to one decimal place, then is converted to A-B-C-D score and score on a scale of 4 under the academic provisions of the University.

10. Materials:

Materials information	Code number
[1]. Plant Molecular Biology Handout	File-BiRDI website
[2]. Acquaah, G., 2007. Principles of Plant Genetics and Breeding. Blackwell Publishing.	BiRDI Library ISBN-13: 978-1-4051-3646-4
[3]. Sonnino, A., O. Brandenberg, Z. Dhlamini, A. Sensi, K. Ghosh,. 2011. Introduction to Molecular Biology and Genetic Engineering. .	BiRDI Library

11. Self-study Guide

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	**Chapter 1. Nuclear architecture Overview and Genome in plants** 1. Nulcear architecture 2. Nulcear Genome 3. Genomes & The tree of life 4. Genome complexity & how many genes in plants?	**10**		Reading Part I-Section 2 [Material 2]; Chapter 1 & 2 [Material 3]..
2	**Chapter 2. Plant Nulcear Gene Expression and Regulation** 2.1. Steps to regulate 2.2. Relative cellular RNA abundance	**6**		Reading Part I-Section 2 [Material 2]; Chapter 3

	2.3. Enhancers and Silencers 2.4. Chromatin modification 2.5. Post transcriptional Processes			[Material 3]..
3	**Chapter 3. Chloroplast Biology** 3.1. Structure 3.2. Functions 3.3. Reproduction 3.4. Development 3.5. Chloroplast genetics	**10**		Reading Part I-Section 4 and Section 5 [Material 2]; Chapter 4 & Chapter 6 [Material 3]..
4	**Chapter 4. Mitochondrial Biology** 4.1. Structure 4.2. Function 4.3. Reproduction 4.4. mtDNA & Genetics 4.5. Size trends in Evolution of mtDNA 4.6. Mitochondria Gene expression 4.7. mtRNA editing	**8**		Reading Part I-Section 4 and Section 5 [Material 2]; Chapter 4 & Chapter 6 [Material 3].
45	**Chapter 5. Plant Transposon Elements** 5.1. What is Transposable elements? 5.2. Transposon Common Features 5.3. Molecular Analysis of Transposon 5.4. Molecular bases of the Myriad Effects of Transposon on Gene Expression 5.5. Control of Transposon	**6**		Reading Part I-Section 5 and Section 6 [Material 2]; Chapter 7 [Material 3]..
6	**Chapter 6. Genetic Engineering of Plants** 6.1. What is Genetic Engineering? 6.2. Steps in GE of plants 6.3. *Agrobacterium tumefaciens* 6.4. Ti plasmid 6.5. *Vir* genes 6.6. Binary vector system	**8**		Reading Chapter 7 [Material 3]..
7	**Chapter 7. DNA Repair & Recombination** 7.1. DNA structure 7.2. Types of DNA damage 7.3. DNA Repair mechanism 7.3. DNA Recombination	**6**		Reading Chapter 4 [Material 3]..
8	**Chapter 8. Plant adaption to Stress** 8.1. Stress Responses & Gene Expression 8.2. Adaptation versus Acclimation 8.3. Types of Stress 8.4. Biotic stress & Plant Defense Responses	**6**		Reading Part I-Section 6 and Section 7 [Material 2]; Annex 1 [Material 3]..

Can Tho, 25/April/2014.

ON BEHALF OF RECTOR
DEAN/ DIRECTOR

HEAD OF DEPARTMENT