MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

DETAILED SUBJECT OUTLINE

1. **Subject title:** **MICROBIAL GENOMICS**
   - **Code:** **MM433C**
   - **Credits:** 2
   - **Work-load:** 30 class hours + 60 self-study hours
2. **Responsible unit:** Department of Molecular Biotechnology
   Institute of Biotechnology Research and Development
3. **Prerequisites:** Introductory Microbiology (MI301C) or equivalents
4. **Subject objectives:** This subject aims at providing students fundamental information about microbial genomics, from concepts and different tools used to perform genomic science to their applications. After completion of the subject, the students should meet the following criteria:
   - **4.1. Knowledge:** The students will obtain/gain knowledge about
     - 4.1.1. DNA, genes, genomes and genomics and
     - 4.1.2. The databases, bio-informatics tools and different techniques used to perform genomic science and their applications.
   - **4.2. Skills:** The students could be able to
     - 4.2.1. Perceive, analyze and discuss different topics on microbial genomics;
     - 4.2.2. Further develop/enhance their knowledge and technical English in genomic science; and
     - 4.2.3. Work in teams to solve genomic problems.
   - **4.3. Attitude:** The students are expected to
     - 4.3.1. Be self-discipline and responsible;
     - 4.3.2. Love life sciences;
     - 4.3.3. Love their community; and
     - 4.3.4. Be active in knowledge sharing and team works.
5. **Subject description:** This subject provides students fundamental information about microbial genomics, from concepts to the databases, bio-informatics tools and different techniques used to perform genomic science. Practical topics, *i.e.*, recombinant DNA technology, comparative microbial genomics, identification of bacteria are also discussed. Furthermore, a number of selective topics relevant to the lectures would be presented and discussed by the students.
6. **Subject content:**

	Class hours	Objectives
Lectures	**20**	4.1; 4.2.1; 4.2.2; 4.3.1; 4.3.2; 4.3.3
Orientation meeting	1	4.3.1; 4.3.2; 4.3.3
Lecture 1. Introduction to microbial genomics	1	4.1.1
Lecture 2. The Central Dogma of Molecular Biology	2	4.1.1
Lecture 3. Databases 3.1. NCBI (National Center for Biotechnology Information) 3.2. EMBL (European Molecular Biology Laboratory) 3.3. DDBJ (DNA Data Bank of Japan)	2	4.1.2
Lecture 4. Bio-informatics tools 4.1. SeqVerter 4.2. DNAClub 4.3. FastPCR 4.4. Primer3 4.5. Primer-BLAST 4.6. ClustalW 4.7. MultAlin 4.8. ComAlign 4.9. ClustalX 4.10. BioEdit 4.11. PAUP* 4.12. BioPro 4.13. NTSYSpc 4.14. PyMOL	4	4.1.2
Lecture 5. Techniques used for microbial genome analyses 5.1. DNA amplification 5.2. DNA sequencing 5.3. Quantitative real-time RT-PCR	4	4.1.2

5.4. Microarrays		
Lecture 6. Recombinant DNA technology 6.1. Restriction enzymes 6.2. DNA ligase 6.3. Plasmid vectors 6.4. Selection markers 6.5. Bacterial host cells	2	4.1.2
Lecture 7. Comparative microbial genomics 7.1. Comparative genomics 7.2. Diversity of microbial populations	2	4.1.2
Lecture 8. Identification of bacteria 8.1. The Bergey's Manual 8.2. The 16S rRNA gene sequence	2	4.1.2
Students' presentations *The following topics are subject to change based on students' background and expectations.*	**8**	4.1; 4.2; 4.3
Topic 1. The genome of bacteria	1	4.1.1
Topic 2. The genome of fungi	1	4.1.1
Topic 3. Searching for references from NCBI *(or another selective database)*	1	4.1.2
Topic 4. Primer design *(present one selective bio-informatics software/tool used to design primers)*	1	4.1.2
Topic 5. Applications of PCR technique	1	4.1.2
Topic 6. Applications of recombinant DNA technology	1	4.1.2
Topic 7. Population diversity of *Xanthomonas oryzae (or another selective bacterium)*	1	4.1.2
Topic 8. Identification of *Pseudomonas fluorescens (or another selective bacterium)*	1	4.1.2
Final examination	**2**	4

7. **Teaching methodology:** Student-centered approach
   - Synchronize subject requirements with the general background and expectations of students;
   - Provide key information, raise questions, lead discussion of the students, summarize and provide take-home messages; and

- Give the students group assignments where they should prepare, present and discuss different selective topics relevant to the lectures.

8. Students' responsibilities:

- Attend ≥ 24/30 scheduled class hours;
- Raise questions and provide feedbacks/comments (if any);
- Be self-discipline and responsible;
- Fulfill group assignments (presentation); and
- Take the final examination.

9. Assessment:

9.1. Grade components:

No.	Grade components	Requirements	Weight	Objectives
1	Presentation	Each group of 4-5 students has to deliver a well-prepared, informative, comprehensive and interesting oral presentation on a selective topic relevant to each lecture. Fruitful discussion is expected during the presentation.	50%	4.1; 4.2; 4.3
2	Final examination	Each student has to complete a written examination with correct and concise answers. Creative solutions/ideas are encouraged.	50%	4

9.2. Grading system: Final grade is calculated as a sum of the 2 grade components (presentation 50% and final examination 50%). This is given from 0 to 10 rounded to one decimal place. The final grade will then be transformed into the "A-B-C-D" grading system, which corresponds to the grades of 4 to 0 provided by the grading policies of Can Tho University.

10. References:

	Location
[1] Madigan M. T., Martinko J. M., and Parker J. 2000. Brock Biology of Microorganisms (9th edition). Prentice-Hall, Inc., USA. 991 pages.	Molecular Biology Laboratory, Institute of Biotechnology R&D , Can Tho University
[2] Reece R. J. 2004. Analysis of Genes and Genomes. John Wiley & Sons, Ltd, UK. 469 pages.	
[3] Glick B. R. and Pasternak J. J. 2003. Molecular Biotechnology - Principles and Applications of Recombinant DNA (3rd edition). ASM Press,	

USA. 760 pages.	
[4] Agostino M. 2013. Practical Bioinformatics. Garland Science, Taylor & Francis Group, LLC, USA. 367 pages.	
[5] Hartl D. L. and Clark A. G. 1997. Principles of Population Genetics. Sinauer Associates, Inc., USA. 542 pages.	
[6] Magurran A. E. and McGill B. J. 2011. Biological Diversity - Frontiers in Measurement and Assessment. Oxford University Press, USA. 345 pages.	
[7] Schaad N. W., Jones J. B., and Chun W. 2001. Laboratory Guide for Identification of Plant Pathogenic Bacteria (3rd edition). APS Press, USA. 373 pages.	
[8] Websites of NCBI, EMBL and DDBJ	http://www.ncbi.nlm.nih.gov/ http://www.embl.org/ http://www.ddbj.nig.ac.jp/

11. Self-study guide:

Week	Content	Hours	Students' activities
1	Orientation meeting Lecture 1: Introduction to microbial genomics	4	Look for the recommended references and read chapters 6 and 9 of book [1] and chapters 1, 5 and 6 of book [2].
2	Lecture 2: The Central Dogma of Molecular Biology	4	Read chapter 6 of book [1], chapter 1 of book [2] and chapter 3 of book [3].
3	Lecture 3: Databases 3.1. NCBI (National Center for Biotechnology Information) 3.2. EMBL (European Molecular Biology Laboratory) 3.3. DDBJ (DNA Data Bank of Japan)	4	Read chapters 1 and 2 of book [4] and search for relevant information in book [4] and websites [8].
4	Lecture 4: Bio-informatics tools 4.1. SeqVerter 4.2. DNAClub 4.3. FastPCR	4	Search for relevant information in book [4] and the website of each tool.

	4.4. Primer3 4.5. Primer-BLAST 4.6. ClustalW 4.7. MultAlin		
5	Lecture 4: Bio-informatics tools *(continued)* 4.8. ComAlign 4.9. ClustalX 4.10. BioEdit 4.11. PAUP* 4.12. BioPro 4.13. NTSYSpc 4.14. PyMOL	4	Search for relevant information in book [4] and the website of each tool.
6	Lecture 5: Techniques used for microbial genome analyses 5.1. DNA amplification 5.2. DNA sequencing	4	Read 10.9 in chapter 10 of book [1], chapters 4 and 9 of book [2] and chapter 5 of book [3].
7	Lecture 5: Techniques used for microbial genome analyses *(continued)* 5.3. Quantitative real-time RT-PCR 5.4. Microarrays	4	Read chapters 4 and 10 of book [2].
8	Lecture 6: Recombinant DNA technology 6.1. Restriction enzymes 6.2. DNA ligase 6.3. Plasmid vectors 6.4. Selection markers 6.5. Bacterial host cells	4	Read chapter 10 of book [1], chapters 2 and 3 of book [2] and chapter 4 of book [3].
9	Lecture 7: Comparative microbial genomics 7.1. Comparative genomics 7.2. Diversity of microbial populations	4	Read 9.12 in chapter 9 and chapters 13, 14 and 15 of book [1], chapters 2, 4 and 5 of book [5] and chapters 15 and 16 of book [6].
10	Lecture 8: Identification of bacteria 8.1. The Bergey's Manual 8.2. The 16S rRNA gene sequence	4	Read chapter 12 and appendix 2 of book [1] and search for relevant information in book [7].

11	Topic 1: The genome of bacteria Topic 2: The genome of fungi	4	Collect references and compose the presentation.
12	Topic 3: Searching for references from NCBI *(or another selective database)* Topic 4: Primer design *(present one selective bio-informatics software/tool used to design primers)*	4	Collect references and compose the presentation.
13	Topic 5: Applications of PCR technique Topic 6: Applications of recombinant DNA technology	4	Collect references and compose the presentation.
14	Topic 7: Population diversity of *Xanthomonas oryzae (or another selective bacterium)* Topic 8: Identification of *Pseudomonas fluorescens (or another selective bacterium)*	4	Collect references and compose the presentation.
15	Final examination	4	Review all the lectures, presented topics and class discussion.

FOR THE RECTOR
DIRECTOR

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