Course: Molecular Ecology of Soil

Identification

Code: SOL 856
Credits: 5 (3 hours theory - 2 hours practice)
Level: Master and Doctorate
Professors: Zaida Inês Antoniolli and Rodrigo Josemar Seminoti Jacques
System: Biennial - odd years (II semester)

Discipline objectives

Provide students with theoretical and practical knowledge of the molecular biology of prokaryotes and eukaryotes. Provide theory and practice on the tools used in molecular biology such as electrophoresis, restriction enzymes, polymerase chain reaction, sequencing, and computational analysis of sequences with a view to their application in soil science. Relate the molecular responses of microorganisms to biotic and abiotic factors in the soil.

Syllabus

Molecular constituents of the cell; cell structure of prokaryotes and eukaryotes; structure and function of nucleic acids; nucleic acid metabolism; mobile genetic elements; recombination and gene transfer; molecular biology tools; molecular methods for the study of soil ecology.

Methodology and/or teaching instruments

Lectures, seminars, discussion of scientific articles, and practical classes.

Forms of evaluation

Written tests, seminars, class participation, and reports on practical classes.

Program: Title and Breakdown of Units

Unit 1

Molecular constituents of the cell
1.1 - Chemical composition of the cell
1.2 - Polysaccharides
1.3 - Lipids
1.4 - Nucleic acids
1.5 - Proteins and enzymes

Unit 2

Cell structure
2.1 - Cell structure of prokaryotes
2.2 - Cell structure of eukaryotes

Unit 3

Structure and function of nucleic acids
3.1 - DNA structure and function
3.2 - RNA structure and function
3.3 - Prokaryotic genomes
3.4 - Eukaryotic genomes
3.5 - Prokaryotic gene organization
3.6 - Gene organization of eukaryotes

Unit 4

Nucleic acid metabolism
4.1 - DNA replication
4.2 - DNA transcription
4.3 - RNA processing
4.4 - Genetic code and protein synthesis

Unit 5

Mobile genetic elements
5.1 - Plasmids
5.2 - Transposons

Unit 6

Recombination and gene transfer
6.1 - Genetic recombination
6.2 - Genetic transformation
6.3 - Conjugation
6.4 - Transduction
6.5 - Electroporation and transfection

Unit 7

Molecular biology tools
7.1 - Restriction enzymes
7.2 - Electrophoresis
7.3 - Polymerase chain reaction (PCR)
7.4 - Sequencing
7.5 - Hybridization
7.6 - Cloning
7.7 - Cloning and expression vectors
7.8 - DNA libraries

Unit 8

Molecular methods for the study of soil ecology
8.1 - RFLP- (T-RFLP) and RAPD-based markers
8.2 - PCR-based markers (ARDRA, RT-PCR, QUANTITATIVE PCR, RISA, ARISA)
8.3 - DGGE, metagenomics, and FISH
8.4 - Bioinformatics

Recommended literature

ALBERTS, B. et al. **Fundamentos da biologia celular.** 2 ed. Porto Alegre: Artmed, 2006, 866p.

BEEBEE, T. & ROWE, G. **An Introduction to Molecular Ecology**. 2 ed. Oxford: Oxford University Press. 2008

COLEMAN, D. C., CROSSLEY JR., D. A., HENDRIX, P. F. **Fundamentals of soil ecology.** 2 ed. New York: Elsevier, 2004, 205p.

COX, M. M.; DOUDNA, J. A.; O´DONNELL, M. **Biologia Molecular Princípios e Técnicas,** São Paulo, Artmed, 2012, 914p.

DE ROBERTIS, E. D. P. & DE ROBERTIS, E. M. F**. Bases da biologia celular e molecular.** 4 ed. Rio de Janeiro: Guanabara Koogan, 2006. 389p.

FREELAND, J. R. **Molecular Ecology.** John Wiley and Son Publichers, 2005, 400p.

HARDARSON. G. & BROUGHTON, W. J. (eds). **Molecular microbial ecology of the soil.** Dordrecht: Kluwer Academic Publichers, 1998, 164p.

KILLHAM, K. **Soil ecology.** Cambridge: University Press, 1994, 242 p.

LEWIN, B. **Genes IX.** 9 ed. New York: Jones and Bartlett Publishers, 2008, 900 p.

LORETO, E. L. S. & SEPEL, L. M. N. **Atividades experimentais e didáticas de biologia molecular e celular.** 2 ed. São Paulo: Sociedade Brasileira de Genética, 2003, 82p.

MADIGAN, M. T. et al. **Microbiologia de Brock.** São Paulo: Printice Hall, 2004, 608p.

MATIAS, F. **Práticas e protocolos básicos de biologia molecular**. São Paulo: Blucher, 2021, 276p.

MOREIRA, F. M. S. et al. **Biodiversidade do solo em ecossistemas brasileiros.** Lavras: UFLA, 2008, 768p.

SAMBROOK, J; RUSSELL, D. W. **Molecular cloning a laboratory manual.** 3rd. ed. New York: Cold Spring Harbor Laboratory Press, 2001. 3 volumes.

VERMELHO, A. B. et al. **Práticas de microbiologia.** Rio de Janeiro: Guanabara Koogan, 2006, 239p.

ZAHA, **A. Biologia molecular básica.** 3 ed. Porto Alegre: Mercado Aberto, 2003, 424p.