Code: 1534 **Transcriptomics and Proteomics**
Degree: 2nd cycle - Functional Biology
Curricular Year: 1st **Semester Course: 1st**
Credits: 6 ECTS **Compulsory**
Language: Portuguese/English
Responsible: Ricardo Manuel Seixas Boavida Ferreira
Other lecturer(s): -
Web Site: http://www.isa.utl.pt/home/node/3768

1. Contact hours:
Lectures 28 **Lecture/Praticals** 14 **Praticals/Laboratory** 28 **Others** 14 **Total** 84

2. Objectives:

The students must become acquainted and up-to-date with a general perspective of the great importance displayed today by the techniques applied in genomics, transcriptomics, proteomics and metabolomics. They will be given real examples of their applications in well known cases, either at the plant or animal levels, with particular emphasis in the case of man.

3. Programme:

Lectures

1. Introduction

Brief summary of the objectives, programme, bibliography and assessment of the Transcriptomics & Proteomics course. Selected examples of research areas in transcriptomics, proteomics and metabolomics.

2. General concepts

Concept definitions. Introduction to bioinformatics. "Ome/omic" topics in biology: genome/genomics, transcriptome/transcriptomics, proteome/proteomics and metabolome/metabolomics.
Example of a real application: A new concept of fungicide. From basic to applied research.

3. Genomics. Genome sequencing, from bacteria to man

Theoretical principles. Main techniques: sequencing by synthesis (Sanger, pyrosequencing), sequencing by bonding (polony method), sequencing by hybridization (DNA microarrays) and nanopore.
Applications: (i) identification of pathogenic organisms (ex. detection of *Legionella pneumophila* in air conditioning pipes); (II) diagnostic of genetic diseases (ex. prenatal diagnostic of cystic fibrosis); (iii) forensic biology (ex. micro-satellite regions for civil identification and criminal research).

4. Transcriptomics. A methodology to understand functional genomics

Introduction to transcriptomics. Gene expression profiling: (i) gene cloning and RT-PCR analysis; (ii) cDNA library production; (iii) microarray analysis; (iv) interference RNA utilization to understand cell signalling pathways; (v) RNA utilization to silence gene expression in cells and organisms.
Transcriptomics as a methodology to elucidate plant-pathogen interactions.

5. Proteomics

Definition and types of proteomics. Proteomic technology: (i) protein separation: mono and bi-dimensional electrophoresis versus bi-dimensional liquid chromatography; (ii) protein identification and characterization: mass spectrometry (peptide mass fingerprinting, de novo sequencing). Applications of proteomics.
Case-study: human neuroblastome proteome-

6. Metabolomics as a tool to understand biological processes and their interactions

Definition and applications of metabolomics. General overview of selected available analytical techniques: (i) chromatography; (ii) mass spectrometry; (iii) NMR. Specific examples: industrial applications.
Case-study.

Individual presentations made by the students

Practicals

1. Protein identification by mass spectrometry
2. Genomic and transcriptómica analyses with DNA microarray technology
3. Application of a methodology based on suppressive subtractive hybridization to identify *Vitis vinifera* and *Eryshiphe necator* genes regulated in response to pathogenicity
4. Proteomic analysis of human neuroblastoma cells after incubation with antioxidant phytochemicals
5. Search for polyphenols displaying anti-proliferative activity in extracts prepared from Portuguese

endemic plants

4. Bibliography:

Main Bibliography

Slides (Power-Point) supplied by the lecturers

Other Bibliography

Scientific articles and/or book chapters

5. Assessment:

- A final exam on the subjects given during the 6-week lecturing period. A minimum of 10 points (out of 20) must be achieved by each student.
- An individual 45 min, oral presentation, followed by a 30 min discussion period.
- Final classification = (N1 x 0.60) + (N2 x 0.40), where N1 represents the final exam classification, and N2 the oral presentation classification.

6. Estimated Workload: 168 Hours

7. Last Update: 14/7/2010