UCLouvain

lbbmc2108

2025

Molecular genetics and plant genomics

5.00 credits	36.0 h + 18.0 h	Q2

Teacher(s)	Batoko Henri ;Chaumont François ;Draye Xavier ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The lectures are based on knowledge from specialised textbooks, published reviews and research papers, and the topics covered are grouped in three modules : 1. Plant genomics : Genome sequencing allows for the global complement of genes and proteins of a species to be studied. Descriptive genomic will put emphasis on specific characteristics of plant species (genes, transcripts, proteins, intergenic regions, transposons); comparative genomic will highlight the structure and organisation of plant genomes and their evolution; functional genomic will detail the means to characterise particular genes or agronomic traits (quantitative trait loci). 2. Molecular biology of plant development : It is a singularity of plants within the multicellular organisms to initiate organs throughout their life cycle. The molecular regulation of cell differentiation and polarisation within the embryo will be detailed. Making use of selected examples of structure and forms of organs initiated by plants, for which our cellular and molecular understanding is available, the contribution of endogenous signals (hormones programmed cell death) and the environment in timing and shaping these organs will be discussed. 3. Genomic adaptation and flexibility : Environmental constraints (dehydration, pathogens, toxics ions, xenobiotics) modify the expression pattern of plant genes, ultimately helping the plant to sustain transient or permanent changes. Sensing and distinguishing between these constraints modulate the activity of specific transcription factors at the basis of the changes in gene expression. From best characterised examples from the literature, the biochemical and physiological consequences of the activity of some of these transcriptional factors will be detailed.
Learning outcomes	**At the end of this learning unit, the student is able to :** The course aims at giving an in-depth view of plant molecular genetics and genomic through specific examples from the recent scientific literature. The first objective will be to understand how knowledge gained from systematic genome sequencing projects can be exploited to : - unravel the complement of gene transcripts (transcriptomic) or proteins (proteomic) of a given tissue or organ - compare genomes and study their origin and evolution 1 - apprehend genes and proteins function. Secondly, the course will allow the student to understand the molecular basis of some developmental processes in plant such as embryogenesis, differentiation and maturation, organs senescence. Lastly, emphasis will be put upon the complexity of endogenous signals and environmental cues (biotic and abiotic) regulating growth and developmental decisions mainly in angiosperms. At the end of the course, each student should be able to master and explain the strategies and methods used in genomics and molecular biology to investigate plant physiology, initiate new hypothesis and experimental designs to answer biological questions related to plant functioning.
Evaluation methods	The assessment takes into account the preparation and presentation of group work in front of the class. On the other hand, students are asked to self-assess on reverse classroom work and this self-assessment can be used to adjust teachers' grades. If generative AIs are used, the student must systematically indicate all parts where AIs have been used, e.g. in a footnote or in Power Point slides, specifying whether the AI was used to search for information, to write the text or to correct it. Furthermore, sources of information must be systematically cited in accordance with bibliographic referencing standards. Students remain responsible for the content of their work, regardless of the sources used.

Teaching methods	The course is organized in inverted class. Students are divided into work groups during the first lecture. Each student will be involved in three group work covering the course material. The students will take care to develop the theoretical aspects according to the directives received from the teachers and for each work, will answer a thematic question of synthesis.
Content	This course deals with recent issues in plant development and physiology that are addressed by "omics" approaches (genomics, transcriptomics, proteomics, metabolomics, ...), epigenetics, and quantitative genetics.
Faculty or entity in charge	BIOL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Biochemistry and Molecular and Cell Biology	BBMC2M	5		
Master [60] in Biology	BIOL2M1	5		
Master [120] in Chemistry and Bioindustries	BIRC2M	5		