



Syllabus

MASTER SCIENCES ET TECHNOLOGIE DE L'AGRICULTURE, DE L'ALIMENTATION ET DE L'ENVIRONNEMENT - INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES

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PRESENTATION


 Diplôme
BAC+5

 Durée
2 ans

 Lieux
Campus Jean-Henri Fabre - UFR STS


 Régime d'étude
initial, continu

 Secteur
Agroalimentaire - Environnement - International

 Niveau d'entrée
BAC +3

 Certifiant
Oui

 Stage
Obligatoire

 Coût de la formation
Oui

Composante

Domaine : Sciences, Technologies, Santé

Description : L'UFR Sciences, Technologies, Santé est composée de 6 départements d'enseignement (Biologie, Chimie, Géologie, Mathématiques, Physique, STAPS), 1 département informatique - Centre d'Enseignement et de Recherche en Informatique (CERI), 4 laboratoires de recherche reconnus et 4 Unités Mixtes de Recherche/INRA.

Doyen-ne : Christophe Emblanch

Equipe enseignante et du laboratoire

Conditions d'admission

SCHEMA GENERAL DU DOMAINE



SCHEMA DU CURSUS



SCHEMA DE LA MENTION



PARCOURS ET NIVEAUX

M2 INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES

Responsable : Philippe Obert

Parcours Master M2IMOAS - M2 : INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES - Semestre 1

Responsable : Philippe Obert

Code	Enseignements et Unités d'enseignements	Volume H.	Coefficient	ECTS
S-U02-4311	PLANT ECOPHYSIOLOGY (PART 2)	15h00	1.50	1.50
S-U02-4312	PLANT BREEDING (PARTS 1 & 2)	25h00	2.50	2.50
S-U02-4313	PLANT HEALTH	15h00	1.50	1.50
S-U02-4334	AGROECOLOGY	20h00	2.00	2.00
S-U02-4315	GREEN FOOD PROCESSING, CONSERVATION & TRANSFORMATION	25h00	2.50	2.50
S-U02-4326	FORMULATION OF FOOD PRODUCTS, CONVERSION OF AGRO-FOOD WASTES	25h00	2.50	2.50
S-U02-4318	PHYTOCHEMICALS : BIOAVAILABILITY & HEALTH EFFECTS (PART 2)	20h00	2.00	2.00
S-U02-4319	SAFETY IN THE PRODUCTION CHAIN OF FRUITS & VEGETABLES (PART 2)	12h00	1.50	1.50
S-U02-4320	CONSUMER SCIENCE	07h00	1.00	1.00
S-U02-4321	DATA ANALYSIS & LINEAR MODELS IN AGROSCIENCES	21h00	2.00	2.00
S-U02-4322	MODELING	22h00	2.00	2.00
S-U02-4323	QUALITY CONTROL & ANALYSIS, METABOLOMICS	12h00	1.00	1.00
S-U02-4335	IMAGING AND TECHNIQUES OF INTERNAL INVESTIGATION	10h00	1.00	1.00
S-U02-4325	PROJET DE CREATION INNOVATION	60h00	7.00	7.00

Parcours Master M2IMOAS - M2 : INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES - Semestre 2

Responsable : Philippe Obert

Code	Enseignements et Unités d'enseignements	Volume H.	Coefficient	ECTS
S-U02-4331	STAGE EN LABORATOIRE (25 A 28 SEMAINES)		30.00	30.00

M1 INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES

Responsable : Philippe Obert

Parcours Master M1IMOAS - M1 : INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES - Semestre 1

Responsable : Philippe Obert

Code	Enseignements et Unités d'enseignements	Volume H.	Coefficient	ECTS
S-U02-3161	TOXICOLOGY	25h00	3.00	3.00
S-U02-3162	MICROBIOLOGY	30h00	3.00	3.00
S-U02-3163	INTEGRATED NUTRITION AND METABOLISM	31h00	3.00	3.00
S-U02-3164	AGRONOMY - PLANTS AND ENVIRONMENT	30h00	3.00	3.00
S-U02-3361	FUNDAMENTALS OF ECOLOGY, EVOLUTION & GENETICS	20h00	2.00	2.00

Code	Enseignements et Unités d'enseignements	Volume H.	Coefficient	ECTS
S-U02-3362	FUNDAMENTALS OF PLANT HEALTH	20h00	2.00	2.00
S-U02-3363	CHEMISTRY OF NATURAL PRODUCTS	15h00	2.00	2.00
S-U02-3364	PRINCIPLES OF TRANSFORMATION	15h00	2.00	2.00
S-U02-3165	FUNDAMENTALS OF HUMAN NUTRITION	20h00	3.00	3.00
S-U02-3365	FUNDAMENTALS OF FOOD SCIENCES	30h00	3.00	3.00
S-U02-3166	BASICS OF PROBABILITY & STATISTICS	27h00	3.00	3.00
S-U02-3368	SCIENTIFIC METHODS	10h00	1.00	1.00

Parcours Master M1MOAS - M1 : INTERNATIONAL MASTER OF AGRICULTURAL SCIENCES - Semestre 2

Responsable : Philippe Obert

Code	Enseignements et Unités d'enseignements	Volume H.	Coefficient	ECTS
S-U02-4301	HISTORY OF AGRICULTURE	06h00	1.00	1.00
S-U02-4327	PLANT ECOPHYSIOLOGY (PART 1)	24h00	3.00	3.00
S-U02-4303	CONVENTIONAL CONSERVATION AND TRANSFORMATION TECHNIQUES	20h00	3.00	3.00
S-U02-4337	PHYTOCHEMICALS : BIOAVAILABILITY & HEALTH EFFECTS (PART 1)	12h00	2.00	2.00
S-U02-4305	SAFETY IN THE PRODUCTION CHAIN OF FRUITS & VEGETABLES (PART 1)	12h00	2.00	2.00
S-U02-4306	ETHICS & SCIENTIFIC INTEGRITY	06h00	1.00	1.00
S-U02-4338	FUNDAMENTALS OF CARDIOVASCULAR HEALTH & IMPACT OF NUTRITION	21h00	3.00	3.00
S-U02-4307	STAGE (12 A 18 SEMAINES)		15.00	15.00

DETAILS DES ENSEIGNEMENTS



S-U02-4311 - PLANT ECOPHYSIOLOGY (PART 2)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.50	1.50	LAURENT URBAN	15h00 - CM : 05h00 TDI : 05h00 TP Semestre 1 : 05h00	

Objectifs

Students should be capable to understand how abiotic and biotic factors and agronomic practices, and their interactions influences yield, quality of production and plant defenses.

Students should notably be able to explain how the global change will affect plant growth and development, and crop performance.

At the end of the course, students should have a comprehensive view of the major concepts and tools used in plant ecophysiology, as well as a first experience of them for research or field diagnosis.

Description

Generally speaking, this course is designed to be a basis for courses of agronomy, crop protection and management of quality of production.

- Introduction to ecophysiology: learning how physiological functions influence yield, quality of production and plant defenses (plant water relationships, metabolism and defenses, metabolism and quality of production).
- Photosynthesis from an ecophysiological perspective: learning how environmental factors influence photosynthesis and its components (photosynthetic capacity, photorespiration, respiration?)
- Oxidative stress and photooxidative stress: learning the importance of oxidative stress and its consequences for plant physiology, yield, quality and defenses
- Field tools for analyzing photosynthesis: getting familiar with actual tools used in ecophysiology and agronomy
- Metabolism and defenses: the objective of this course is to show how metabolic pathways are involved in plant responses to biotic stresses, and how the plant's environment (e.g. water availability, nutrients) contributes to a given metabolic status more or less adapted to an effective defense. A general lecture will be given to set metabolic processes in the overall defense cascade against pests and pathogens with different infection and virulence strategies, and illustrate the impact of the abiotic environment. In an interactive tutorial session, case-studies of metabolic switches towards defense will be examined.
- Metabolism and quality of production: learning how environmental factors influence plant phenology and physiology, assimilate partitioning, primary and secondary metabolism, and consequently the quality of production.

Travail attendu

Students will attend lectures, use computer simulations and participate in small trials, which objective is to make them acquainted with some of the tools used in plant ecophysiology.

Modalités de contrôle des connaissances

1 one-hour written exam

Prérequis

Basic concepts of plant physiology, plant pathology, biochemistry and biophysics

Compétences acquises

Capacity to understand how environmental factors, including agronomic levers and stress, influence yield, quality of production and plant defenses. Capacity to propose strategies to maintain or improve crop performance and reduce pesticide use in the context of climatic change. Basic competences with the major field tools of plant ecophysiology.

Références bibliographiques et ressources numériques

Plant Physiology. Taiz and Zeiger (eds.). Sinauer (publisher)

S-U02-4312 - PLANT BREEDING (PARTS 1 & 2)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.50	2.50	CINDY MORRIS NICOT	25h00 - CM : 18h00 TDI : 07h00	Semestre 1

Objectifs

Objectifs d'apprentissage :

- Understanding the need for plant genetic resources conservation and related techniques
- Understanding the majors stakes of plant breeding
- Getting familiar with the majors breeding methods relying on molecular biology, biostatistics and quantitative genetics
- Getting familiar with the forces ruling the evolution of live organisms (plants and their pathogens)

Description

Ideal order in time:

1. Fundamentals of evolution & population genetics of plant bioagressors (part 1). The presentation will cover evolutionary processes in phytopathology. The five basic forces of evolution will be described (Mutation, Genetic exchanges, Selection, Genetic drift, Migration). Evolutionary models of plant-parasite interactions will be shown.
2. Introduction to plant breeding ?Back to the future? The presentation will cover history and prospects of breeding in the introductory course. We will approach new goals for sustainable agriculture and the challenges that they raise.
3. Management and maintenance of genetic resource collections: Short presentations are included on why diversity is important and how to maintain diversity. The Unit's genetic resource collection will be presented including the rules for exchanging seeds. At the end of this section the students will answer questions related to seed conservation, screening of diversity and genetic resources for traits for plant breeding.
4. Breeding for durable resistance. Presentation and discussion on: mechanisms of resistance breakdown by parasites; factors that influence breakdown risks; durable strategies of breeding and managing plant resistance.
5. Opportunities for genome editing for plant breeding. The presentation will cover different uses of CRISPR technology to select new traits in crops.
6. The use of predictions in plant breeding: The presentation will cover why we need predictions in PB, QTL mapping & GWAS for marker-assisted selection, genomic and phenomic selection.

Travail attendu

Active participation during the classes (questions, quiz), Journal Club and presentations of students

Modalités de contrôle des connaissances

Practical exercises and final exam of 2 hours

Prérequis

Solid knowledge in biology, especially in genetics

Compétences acquises

? Seed biology and management of seed collections

- ? Plant breeding strategies
- ? Developing abilities to analyze complex problems
- ? Biostatistics & quantitative genetics
- ? Evolutionary biology

**Références bibliographiques et
ressources numériques**

— Will be provided during the class electronically

S-U02-4313 - PLANT HEALTH

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.50	1.50	CINDY MORRIS NICOT	15h00 - CM : 05h00 TDI : 10h00	Semestre 1

Objectifs

The objective of the course is to expose students to a range of advanced topics related to the complex factors intervening in plant health and their consideration when establishing integrated pest management of cropping systems. The students will have opportunities to debate and present critical evaluation of different types of plant health scenario and paradigms.

Description

- Principles and challenges of integrated pest management and integrated plant health management. Brief overview of and historical perspective on the concept of IPM/IPHM and the main tools that can be applied. Project: design an IPHM strategy based on the analysis of the existing state of the art for a crop and production system, identify key challenges that would require research work, and propose one detailed research action.
- Fundamentals of evolution & population genetics of plant bioagressors. This part will cover speciation mechanisms (speciation types and reproductive barriers) with a focus on plants. Expanding the topic to crops and crop health, this class will also present the mechanisms of plant domestication and will introduce some ways to measure and use plant genetic diversity for improving plant health. Most examples are chosen in Mediterranean plants.
- Biological control of plant diseases. The main types of biocontrol agents against diseases, their modes of actions and the key factors of their efficacy in the field.
- Debate: What is plant health/disease? Acknowledge the "paradox" that microbial symbionts and biocontrol agents deploy many of the same molecular strategies as pathogens. Understand that plant "health" and "disease" are subjective concepts. Discuss how this understanding could be useful in developing strategies to manipulate plant-microbe interactions for outcomes that are favorable for plant production.
- Frost damage: how a microorganism can cause abiotic damage. Learn about the processes involved in frost damage to plants and how it can be catalyzed by certain plant-associated microorganisms.

Travail attendu

Attendance of class is mandatory. There will be 5 h of formal lectures. In addition, the students will be involved in individual and group work to be rendered as part of 10 h of debate and discussion on a range of subjects. Overall, each student will be part of teams that prepare presentations on about 3 subjects concerning evolution, ecology and general paradigms about what defines a plant pathogen and disease.

Modalités de contrôle des connaissances

Grades will be based on a 1h written exam and on the quality of presentations made in the classroom as well as on participation in discussion.

Prérequis

Undergraduate level courses about the fundamentals of plant biology, microbiology and agronomy. Knowledge of the basic principles of plant

and population genetics and of evolution. A good level of oral and written skills in English.

Compétences acquises

The capacity to think critically about the wide range of factors to consider when conceiving and implementing integrated pests management and when identifying the knowledge gaps where further research is needed in this domain.

Références bibliographiques et ressources numériques

All reference materials will be available on the EDT platform of Avignon University

S-U02-4334 - AGROECOLOGY

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	ARMIN BISCHOFF	20h00 - CM : 04h00 TP : 16h00	Semestre 1

Objectifs

The module Agroecology aims at an understanding of ecological interactions in agro-ecosystems, in particular interactions between crops, spontaneously occurring plants and arthropods. The major objectives are

(1) Learning to develop experimental protocols in order to analyse scientific questions,

(2) Testing such protocols in the lab and in the field.

Such improved understanding allows the participants to develop skills in conservation biological control and environmental evaluation of agrochemical use.

Description

Lectures include the following topics:

- Control of pest insects, regulation by natural enemies, conservation biological control using agro-ecological infrastructures (wildflower strips, grass strips, hedgerows, etc.)
- Chemical control and the influence of agricultural practices
- Impact of agrochemicals on arthropods

In Agroecology Tutorials students analyse ecological interaction in crop fields and in the lab. Effects of crop management and surrounding habitats on arthropods are tested to evaluate biological control and ecotoxicological risks:

- Approaches to improve conservation biological control and methods to test its efficiency (field)
- Impact of pesticides on non-target organisms and their ecological functions: from the molecule to population (lab)

Travail attendu

Relevés floristic and arthropod observation to analyse effects of field margin vegetation.
 Arthropod trapping.
 Analysis of field data using correlative statistics (regression analysis and statistical testing)
 Ecotoxicological studies in the lab and data analysis

Modalités de contrôle des connaissances

Report on interactions between flora and arthropods
 Report on arthropod diversity
 Report on ecotoxicological study

Prérequis

Good command in Excel
 Basic knowledge in test statistics using R

Compétences acquises

See objectives

**Références bibliographiques et
ressources numériques**

S-U02-4315 - GREEN FOOD PROCESSING, CONSERVATION & TRANSFORMATION

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.50	2.50	SANDRINE PERINO	25h00 - CM : 18h00 TP : 07h00	Semestre 1

Objectifs To have the knowledge of food processing mainly food sustainability

Description

- Green and innovative food processing
- Sustainability in the food industry
- Instant controlled pressure drop technology; pulsed electric field; high pressure processing; supercritical fluids: process and procedure; applications in food processing; HACCP and HAZOP; environmental impact; up-scaling or numbering; success stories in food industry.
- Microwave technology; ultrasound processing; solar energy: process and procedure; applications in food processing; HACCP and HAZOP; environmental impact; up-scaling or numbering; success stories in food industry.
- How to create innovation and intellectual property for applied research.
- Conservation and transformation
- Current postharvest research and innovations and sustainable technology

Travail attendu A complete mastering about Green and sustainable food processing techniques.

Modalités de contrôle des connaissances 1épreuve écrite 2H

Prérequis To have the knowledge of food processing mainly unit operations

Compétences acquises Green food processing (CO2 balance, mass balance and energy balance).

Références bibliographiques et ressources numériques

F. Chemat, E. Vorobiev (Editors)
 Green Food Processing Techniques: Transformation, Preservation and Extraction.
 Elsevier, Amsterdam, 588 pages. 2019. ISBN : 978-0-12-815353-6

S-U02-4326 - FORMULATION OF FOOD PRODUCTS, CONVERSION OF AGRO-FOOD WASTES

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.50	2.50	GREGORY DURAND	25h00 - CM : 12h30 TDI : 12h30	Semestre 1

Objectifs

Description

- Particle characterization methods for food formulation and processing: the course will provide a comprehensive description of the dynamic light-scattering technique and its use for the characterization of self-aggregation in food processing. An experimental set-up will be presented.
- Nuclear Magnetic Resonance and Electron Paramagnetic Resonance for food formulation and analysis: the course will provide a comprehensive description of the two techniques. Applications in food formulation and processing through several examples will be provided.

Large quantities of wastes are generated every year from the agricultural and food processing industries. Producing energy and/or added-value products from the recycling of these wastes is a major challenge from both environmental and economic perspectives.

- Introduction to basic knowledge of bioeconomy, biorefinery and eco-design concepts. Illustration with winery by-products and distilleries.
- Dry fractionation of agricultural by-products and wood resources as a processing step to produce energy, molecules and materials.
- Sugar- and lipid-derived building blocks for the production of bioplastics. During interactive tutorial sessions, case-studies will be examined and a workshop will be prepared.

Travail attendu

Modalités de contrôle des connaissances

written test on particle characterization methods and Nuclear Magnetic Resonance and Electron Paramagnetic Resonance for food formulation (50 minutes) + one report and oral presentation on?

Prérequis

Basic knowledge on chemistry (bachelor level)

Compétences acquises

General knowledge of the principles and application of Nuclear Magnetic Resonance and Electron Paramagnetic Resonance in food science

General knowledge of the principles and methods of Particle size determination.

Références bibliographiques et ressources numériques

S-U02-4318 - PHYTOCHEMICALS : BIOAVAILABILITY & HEALTH EFFECTS (PART 2)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	CYRIL REBOUL	20h00 - CM : 15h00 TDI : 05h00	Semestre 1

Objectifs
 The overall objective of this module is to bring general knowledge about the absorption of vitamins and carotenoids and molecular mechanisms involved in health effect of these molecules.

Description
 Introduction to molecular mechanisms governing the absorption of vitamins and carotenoids and molecular mechanisms involved in the biological effects of bioactives. The approach will combine nutrigenetics, nutrigenomics, metabolomics and epigenetics.

- Intestinal fate and molecular mechanism for the absorption of fat-soluble vitamins and carotenoids
- Nutritional genomics of micronutrients
- Epigenetic regulation mediated by micronutrients
- From molecular targets to human health (molecular targets: cell and animal models, signaling pathways modulated by micronutrients; plant food and cardiometabolic diseases, a metabolomics approach.

Travail attendu
 Attendance at lectures, critical analysis of one scientific article during practical teaching.

Modalités de contrôle des connaissances
 1 épreuve écrite 1,5H

Prérequis
 Basic knowledge in nutrition, metabolism, cell biology and molecular biology.

Compétences acquises
 Fundamental knowledge about mechanisms of actions and absorption of vitamins and carotenoids. Article analysis

Références bibliographiques et ressources numériques

S-U02-4319 - SAFETY IN THE PRODUCTION CHAIN OF FRUITS & VEGETABLES (PART 2)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.50	1.50	CATHERINE DUPORT DIT ROUSSEAU	12h00 - CM : 09h00 TDI : 03h00	Semestre 1

Objectifs
 Knowledge is provided so that students are able to assess the risk in a food context, to model this risk using mathematical tools, and then to communicate on this risk.

Description
 For the safety control of fruits and vegetables, a worldwide traceability system has been implemented. The presentation will cover:
 - Bacterial hazards: contamination routes and principles of control
 - Microbiological hazard characterization. Bacterial toxins
 - Applying mathematical model for risk assessment. Model for prediction of survival or growth. Models for environmental dispersion

Travail attendu
 Active participation in lectures

Modalités de contrôle des connaissances
 Written exam

Prérequis
 Microbiology -Cellular biology, toxicology, epidemiology, modelling, biostatistics

Compétences acquises
 Identify microbiological hazards throughout the food production chain.
 Quantitatively assess microbiological risks.
 Manage risks within companies in relation to regulatory constraints

Références bibliographiques et ressources numériques

S-U02-4320 - CONSUMER SCIENCE

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.00	1.00	PHILIPPE OBERT	07h00 - CM : 07h00	Semestre 1

Objectifs
— The scope of this presentation is to provide basic knowledge of what influences consumer behavior, specifically food consumption, and to introduce the various ways to change consumer behavior.

Description
— This presentation will explore how consumer behavior can be analyzed and utilized to advance healthy and sustainable nutrition. It will cover:

- Theories and methodologies developed in consumer science
- Interactions between "foodscape" and consumers, health consequences
- Determinants of consumers (individual, social and physical environments)
- Agri-food transitions and consumers ("Bio"): perceptions and attitudes
- Consumer, waste and losses
- Nudging and consumer changes

Travail attendu
— Interactive work during teaching, students are expected to be active. The exam requires a really good understanding of the lessons.

Modalités de contrôle des connaissances
— 2 épreuves écrite de 0,5H

Prérequis
— None

Compétences acquises
— Basic skills in understanding food purchase and consumption

Références bibliographiques et ressources numériques
— Marketing des produits agroalimentaires, Philippe Aurier et Lucie Sirieix (2012). Dunod, Paris.
— Solomon, M., Russell-Bennett, R., & Previte, J. (2012). Consumer behaviour. Pearson Higher Education AU.

S-U02-4321 - DATA ANALYSIS & LINEAR MODELS IN AGROSCIENCES

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	FLORENT BONNEU	21h00 - CM : 10h30 TDI : 10h30	Semestre 1

Objectifs

The objective of this course is to familiarize students with multivariate descriptive statistical methods and explanatory or predictive modeling of a variable of interest by generalized linear models. At the end of this course, students will be able to implement few multivariate methods and elementary linear models on experimental datasets to answer a scientific problem in agrosiences.

Description

This course is splitted in two parts. The first one introduces some basics multivariate statistical techniques (PCA, LDA..) to describe large datasets. These methods are useful for identifying the main drivers of variability in the data and so to extract the global trends explaining the most information part. The second one deals with generalized linear models and the associated statistical methods useful in their construction and interpretation. After reminding the concepts of linear model with fixed effects, we will introduce some generalized linear models in theoretical and practical courses.

Travail attendu

Attendance of class is mandatory. Students are expected to prepare some works before the course.

Modalités de contrôle des connaissances

2 written exams (1h and 30% each) and an oral presentation with a short report (40%).

Prérequis

Course « Basics of probability and statistics » in M1.

Compétences acquises

- Know how to convey the basics mathematical concepts of factorial analysis methods and how to interpret the results.
- Use relevant multivariate factorial analysis methods, appropriate to concrete problems and to characteristics of experimental large datasets, in order to summarize the information.
- Know how to convey the statistical concepts used in the framework of generalized linear models and how to interpret the results.
- Use generalized linear models, with fixed or random effects, appropriate to the characteristics of experimental datasets in order to answer scientific questions.
- Use Rstudio software and R packages to implement multivariate factorial analysis techniques and generalized linear models on real datasets.

Références bibliographiques et ressources numériques

All reference materials will be available on the Avignon University ENT platform.

S-U02-4322 - MODELING

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	FLORENT BONNEU	22h00 - CM : 16h00 TDI : 06h00	Semestre 1

Objectifs
**Description**


This presentation will cover:

- Graphs and Markov models
- Spatial processes and geostatistics
- Plant-Fruit eco-physiological modelling: objectives, development, calibration, use
- Integration of genetic control in process-based plant models: objectives, progress and perspectives
- Introduction to model uncertainty and sensitive analysis

Travail attendu
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**


S-U02-4323 - QUALITY CONTROL & ANALYSIS, METABOLOMICS

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.00	1.00	RAPHAEL LUGAN	12h00 - CM : 07h30 TDI : 04h30	Semestre 1

Objectifs
 To discover the principles of metabolomic analysis by mass spectrometry.

Description
 Learn the principles of metabolomics applied to the quality analysis of plant productions.

2 séances de 3h de cours.

1- Metabolomics definition

2- Physico-chemical principles of metabolite extraction from complex matrices

3- Principles of liquid and gas chromatography

4- Principles of mass spectrometry: electron impact and electrospray ion sources

5- Methodological precautions to manage bias

6- Data structure and multivariate statistics for the analysis of large metabolomic data sets

7- Examples of metabolomic analyses applied to the determination of the loyalty of a product, its biochemical evolution during industrial transformation or to traceability, taken from the literature.

8- Visit to the 3A metabolomics platform, the Metaboscope.

Travail attendu
 Students are given the entire course on video and are expected to familiarise themselves with it. The class sessions are used to review the key points and address any questions.

Modalités de contrôle des connaissances
 MCQ

Prérequis
 Bases de biochimie et biologie :
 - Plant metabolism
 - Analytical chemistry
 - Statistics

Compétences acquises
 Use the knowledge of the principles and scope of metabolomics to address biological questions
 Use the theory of chromatography and mass spectrometry techniques to select suitable methods for different metabolic targets
 Evaluate the interest of metabolomics applications in food industry through publications about fraud detection, sourcing, process monitoring
 Master the interpretation of basic multivariate statistics used in metabolomics.

Références bibliographiques et ressources numériques
 The entire course is available on ouTube
<https://www.youtube.com/watch?v=FaNSR4BLEXQ&list=PLwo5e0jWFBluL2ZNBNaNfHBeSfjYKOuv>

S-U02-4335 - IMAGING AND TECHNIQUES OF INTERNAL INVESTIGATION

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.00	1.00	CHAHINE ABBAS	10h00 - CM : 04h00 TDII : 06h00	Semestre 1

Objectifs
**Description**


Imaging techniques, whether for illustrative or quantitative purposes, have become a significant lever in all fields of science and industry. Acquiring basic knowledge in this area is now essential for scientists. The course will give some basics in mathematical morphology and keys to facilitate the use of the open source ImageJ software in order to easily handle, filter and process images.

Travail attendu
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**


S-U02-4325 - PROJET DE CREATION INNOVATION

Crédits ECTS 7.00	Coefficients 7.00	Enseignant-e responsable PHILIPPE OBERT	Volume horaire 60h00 - TDI : 60h00	Période Semestre 1
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Objectifs
**Description**
**Travail attendu**
**Modalités de contrôle des
connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et
ressources numériques**


S-U02-4331 - STAGE EN LABORATOIRE (25 A 28 SEMAINES)

Crédits ECTS 30.00	Coefficients 30.00	Enseignant-e responsable PHILIPPE OBERT	Volume horaire -	Période Semestre 2
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Objectifs
**Description**
**Travail attendu**
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**


S-U02-3161 - TOXICOLOGY

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	PHILIPPE OBERT	25h00 - CM : 15h00 TDI : 10h00	Semestre 1

Objectifs

Description

Lectures: Definitions: ecotoxicology and toxicology, toxicity and intoxication, xenobiotic, ecosystem, pollutant and contaminant. Sources of pollution. Classification of pollutants. Physicochemical properties of pollutants. The fate of pollutants in the environment and in organisms. Concept of residues. Toxicity of pollutants. Interactions between pollutants. Lethal and sub-lethal effects and their nature. Population distribution of the sensitivity of individuals to toxicants. Impacts of pollutants on the agro-ecosystem and the hydrosystem (ecotoxicological qualities of aquatic and terrestrial environments). Action of pollutants in organisms and concept of bio-indication. Population effects of pollutants. Target and non-target species (for pesticides). Risk assessment. Assessment of the biological quality of the media (IBGN).

Tutorials: Analysis of concrete cases and articles. Risk assessment of substances with or without a toxicity threshold, determination of hazards, analysis of dose-response relationships, analysis of exposure to chemical substances in different environments. Deterministic and probabilistic approaches.

Travail attendu

Modalités de contrôle des connaissances

Prérequis

Compétences acquises

Références bibliographiques et ressources numériques

S-U02-3162 - MICROBIOLOGY

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	CATHERINE DUPORT DIT ROUSSEAU	30h00 – CM : 10h00 TDI : 10h00 TP : 10h00	Semestre 1

Objectifs
 Identification and analysis of microbiomes as indicators of agroecosystems and health, highlighting future achievements and micro-skills.

Description
 This course covers the diversity of the microbial world, soil microbial ecosystems and bio-transformations, and the fate of pathogens in the environment. The labworks deal with enzymology and the microbiological study of a soil on the one hand, and the microbiological characterization of a food pathogen on the other.

Travail attendu
 Synthesis, writing and restitution work. Practical work

Modalités de contrôle des connaissances
 An oral presentation (40%), a written exam (40%), a practical work report (20%)

Prérequis
 Pasteurian microbiology, molecular biology tools

Compétences acquises
 Fundamental and methodological knowledge in the field of environmental microbiology

Références bibliographiques et ressources numériques

S-U02-3163 - INTEGRATED NUTRITION AND METABOLISM

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	LAURENT LEGENDRE	31h00 - CM : 15h00 TDI : 06h00 TP : Semestre 1 10h00	

Objectifs

The objective for students is to acquire a basic understanding of the way plants function mainly at the cell and organ levels. The focus will be on the major functions determining growth and development: photosynthesis, respiration, water uptake, mineral absorption and assimilation. Students will be introduced to the major pathways of the Carbon and Nitrogen metabolisms and primary and secondary metabolisms, A fair command of these basics elements is expected for they are a prerequisite for the upcoming courses of plant ecophysiology and plant physiopathology, among others.

Description

Photosynthesis: Interception of light energy, photochemical reactions, photosynthetic carbon fixation (C3, C4, CAM), photorespiration, distribution of assimilates, regulation of photosynthetic activity. Water supply (absorption, transport), water state, concept of stress. Interactions between water nutrition and carbon nutrition. Mineral food. Slides available online.

Practical work: Influence of ferti-irrigation management on the growth of vegetable crops and associated physiological parameters: influence of the water status (water and osmotic potentials, water content, transpiration, stomatal conductance) on photosynthesis, respiration and nitrogenous nutrition. The objective is also to master the use of tools such as the pressure chamber (Scholander type), LICOR, nitracheck...

The lab report is produced in the form of a scientific article.

Plant physiology labwork (10h)

The aim is to make students familiar with the main concepts and common techniques in plant physiology. We will examine how plants survive under environmental stress by modifying their physiology (water and mineral acquisition, photosynthesis).

Travail attendu

In addition to learning basic knowledge about plants major functions, the signaling and metabolic pathways and their regulation, it is expected from students to link these mechanisms to the way they interact and are involved in growth and development.

Modalités de contrôle des connaissances

two exams are programmed.

Prérequis

Basic concepts of plant biology and physiology. Minimal skills in chemistry/biochemistry and physics.

Compétences acquises

- ? Master the major methods and tools of plant physiology.
- ? Recognize nitrogenous molecular family from formulas
- ? Interpret correctly simple experiments from scientific literature about nitrogen assimilation mechanisms
- ? Be able to link stages of the nitrogen cycle to nitrogen nutrition

? Be able to summarize their knowledge in precise texts

**Références bibliographiques et
ressources numériques**

Recommended lecture : Plant Physiology, Taiz and Zeiger, Sinauer publisher.

Articles to download from the website of the course.

S-U02-3164 - AGRONOMY - PLANTS AND ENVIRONMENT

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	PHILIPPE OBERT	30h00 - CM : 18h00 TDI : 12h00	Semestre 1

Objectifs**Description**

Objective of the module: to describe the soil and atmosphere compartments which allow exchanges between the plant and its environment. The module is separated into three parts: bioclimatology, soil physics, and biogeochemistry. The main physical, chemical and biological principles that govern the functioning of these compartments are presented and illustrated using contextualized examples. The modeling of certain processes is approached.

Prerequisites: function analysis, differential equations, notions of fluid dynamics, thermodynamics, conservation laws, solution chemistry, bases of organic chemistry

Course content

- Bioclimatology: Radiation, temperature, wind, water and water balance, carbon dioxide, energy balance. Impacts of climate change on agriculture. Spatial scales for taking climate into account

- Soil physics: Descriptive elements of the soil (volume, texture, structure), hydrostatic in soils (water properties, surface tension, capillarity, notion of water potential, retention curve), hydrodynamics (hydraulic conductivity, Darcy's law, Richards' equation), hydrology (calculation of stocks, infiltration, drainage, runoff, evapotranspiration). Associated instrumental techniques

- Biogeochemistry: the main types of soils and their formation, the organic constituents of soils, the main chemical reactions in soils, physicochemistry of liquid-solid interface, cycle of mineral elements. Establishment of root systems and their architecture, dynamics of mineral elements in solution, acquisition of mineral elements

4 hours of tutorials per subject are planned to apply the principles presented: simple numerical applications or modeling

Teaching aids: slides and courses in pdf format, paper supports, reference books.

Assessment: Personal work and exam at the end of the module (2h)

Travail attendu**Modalités de contrôle des connaissances****Prérequis****Compétences acquises****Références bibliographiques et ressources numériques**



S-U02-3361 - FUNDAMENTALS OF ECOLOGY, EVOLUTION & GENETICS

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	PHILIPPE OBERT	20h00 - CM : 15h00 TDI : 05h00	Semestre 1

Objectifs

Ecology, evolution and genetics are disciplines that allow understanding major biological processes across different timescales. Mobilizing this knowledge is crucial when it comes to environmental or agricultural problematics. The objective of this course is to familiarize students with the nature and origin of biological diversity on Earth and, in particular, the processes of diversification on which plant breeding and emergence of plant diseases and pests are based. At the end of the class students will get familiar with the complexity of biological systems through the lens of the three disciplines and they should be able to identify in scientific literature/studies the biological forces shaping biodiversity at different scales (from micro-organisms to plants, from individuals to ecosystems). This course will provide the basic knowledge that will facilitate understanding of courses in the M2 program.

Description

The course is divided into 4 parts: 1) the timeline and evolutionary origins of life on Earth with a focus on terrestrial plants, microorganisms and insects, 2) the fundamental forces of evolution that lead to diversification and speciation, 3) the specific processes of speciation in plants and 4) the ecological traits of cropping systems that foster the co-existence of species and the dynamics of their populations.

Travail attendu

Part 1 and 2 will require the preparation of 10-minute oral presentations (one per semester)

Modalités de contrôle des connaissances

1 exam 1H30 coeff 1

Prérequis

Good level in English (reading, writing, speaking), sufficient background in biology (> highschool level)

Compétences acquises

Improved capacity to read scientific reading literature objectively, fundamental and integrative biology, capacity to participate in multidisciplinary activities

Références bibliographiques et ressources numériques

All the material will be provided in the class via the ENT

S-U02-3362 - FUNDAMENTALS OF PLANT HEALTH

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	CINDY MORRIS NICOT	20h00 - CM : 16h00 TDI : 04h00	Semestre 1

Objectifs

At the end of the course students are expected to know examples of diseases of plants caused by bacteria, fungi, oomycetes, viruses and viroids as well as the major traits that distinguish these different types of organisms. They will learn where to find information about causes of disease, the important environmental factors that are favorable for disease and the available methods of control. They will also understand the importance of knowledge about the ecology of plant pathogens for developing methods of control that reduce the amounts of synthetic pesticides used in disease management.

Description

The objective of this course is to provide students with an introduction to the basic concepts of Plant Pathology and plant health management. Students will learn 1) the definitions of plant disease/plant health and the principles of etiology, 2) concepts concerning disease epidemiology and 3) strategies of disease management. They will also become familiar with the full array of microorganisms that can cause harm to plants including bacteria, fungi, viruses and viroids. The course will include a series of lectures providing the basics of plant pathology and homework where the students will prepare and give a talk on the main phytosanitary problems encountered on cultivated plants.

Travail attendu

Attendance of class is mandatory. Students are expected to participate in discussions during class. Students will also prepare and deliver (to the class) a 20-minute presentation on the etiology, epidemiology and control methods of a phytosanitary problem of cultivated plants

Modalités de contrôle des connaissances

1 exam 1H30 coeff 1

Prérequis

Undergraduate level courses about the fundamentals of plant biology, microbiology and agronomy.

Compétences acquises

Good skills in oral and written English. Background in plant biology and microbiology equivalent to the first two years of undergraduate level training (2 years after highschool) ad minima.

Références bibliographiques et ressources numériques

All reference materials will be available on the EDT platform of Avignon University

S-U02-3363 - CHEMISTRY OF NATURAL PRODUCTS

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	GERALD CULIOLI	15h00 - CM : 10h00 TDI : 05h00	Semestre 1

Objectifs
— The aim of this course is to enable a student with a basic understanding of chemistry to be able to define, isolate and characterise a natural product. A brief description of some of the functions and applications of these molecules will also be given.

Description
— This course is divided in 4 parts. The main definitions useful in the field of natural products chemistry (e.g. primary/central vs secondary/specialized metabolites) will be developed in a brief introduction. The second part will be devoted to the description of the main classes of natural products on the basis of the biosynthetic pathways (acetate, shikimate, mevalonate?) which allow the production of such chemical compounds. The principal chromatographic (GC & HPLC) and analytical (1D & 2D NMR, MS?) techniques used for the purification and the structural characterization of natural products will be presented with specific applications in the field of phytochemistry. This course will end with a brief inventory of the different ecological roles played by natural substances in the environment and their use by mankind.

Travail attendu
— Have a good knowledge of the course.
By means of the examples that will be provided, practice finding the biosynthetic origin and, in fact, the chemical class of a natural product via its chemical structure.
Be able to find extraction and separation strategies adapted to natural products.
Be able to characterize the chemical structure of a natural product using its spectral dataset (1D & 2D NMR, MS, IR...).

Modalités de contrôle des connaissances
— 2 exams with the same coefficient (0.5 each).

Prérequis
— Basic knowledge of organic chemistry (main chemical functions, stereochemistry ...) is required
Good knowledge of chromatographic (HPLC, GC...) and spectroscopic (NMR, MS, IR, UV-Vis...) techniques is required.
Basic knowledge of biochemistry would be useful.

Compétences acquises
— Define a natural product.
Know the main classes of natural products based on their biosynthetic origin.
Know the analytical tools for studying natural products, in particular be able to interpret spectral data resulting from the analysis of such molecules.
To know a wide range of functions and applications of these molecules.

Références bibliographiques et ressources numériques



S-U02-3364 - PRINCIPLES OF TRANSFORMATION

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	MARYLINE VIAN	15h00 - CM : 10h00 TDI : 05h00	Semestre 1

Objectifs To have the knowledge of food processing mainly unit operations

Description This course is divided in 3 parts. It will address three fundamental principles of food processing (unit operations, mass balance and energy balance). These theoretical principles will be put into practice through simple problems and linked to actual situations of large-scale food production. It will introduce the different strategies that can be used to stabilize foods, focusing on heat treatments such as pasteurization and sterilization. It addresses also the notion of equivalent treatment, process control, the various possible technologies and the impact on food quality. Finally, an introduction to fermentation as an ancestral and cultural low-cost food preservation process, run by microbial enzymatic activities, that brings a certain stability and quality value to raw material such as veggies.

Travail attendu A complete mastering about mass balance and energy balance.

Modalités de contrôle des connaissances 1 exam 1H, coeff 1

Prérequis Bachelor degree in science

Compétences acquises Principles of food processing (unit operations, mass balance and energy balance).

Références bibliographiques et ressources numériques F. Chemat, E. Vorobiev (Editors)
Green Food Processing Techniques: Transformation, Preservation and Extraction.
Elsevier, Amsterdam, 588 pages. 2019. ISBN : 978-0-12-815353-6

S-U02-3165 - FUNDAMENTALS OF HUMAN NUTRITION

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	GUILLAUME WALTHER	20h00 - CM : 15h00 TDI : 05h00	Semestre 1

Objectifs

- Master the anatomical and physiological bases of solid and liquid food digestion.
- Understand physiological mechanism implicated in the digestion of macronutrients in human from taste perception to digestive process.
- Knowing and understanding the main international human nutrition recommendations.

Description

It will address the fundamental principles of human nutrition from energy metabolism basis to up-to-date human nutrition recommendations. More precisely, this teaching unit will propose a reminder on carbohydrates, proteins, amino acids and lipids metabolism essential to human cellular homeostasis. This will provide a foundation for understanding how different foods (solids and fluids) affects human health, covering concepts of physiology from taste perception to the digestive process. This course will also address the latest international recommendations for human nutrition (in healthy people or patients with chronic disease).

Lessons proposed:

- Body composition and energy metabolism
- Digestion, absorption
- Metabolism of carbohydrates, proteins, amino acids and lipids
- Regulation of food intake and taste physiology
- Energetic balance and regulation of blood glucose
- Water balance
- Food and nutrition: recommendations
- Food and nutrition related diseases

Travail attendu

Scientific paper reading and presentation

Modalités de contrôle des connaissances

1 written exam of 1h30 (and adapted for special cases).

Prérequis

Basis in cardiovascular physiology

Compétences acquises

- Be able to identify the major physiological systems involved in the digestion process according to the foods consumed, particularly fruit and vegetable-based foods, in line with reference nutritional recommendations.

Références bibliographiques et ressources numériques

S-U02-3365 - FUNDAMENTALS OF FOOD SCIENCES

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	MARIA FIGUEROA ESPINOZA	30h00 - CM : 20h00 TDI : 10h00	Semestre 1

Objectifs

1- Describe the characteristics of various food groups, including their chemical composition, their structure, and classes of nutrients

2- Describe the main channels/methods of food production, preservation and distribution based of the characteristics of raw materials and the desired characteristics of the final food products

Description

This course will address the basic principles of food science, covering the four core disciplines of food science: food chemistry, food processing, food microbiology, and sensory science. Food chemistry will be addressed through basic biochemistry of the main classes of nutrients and their analysis (lipids, proteins, carbohydrates, water and minor food constituents), and applied to common food groups (cereals, dairy products, fruits and vegetables, etc.). Food processing and microbiology will be addressed through their fundamental principles and their applications to food preservation. Finally, sensory science will be addressed through its two main components, texture and flavor, and connections will be established with concepts of food biochemistry, showing how structure and physical/chemical properties of food constituents affect texture and flavor. The overall approach of this course will be integrative and will strive to make links between molecular properties of food constituents and properties of food itself.

Travail attendu

Learning and understanding of course material (exam questions and learning objectives are entirely covered in course material).

Modalités de contrôle des connaissances

Written exam, multiple choice questions.

Prérequis

Undergraduate level chemistry, organic chemistry, biochemistry, and biology.

Compétences acquises

1- Understanding of the nature, composition and structure of the main classes of foods

2- Understanding of transformations of and interactions among food components from raw materials to edible foods

3- Understanding of basic principles of food preservation, food analysis, sensory evaluation and food value-chain

Références bibliographiques et ressources numériques

S-U02-3166 - BASICS OF PROBABILITY & STATISTICS

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	FLORENT BONNEU	27h00 - CM : 15h00 TDI : 06h00 TP : 06h00	Semestre 1

Objectifs
 This course provides basics in probability and statistics in order to solve some simple problems and answer scientific questions in agrosociences with statistical analysis approaches. The content of this course is fundamental for others courses first and second year of the master IMAS.

Description
 This course introduces in a practical point of view the main mathematical concepts useful for statistical modeling. The first part is devoted to the definitions and rules of probability calculus, the presentation of the most useful random variables and their characteristics. The second part introduces basics in parameter estimation and hypothesis testing. The last part is dedicated to variance analysis and linear regression. Teaching focuses rigorously on mathematical application hypothesis and illustrates concepts on practical examples with the R software. The content of this course is fundamental for future courses on statistical modeling in numerous domains: environment, ecology, agronomy...

Travail attendu
 Attendance of class is mandatory. Students are expected to prepare some works before the course.

Modalités de contrôle des connaissances
 2 written exams (1h and 50% each).

Prérequis
 Basics in mathematics (functions, integrals, series).

Compétences acquises

- Use the basics of modeling and probabilistic calculus to answer practical scientific questions in agrosociences.
- Use the basics of exploratory and descriptive statistics to analyze experimental results in agrosociences.
- Use basics and relevant statistical models and tests to answer practical scientific questions in agrosociences.
- Use Rstudio software and R packages to implement statistical techniques on real datasets in agrosociences.

Références bibliographiques et ressources numériques
 All reference materials will be available on the Avignon University ENT platform.

S-U02-3368 - SCIENTIFIC METHODS

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.00	1.00	CINDY MORRIS NICOT	10h00 - CM : 07h00 TDI : 03h00	Semestre 1

Objectifs

Students are expected to improve their use of objective, analytical approaches in the definition of scientific questions and the formulation and testing of hypotheses. They will learn how to use laboratory notebooks and the importance of the notions of traceability and repeatability of their work. They are also expected to learn how to improve their ability to be concise, direct and pertinent when communicating their discoveries via written or oral formats.

Description

The objective of this course is to stimulate students to think and debate about how scientific discoveries are made and communicated. The course will cover 6 topics: 1) History of the scientific method, 2) How culture influences science, 3) Methods to generate ideas and scientific goals, 4) Defining and testing hypotheses, 5) Why and how scientific results are communicated and 6) Ethical issues in science. The course is expected to influence the students' perspective on how they conduct their own research, especially in terms of defining objectives, testing hypotheses and assuring traceability.

Travail attendu

Attendance of class is mandatory. Students are expected to participate in discussions during class. They will read and analyze scientific articles in preparation for in-class discussions. Students will also prepare (with the course instructors) and deliver (to the class) a 5-minute presentation of research results for an audience of non-specialists.

Modalités de contrôle des connaissances

1 exam 1H00 coeff 1

Prérequis

Good skills in oral and written English. Background in biology equivalent to a highschool diploma ad minima.

Compétences acquises

Basic understanding of the processes by which scientific knowledge is created and communicated

Références bibliographiques et ressources numériques

All reference materials will be available on the EDT platform of Avignon University

S-U02-4301 - HISTORY OF AGRICULTURE

Crédits ECTS 1.00	Coefficients 1.00	Enseignant-e responsable LAURENT LEGENDRE	Volume horaire 06h00 - CM : 06h00	Période Semestre 2
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Objectifs
**Description**


This course will cover the natural selection of chemical elements in the critical zone and the history of agriculture during the last 10 000 years: the main biotechnological, biophysical and socioeconomic drivers of the spatial, organizational and functional dynamics of the soil - water - plant system; Green Revolution; Climate Change; Anthropocene.

Travail attendu
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**


S-U02-4327 - PLANT ECOPHYSIOLOGY (PART 1)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	LAURENT URBAN	24h00 - CM : 18h00 TDI : 06h00	Semestre 2

Objectifs

Students should be capable to understand how abiotic and biotic factors and agronomic practices, and their interactions influences yield, quality of production and plant defenses.

Students should notably be able to explain how the global change will affect plant growth and development, and crop performance.

At the end of the course, students should have a comprehensive view of the major concepts and tools used in plant ecophysiology, as well as a first experience of them for research or field diagnosis.

Description

Generally speaking, this course is designed to be a basis for courses of agronomy, crop protection and management of quality of production. This course will introduce the role of carbon budget and stress in yield, quality and defenses. Then, a focus on photosynthesis will be given: role of light, photo-inhibition, photo-oxidative stress, temperature, CO₂, climate change. Modeling.

Field tools for measuring photosynthesis, and respiration/translocations ? Tutorials test

Travail attendu

Students will attend lectures, use computer simulations and participate in small trials, which objective is to make them acquainted with some of the tools used in plant ecophysiology.

Modalités de contrôle des connaissances

2 exams with the same coefficient (0.5 each)

Prérequis

Basic concepts of plant physiology, plant pathology, biochemistry and biophysics

Compétences acquises

Capacity to understand how environmental factors, including agronomic levers and stress, influence yield, quality of production and plant defenses. Capacity to propose strategies to maintain or improve crop performance and reduce pesticide use in the context of climatic change. Basic competences with the major field tools of plant ecophysiology.

Références bibliographiques et ressources numériques

Plant Physiology. Taiz and Zeiger (eds.). Sinauer (publisher)

S-U02-4303 - CONVENTIONAL CONSERVATION AND TRANSFORMATION TECHNIQUES

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	CARINE LE BOURVELLEC	20h00 - CM : 15h00 TDI : 05h00	Semestre 2

Objectifs

Description

Conventional conservation techniques
 Postharvest plant physiology and quality deterioration
 Conventional storage of fresh fruits and vegetables: from cooling to modified atmospheres
 Conventional transformation techniques

- Why process fruits and vegetables? Overview of fruit and vegetable processing and challenges for the sector
- Contribution of Near-Infrared and Mid-Infrared spectroscopy to evaluate the variability of raw and processed fruits and vegetables
- Aroma compounds in processed fruits: origin, variability among species, and release from food matrix
- Phenolic compounds in processed fruits: variability among species, agricultural practices and evolution from fruit to food matrix
- Polysaccharides and fibers and their modifications during processing
- Texture of fresh and processed fruits & vegetables: measurements and modeling
- Kinetic modeling of food quality change during processing: focus on chemical and enzymatic reactions affecting sensory and nutritional properties of food
- Membrane technologies for fruit juice processing: Focus on micronutrients

Travail attendu

Modalités de contrôle des connaissances

Prérequis

Compétences acquises

Références bibliographiques et ressources numériques

S-U02-4337 - PHYTOCHEMICALS : BIOAVAILABILITY & HEALTH EFFECTS (PART 1)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	PHILIPPE OBERT	12h00 - CM : 09h00 TDI : 03h00	Semestre 2

Objectifs
 The overall objective of this module is to bring general knowledge about the absorption of vitamins and carotenoids and molecular mechanisms involved in health effect of these molecules.

Description
 Teachers: Claire DUFOUR (INRAE), Sabine GALINDO (INRAE Montpellier)
 - Eat 5 fruits and vegetables a day: a scientific approach (CM: 1.5h, TD: 1.5h)
 - Main classes of dietary plant phenols, dietary abundance, bioaccessibility, activity in the gastro-intestinal tract (CM: 3h)
 - Intestinal absorption of plant phenols, bacterial and human metabolisms (CM: 3h)
 - A microbiota approach of plant food (CM: 1.5h, TD: 1.5h) ? S. Galindo

Travail attendu
 Attendance at lectures, critical analysis of one scientific article during practical teaching.

Modalités de contrôle des connaissances

Prérequis

Compétences acquises

Références bibliographiques et ressources numériques

**S-U02-4305 - SAFETY IN THE PRODUCTION CHAIN OF FRUITS & VEGETABLES
(PART 1)**

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
2.00	2.00	PHILIPPE OBERT	12h00 - CM : 09h00 TDI : 03h00	Semestre 2

Objectifs
**Description**


- The mycotoxin hazard in the production chain of fresh and processed vegetables
- The toxicological risks due to crop protection
- The risk of viruses: hazards, contamination routes and principles of control

Travail attendu
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**


S-U02-4306 - ETHICS & SCIENTIFIC INTEGRITY

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
1.00	1.00	PHILIPPE OBERT	06h00 - CM : 06h00	Semestre 2

Objectifs

La formation vise à donner aux étudiants un aperçu de problèmes éthiques liés à l'Agrosceience. Durant la formation, on présente aux participants 3 situations auxquelles ils pourraient être confrontés. Les participants, réunis en 3 groupes de 3 ou 4 personnes, doivent réfléchir à la situation proposée, proposer une solution qui leur paraît adaptée, et enfin présenter celle-ci avec avantages et inconvénients à l'ensemble de la classe. Le formateur embraie ensuite sur les questions éthiques générales soulevées par la situation, avec lorsque c'est pertinent des présentations d'histoires similaires parues dans l'actualité. La formation se déroule en présentiel, sur plusieurs séquences successives durant la journée. Elle se déroule entièrement en anglais

Description

Séquence 1 : Expériences sur animaux en laboratoire
 Situation 1 : Test d'un médicament dermique sur un singe
 Situation 2 : Mesure de l'effet d'un type de nourriture sur la santé d'un rat
 Situation 3 : Expérience de chirurgie sur un cochon

Séquence 2 : OGM et manipulations génétiques
 Situation 1 : Manipulation de l'ADN d'une souche de drosophile
 Situation 2 : Retrait d'un gène d'une maladie sur un f?tus humain
 Situation 3 : Ajout d'un gène positivement nutritionnel dans de la nourriture

Séquence 3 : Expériences sur personnes humaines
 Situation 1 : Expérience nutritionnelle sur volontaire avec information cachée
 Situation 2 : Expérience de nouveau traitement médical sur une personne malade
 Situation 3 : Expérience psychologique sur les préférences alimentaires d'un consommateur

Séquence 4 : Etudes et recherche
 Situation 1 : Financement privé d'un travail de recherche
 Situation 2 : Transparence et honnêteté de la présentation d'un résultat de recherche
 Situation 3 : Reproductibilité d'un travail de recherche

Travail attendu
Modalités de contrôle des connaissances

Etude de document, sur un article de journal présentant une des situations similaires à une de celles vues en cours. L'étudiant devra lister les problèmes éthiques soulevés par la situation, et devra lister proposer plusieurs solutions au problème, avec avantages et inconvénients.
 Durée : 45 minutes.

Prérequis



Compétences acquises



**Références bibliographiques et
ressources numériques**



S-U02-4338 - FUNDAMENTALS OF CARDIOVASCULAR HEALTH & IMPACT OF NUTRITION

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
3.00	3.00	PHILIPPE OBERT	21h00 - CM : 15h00 TDI : 04h30 TP : Semestre 2 01h30	

Objectifs

- ? Master the anatomical, physiological and pathological bases of the cardiovascular system.
- ? Understand traditional and novel cardiovascular risk factors
- ? Master the influence of common diets as well as of macronutrients and micronutrients on cardiovascular risk factors and mortality, heart and vessels.

Description

- Concept of cardiovascular health
- Basics of cardiovascular physiology (vascular apparatus, heart)
- Characterization of the main cardiovascular diseases
- Dietary regimens and their impact on cardiovascular prevalence / incidence and mortality
- Impact of fruit & vegetable consumption on cardiovascular risk factors:
 - ? Dyslipidemia, hypertension, inflammation, oxidative stress: effects of fats, dietary fibers, phytosterols, vitamins (E, C, B9), carotenoids and polyphenols
 - ? Glycemic control
 - ? Obesity: weight control and modulation of adipose tissue
- Practical work: cardiac remodeling and function, FMD and arterial compliance.
- Impact of F&L and their related micronutrients (mainly polyphenols) on heart and vessels .
- ? Integrative approach from meta-analyses of randomized clinical trials (2H P Obert),
- ? Ex vivo and in vitro effects : from organ to cells (2h30 Heart C Reboul; 2h30 vessels G Meyer).

Travail attendu

- ? Reading scientific papers (epidemiological studies, clinical trials, experimental studies) to enhance their competencies and skills about the effects of foods on cardiovascular health

Modalités de contrôle des connaissances

Prérequis

- ? Basic knowledge of human physiology and nutrition

Compétences acquises

- ? Be able to implement a project aimed at improving cardiovascular health in healthy and pathological subjects, using nutritional approaches based on fruit and vegetable consumption.

Références bibliographiques et ressources numériques

- : Reading of scientific articles (original articles, meta-analyses and systematic reviews) referenced by teachers as part of their courses, to complement the knowledge provided.

S-U02-4307 - STAGE (12 A 18 SEMAINES)

Crédits ECTS	Coefficients	Enseignant-e responsable	Volume horaire	Période
15.00	15.00	PHILIPPE OBERT	-	Semestre 2

Objectifs
**Description**
**Travail attendu**
**Modalités de contrôle des connaissances**
**Prérequis**
**Compétences acquises**
**Références bibliographiques et ressources numériques**
