Erasmus+

As part of the Erasmus+ mobility program,

The Research Laboratory of Genetics and Cereal Breeding

Organize an advanced course on

ADVANCED TOOLS IN PLANT PHYSIOLOGY

OBJECTIVE

This course aims to provide students with:

- An in-depth understanding of the molecular mechanisms that govern plant responses to abiotic stress.
- The theoretical and practical basis of genetic engineering technologies for crop improvement.
- The skills to apply photosynthetic organisms to biotechnology for industrial purposes.
- The knowledge to interpret and integrate -omics data from NGS technologies in plant research.

COURSE PROGRAM (4 CFU)

Day 1 _ 09 June 2026

Opening: The director of INAT: Mr. Khazi KRIDA **08:30 – 09:00**
The director of Studies at INAT: Mrs. Amira MOUGOU

Module 1: Molecular Physiology of Abiotic Stress in Plants **09:00 – 11:00**

- Importance of plants in climate and food security
- Green Revolution, genetic erosion, and biodiversity loss
- Climate change impacts on water and soil resources
- Physiological and molecular responses to drought, salinity, and heat
- Hormonal regulation (e.g., ABA), ROS signaling, and stress pathways
- Key stress-response genes: NCED, HSP70, LEA, P5CS, SOS1
- Photosynthesis under stress: NPQ, chloroplast adaptations

Coffee break **11:00 – 11:30**

Module 2: Genetic Engineering in Plants and GMOs – 1 CFU **11:30 – 13:30**

- Transformation techniques: Agrobacterium, gene gun, protoplasts
- RNA interference and antisense oligonucleotides
- New Genomic Technologies (NGTs) and CRISPR/Cas9
- Chloroplast genome manipulation and its advantages
- Constitutive and tissue-specific promoters
- Selection strategies (antibiotics, herbicides, metabolic markers)
- Case studies: Bt maize, Cavendish banana, Creso wheat

REFERENT

Dr. Simone Landi – Associate professor, Department of Biology, University of Naples Federico II, Italy

DATE

09 and 10 June 2026

STRUCTURE

Four modules **4 CFU**

LANGUAGE OF THE COURSES

English

TEACHING METHODS

Lectures with multimedia presentations and group discussions in presence

TARGET AUDIENCE

Master and PhD students with an interest in plant physiology, biotechnology, and molecular biology

ADMISSION PROCEDURES

Required documents:

- Completed form
- Curriculum vitae
- Cover letter including a brief description of the PhD/Master research topic (optional)

APPLICATION

Application to be submitted **before 02 June 2026**

REGISTRATION FEES

Registration fee: free

CERTIFICATE

will be delivered at the end of the course. Only students who attended the 4 sessions are eligible.

Day 2 _ 10 June 2026

Module 3: Photosynthetic and Microalgal Biotechnologies **09:00 – 11:00**

- Evolution of photosynthesis and classification of photosynthetic organisms
- Features of green, red, brown algae and diatoms
- Cultivation systems: open ponds vs. photobioreactors
- Valuable products: spirulina, fucoxanthin, astaxanthin, phycoerythrin
- Fatty acid and lipid biosynthesis (omega-3, omega-6)
- Industrial applications: biofuels, nutraceuticals, cosmetics
- Metabolic engineering in microalgae: strategies to increase yield and stress resistance.

Coffee break **11:00 – 11:30**

Module 4: Omics Technologies and NGS Applications in Plants **11:30 – 13:30**

- NGS platforms: Illumina, PacBio, Nanopore
- Plant genomics: genome assembly, annotation, and gene discovery
- Transcriptomics (RNA-seq): gene expression profiling under stress
- Proteomics and metabolomics: LC-MS/MS, 2D-Gel, pathway analysis
- Multi-omics integration and network modelling
- Applications in marker-assisted selection (MAS) and molecular breeding
- Theoretical basis for the analysis of real datasets using open-source bioinformatics tools.