Blended Intensive Program

Plant adaptations to climate changes

2nd edition

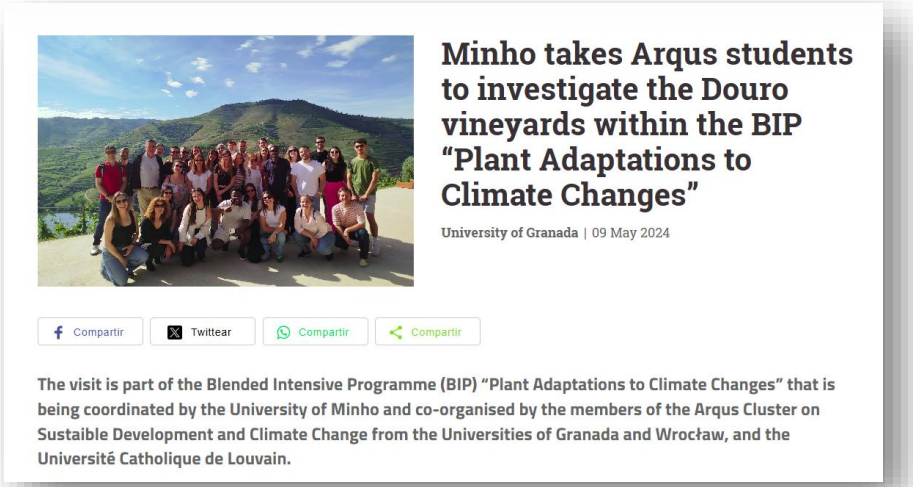
University of Minho, School of Sciences
Braga, Portugal
15-26 June 2026

University of Minho
School of Sciences | Centre of Molecular and Environmental Biology | Department of Biology
School of Engineering | Center for MicroElectroMechanics Systems

+ Info: Prof. Hernâni Gerós - geros@bio.uminho.pt

EU Project vinny

Info of the 1st edition - May 2024

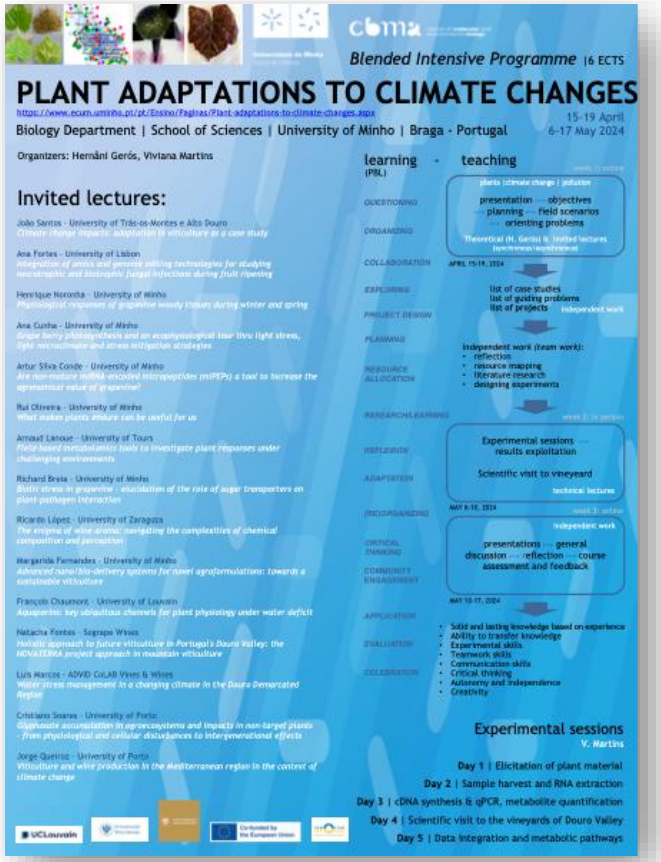


Minho takes Arqus students to investigate the Douro vineyards within the BIP “Plant Adaptations to Climate Changes”

University of Granada | 09 May 2024

Compartir | Twittear | Compartir | Compartir

The visit is part of the Blended Intensive Programme (BIP) “Plant Adaptations to Climate Changes” that is being coordinated by the University of Minho and co-organised by the members of the Arqus Cluster on Sustaible Development and Climate Change from the Universities of Granada and Wrocław, and the Université Catholique de Louvain.



Blended Intensive Programme | 6 ECTS

PLANT ADAPTATIONS TO CLIMATE CHANGES

https://www.ecum.uminho.pt/pt/Ensino/Paginas/Plant-adaptations-to-climate-changes.aspx

Biology Department | School of Sciences | University of Minho | Braga - Portugal

15-19 April
6-17 May 2024

Organizers: Hernâni Gerós, Viviana Martins

Invited lectures:

João Santos - University of Trás-os-Montes e Alto Douro
Climate change impacts: adaptation in viticulture as a case study

Ana Fortes - University of Lisbon
Adaptation of tomato and genome editing technologies for studying necrotrophic and biotrophic fungal infections during fruit ripening

Henrique Noronha - University of Minho
Physiological responses of grapevine woody tissues during winter and spring

Ana Cunha - University of Minho
Grape berry photosynthesis and an ecophysiological tour thru light stress, light microclimate and stress mitigation strategies

Artur Silva Conde - University of Minho
Are non-mature miRNA-encoded microproteins (miPEPs) a tool to increase the agronomical value of grapevine?

Rui Oliveira - University of Minho
What makes plants mature can be useful for us

Arnaud Lanoue - University of Tours
Plant-based metabolomics tools to investigate plant responses under challenging environments

Richard Breia - University of Minho
Biotic stress in grapevine - elucidation of the role of sugar transporters on plant-pathogen interaction

Ricardo López - University of Zaragoza
The enigma of wine aroma: navigating the complexities of chemical composition and perception

Margarida Fernandes - University of Minho
Advanced nano/bio-delivery systems for novel agroformulations: towards a sustainable viticulture

François Chaumont - University of Louvain
Aquaporins: key ubiquitous channels for plant physiology under water deficit

Natacha Fontes - Sograpa Wines
Holistic approach to future viticulture in Portugal's Douro Valley: the NOVATERRA project approach in mountain viticulture

Luís Marcos - ADVID CoLAB Vines & Wines
Water stress management in a changing climate in the Douro Demarcated Region

Cristiano Soares - University of Porto
Glyphosate accumulation in agroecosystems and impacts in non-target plants - from physiological and cellular disturbances to intergenerational effects

Jorge Queiroz - University of Porto
Viticulture and wine production in the Mediterranean region in the context of climate change

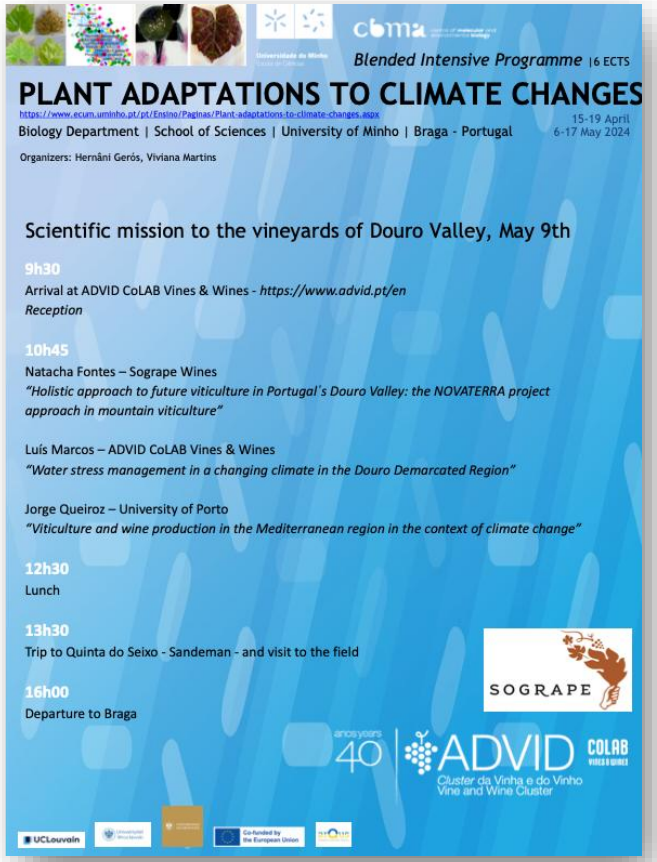
learning - teaching (PBL)

QUESTIONING
ORGANIZING
COLLABORATION
EXPLORING
PROJECT DESIGN
PLANNING
RESOURCE ALLOCATION
RESEARCH/LEARNING
REFLEXION
ADAPTATION
(RE)ORGANIZING
CRITICAL THINKING
COMMUNITY ENGAGEMENT
APPLICATION
EVALUATION
CELEBRATION

plants | climate change | pollution
presentation — objectives
planning — field scenarios
orienting problems
Theoretical (H. Gerós) & Invited lectures
APRIL 15-19, 2024
list of case studies
list of guiding problems
list of projects
Independent work
Independent work (team work):
- reflection
- resource mapping
- literature research
- designing experiments
Experimental sessions
results exploitation
Scientific visit to vineyard
technical lectures
MAY 6-10, 2024
week 3: online
independent work
presentations — general discussion — reflection — course assessment and feedback
MAY 13-17, 2024
- Solid and lasting knowledge based on experience
- Ability to transfer knowledge
- Experimental skills
- Teamwork skills
- Communication skills
- Critical thinking
- Autonomy and independence
- Creativity

Experimental sessions
V. Martins

Day 1 | Elicitation of plant material
Day 2 | Sample harvest and RNA extraction
Day 3 | cDNA synthesis & qPCR, metabolite quantification
Day 4 | Scientific visit to the vineyards of Douro Valley
Day 5 | Data integration and metabolic pathways



Blended Intensive Programme | 6 ECTS

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Biology Department | School of Sciences | University of Minho | Braga - Portugal

15-19 April
6-17 May 2024

Organizers: Hernâni Gerós, Viviana Martins

Scientific mission to the vineyards of Douro Valley, May 9th

9h30
Arrival at ADVID CoLAB Vines & Wines - *https://www.advid.pt/en*
Reception

10h45
Natacha Fontes – Sogrape Wines
“Holistic approach to future viticulture in Portugal's Douro Valley: the NOVATERRA project approach in mountain viticulture”

Luís Marcos – ADVID CoLAB Vines & Wines
“Water stress management in a changing climate in the Douro Demarcated Region”

Jorge Queiroz – University of Porto
“Viticulture and wine production in the Mediterranean region in the context of climate change”

12h30
Lunch

13h30
Trip to Quinta do Seixo - Sandeman - and visit to the field

16h00
Departure to Braga

SOGRAPE

ancoyers 40 | ADVID COLAB Cluster da Vinha e do Vinho Vine and Wine Cluster

UCLouvain

- https://www.ecum.uminho.pt/pt/Ensino/Paginas/Plant-adaptations-to-climate-changes.aspx
- https://arqus-alliance.eu/news/minho-arqus-students-douro-vineyards-bip-plant-adaptations/

What is a BIP?

- ✓ The BIPs aim to promote mixed mobility, create innovative approaches to teaching and learning, and implement transnational and transdisciplinary short-term courses for students and/or administrative staff.
- ✓ The virtual component is mandatory (of any duration and can take place before or after physical mobility), and physical mobility can last between 5 to 30 days.
- ✓ A BIP must involve a minimum of three Higher Education Institutions (HEIs) from three countries in the Erasmus+ Program, with 15 to 20 participants, and the combined mobility (virtual and physical) must award a minimum of 3 ECTS to participants.
- ✓ Erasmus+ Interinstitutional Agreements must be signed between the host and foreign HEIs before the (virtual and physical) mobilities take place

Code of good practices of a BIP:

- ✓ They should add value to other existing programs or courses in terms of their content or relevance;
- ✓ They should promote transdisciplinary and multinational teaching and training, benefiting from special learning and teaching conditions not available in a single institution;
- ✓ They must ensure transnational participation: individual participants or groups from at least three countries;
- ✓ They may include challenge-based learning, where transnational and transdisciplinary teams collaborate synergistically;
- ✓ They should encourage faculty to exchange views on content, new curricular approaches, and innovative teaching methods that may eventually be applied to other national or international teaching projects;
- ✓ They should provide students with new learning and skill development opportunities, particularly in information exploration;
- ✓ They should aim to reach all types of students from diverse backgrounds and any fields and study cycles;
- ✓ The student-to-faculty ratio should be adjusted to allow for active student engagement;
- ✓ A balance between transnational and national participation, as well as teaching staff, should be considered;
- ✓ They should facilitate the development of cross-cutting skills beyond discipline-specific competencies;
- ✓ It should ensure that the majority of the work carried out by students/professors at the foreign institution is of the face-to-face learning/teaching type.

Priorities addressed:

Environment and fight against climate change

Objectives and methods:

Agriculture faces significant challenges exacerbated by climate change and pollution. Our program addresses this need through a multifaceted approach. Theoretical sessions, conducted both online and in-person, in synchronous and asynchronous formats, explore the diverse facets such as plant physiology, development, and productivity in response to abiotic and biotic stresses induced by climate change and pollution. Hands-on experimental activities will enable participants to apply theoretical concepts. Furthermore, seminars by national and international specialists will enrich participants' understanding of cutting-edge research and emerging trends.

Field of Education: Biology
Level of Study: Master or Doctorate
Main Teaching/Training Language: English
Number of ECTS Credits Awarded: 6 ECTS

Blended Intensive Program

Plant adaptations to climate changes

Physical (in person) start/end date: 22 – 26 June 2026

- ✓ Country of venue: Portugal
- ✓ City of venue: Braga
- ✓ Physical component description: Conducting experimental research aimed at elucidating the interactions between plants and their environment. Theoretical-practical sessions.

Virtual component description

- ✓ 15 – 19 June 2026: kick off with presentations, group formation, seminars (online and in-person; synchronous and asynchronous) by national and international experts, and problem and project elaborations.
- ✓ 15 June – 3 July: analyzing the results, preparing and presenting oral communications, and evaluating students.

Teachers/Researchers delivering the Programme

Hernâni Gerós (UMinho, plant molecular physiology)

Experienced national and international professors and researchers, including from the partner institutions (see 1st edition info).

Learning outcomes (general)

- ✓ Explain the impact of climate change on plant diversity, growth, and productivity;
- ✓ Explain how pollution and climate change are closely intermingled;
- ✓ Identify the main air pollutants that contribute to the greenhouse effect;
- ✓ Identify the main environmental factors affecting plant development and productivity;
- ✓ Identify the main route by which air pollutants are incorporated in plants;
- ✓ Identify the main water pollutants;
- ✓ Explain how different stresses, including salinity and heavy metal stress, affect plant metabolism at the biochemical and molecular levels;
- ✓ Provide examples of diseases and pests that compromise plant productivity;
- ✓ Identify key molecular mechanisms of plant interaction with the environment, including cellular signaling and substrate transport;
- ✓ Explain the concept of biocontrol and provide examples;
- ✓ Give examples of bio-stimulants used, for instance, in viticulture;
- ✓ Explain how optimizing agricultural practices can mitigate the negative impact of environmental factors;
- ✓ Provide examples of precision agriculture and its applications;
- ✓ Give examples of successful cases of environmental stress mitigation strategies;
- ✓ Explain the importance of omics approaches, such as transcriptomics and metabolomics, in studying plant-environment interactions;
- ✓ Explain strategies for the rational design of miRNA-derived micropeptides aimed at stimulating secondary metabolite biosynthesis in plant cell cultures and fruits.
- ✓ Design and interpret in vitro and in planta assays to assess the efficacy of bioactive compounds in controlling plant diseases and improving plant health.
- ✓ Develop protocols for studying gene expression in plant response.

Methods and outcomes

- ✓ The challenge-based learning approach will place students at the center of the teaching/learning process;
- ✓ The adopted approach will be constructivist, requiring students to build their own knowledge through active exploration and practical application of theoretical concepts;
- ✓ The course will begin with the exploration of key learning outcomes and the definition of assessment methods and criteria aligned with these outcomes;
- ✓ Foundational scientific literature will be provided, and research and information-seeking methods will be explored, including the use of databases such as PubMed;
- ✓ The progress of the Course will be planned as much as possible, particularly regarding in-person teaching moments, such as experimental sessions, reflection and debate periods, and the final event where students will present their projects and results;
- ✓ Activities will commence with "inspirational lectures" and "challenging sessions" (e.g., on intensive agriculture and diseases and pests in a field context);
- ✓ This approach will create real-world field scenarios and the definition of guiding problems that will constitute the backbone of the entire project;
- ✓ Students are then encouraged to seek and explore relevant scientific literature and design experiments, in other words, to make decisions;
- ✓ (However, it is important to set boundaries in advance for activities and tasks, especially experimental or field visits in which students may be involved, as well as the resources available in the laboratory)
- ✓ Invited scientists from Portuguese and foreign institutions will give lectures (in-person or online) on topics that best fit each group's project, followed by brainstorming sessions;
- ✓ In the end, students should present their results, collectively, in a creative and accessible manner with a focus on proximity, aiming to develop oral and written communication skills;
- ✓ Students will also be invited to reflect on the construction process of the Course and its results, making their feedback crucial for the enhancement of the Course each year.

teaching

inspiring lectures and challenges

(climate change & climate models; pollution & global warming; biotic & abiotic stress; water & air pollution; plant response mechanisms; intensive agriculture; challenges of sustainable agriculture; ...)

week 1: online 25 h

presentation ⟼ objectives ⟼ planning ⟼ field scenarios ⟼ orienting problems

(synchronouys/assynchronous)

15-19 June, 2026

- understood learning outcomes
- definition of the groups
- list of case studies
- list of guiding problems
  - list of projects

supporting theoretical-practical lessons

online supporting sessions for protocol definition (on students' demand)

specialized guidance lectures on study methods
(RNA isolation; omics analyses; ...)

week 2: presencial 30 h

Experimental sessions ⟼ results exploitation

(foreign students at UMinho)

22-26 June 6-10, 2026

Experimental sessions
- Handling grapevine cell cultures
- Applying stressors & elicitors
- *In vivo* biocontrol assays of grape berry pathogens using bioactives
- Gene expression studies by Real-Time PCR
- Metabolite quantification
- Scientific visit to the field

(...)

online supporting sessions (on students' demand)

results' interpretation and oral presentations' preparation

independent work (in groups): preparation of oral presentations

week 3: online 5 h

Presentations ⟼ general discussion ⟼ Reflection ⟼ course assessment and feedback

29 June -3 July, 2026

- Solid and lasting knowledge based on experience;
- Ability to transfer knowledge;
- Experimental skills;
- Teamwork skills;
- Communication skills;
- Critical thinking;
- Autonomy and independence;
- Creativity;
- (...)

achievements of students

learning

QUESTIONING *ORGANIZING* *EXPLORING* *PLANNING* *RESEARCH/LEARNING* *THINKING* *(RE)ORGANIZING* *LEARNING* *APPLYING*

Figure 1: General structure of the Erasmus+ Blended Intensive Course (BIP) titled "Plant adaptations to climae changes" delivered in the Challenge Based Learning (CBL) format.

In summary:

- ✓ **3** Higher Education Institutions
- ✓ *Blended*: remote + presential lessons
- ✓ Challenge-based learning
- ✓ **15** foreign students
- ✓ **1 week** of presential activities at UMinho (experimental)
- ✓ **1 week** of remote activities (synchronous & asynchronous)
- ✓ **6 ECTS**
- ✓ 15-26 June, 2024