Teaching Guide				
Identifying Data				2023/24
Subject (*)	Molecular Plant-Pathogen Interaction Mechanisms		Code	610441019s
Study programme	Máster Universitario en Bioloxía Molecular, Celular e Xenética (semipresencial)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishGalicianEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	BioloxíaDepartamento profesorado másterPsicoloxía			
Coordinador	Diaz Varela, Jose	E-mail	jose.diaz.varela@udc.es	
Lecturers	Bernal Pita da Veiga, María de los Ángeles Diaz Varela, Jose	E-mail	angeles.bernal@udc.es jose.diaz.varela@udc.es	
Web				
General description	This subject is focused on the molecular aspects of plant-pathogen interaction and, in a short view, of interactions related to other organisms (herbivores, rhizobioa and mycorrhyzae)			

Study programme competences / results	
Code	Study programme competences / results
A4	Skills to apply molecular techniques to the study of the plant cell physiology, its response to external triggers and their biotechnological applications.
A5	Skills of understanding the microorganisms' role as pathogenic agents and as biotechnological tools.
A6	Skills of understanding the functioning of cells through the structural organization, biochemistry, gene expression and genetic variability.
A8	Skills of having an integrated view of the previously acquired knowledge about Molecular and Cellular Biology and Genetics, with an interdisciplinary approach and experimental work.
B3	Skills of management of the information: that are able to gather and to understand relevant information and results, obtaining conclusions and to prepare reasoned reports on scientific and biotechnological questions
B5	Ability to draft, represent, analyze, interpret and present technical documentation and relevant data in the field of the branch of knowledge of the master's degree in the native language and at least in another International diffusion language.
B9	Skills of preparation, show and defense of a work.
C2	Ability to know and use appropriately the technical terminology of the field of knowledge of the master, in the native language and in English, as a language of international diffusion in this field

Learning outcomes			
Learning outcomes	Study programme competences / results		
- To understand the molecular mechanisms of plant-pathogen interaction	AR4 AR8		CC2
- To know the different mechanisms of the plant response to pathogens.	AR4 AR5 AR6 AR8		CC2
To understand and be able to use the experimental approaches to research in this field.	AR4 AR5	BR3 BR5	CC2
- Ability for critically reviewing scientific papers related to this subject.	AR5 AR6	BR3 BR5 BR9	CC2

Contents	
Topic	Sub-topic
Molecular mechanisms in plant-pathogen interaction.	Recognition of the plant by the pathogen and mechanism to attack the plant. Recognition of the pathogen by the plant amnd mechanisms of defense. Pathogen Associated Molecular Patterns (PAMPs). Oxidative burst. Salicylates, jasmonates and ethylene. Hypersensitive response. Gene-for-gene resistance. Nonhost resistance. Induced resistance to pathogens: SAR and ISR. Npr1. Priming. Transcription factors involved in resistance.
Other interactions related to plant-pathogen interaction.	Recognition of herbivores, signalling and defense mechanisms. Rhizobium-plant interaction. Mycorrhizae.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A4 A5 A6 A8	0	40	40
Document analysis	A8 B3 B9 C2	0	12	12
Laboratory practice	A5 B3 B5 C2	0	16	16
Objective test	A5 A6 B3 B5 C2	2	0	2
Personalized attention		5	0	5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	In this blended mode, lectures are replaced by videos, texts and other materials so that students can learn the fundamental contents of the subject. There will be virtual forums for dialogue and debate between students and lecturers on the issues addressed.
Document analysis	Reading and analysis of a primary research paper related to the subject, accompanied by its presentation in Teams by the student and further discussion.
Laboratory practice	Laboratory practices The blended students will do virtual laboratory and field practical activities designed ad hoc by the lecturers. Optionally, each blended student can request, individually, the possibility of attending the practices on the dates established for face-to-face students.
Objective test	Exam on the contents of the lectures carried out through the Virtual Campus

Personalized attention	
Methodologies	Description
Guest lecture / keynote speech Document analysis Laboratory practice	The students can ask any question about the subject, and particularly about the work to do, using Teams and email.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Guest lecture / keynote speech	A4 A5 A6 A8	Participation in the forums about contents of the virtual lecture units.	10
Document analysis	A8 B3 B9 C2	Aspects to be assessed: Proper understanding of the paper by the student, the presentation in Teaams and the participation in the discussion (including the critical review of the paper).	40
Laboratory practice	A5 B3 B5 C2	Participation in the virtual activities, as well as a written report.	20

Objective test	A5 A6 B3 B5 C2	Exam about the virtual lecture units.	30

Assessment comments
The students who pass the subject in the first opportunity, will be prefentially considered to get the highest qualification (with honors). Any academic dishonesty (plagiarism, cheating in exams, etc.) will be penalised in accordance with the provisions of the UDC regulations.

Sources of information	
Basic	Hammond-Kosack, K.E. & Jones, J.D.G. 2015. Responses to plant pathogens. En: Buchanan, B.B., Gruissem, W. & Jones, R.L (eds.) "Biochemistry and molecular biology of plants" Capítulo 22, pp. 984-1050. Wiley-Blackwell-ASPB. Lucas, J.A. 2020. Plant pathology and plant pathogens. Wiley Blackwell.Smith, A.M., Cupland, G., Dolan, L., Harberd, N., Jones, J., Marin, C., Sablowski, R. & Amey, A.. 2009. Plant Biology. Garland Science. Capítulo 8.Taiz, L., Zeiger, E., Moller, A.M. & Murphy, A. 2022. Plant Physiology and Development, 7th ed. Oxford University Press. Tronsmo, A. M., Collinge, D.B., Djurle, A., Munk, L., Yuen, J. & Tronsmo, A. 2020. Plant Pathology and Plant Diseases. CABI.Walters, D. R. 2011. Plant defense. Wiley-Blackwell.
Complementary	- Agrios, G. N. 2005. Plant pathology, 5ª Ed. Academic Press.- Albersheim, P. Darvill, A., Roberts, K., Sederoff, R. & Staehelin, A.. 2010. Plant Cell Walls: from Chemistry to Biology. Garland Science. Capítulo 8.- Dickinson, M. 2003. Molecular Plant Pathology. Bios Scientific Publishers.- Dyakov, Y., Dzhavakhiya, V. & Korpela, T. 2007. Comprehensive and molecular phytopathology. Elsevier.- Nuez, F., Pérez de la Vega, M. & Carrillo, J.M. 2004. Resistencia genética a patógenos vegetales. Univ. Politécnica de Valencia ? Univ. de León.- Pallás, V., Escobar, C., Rodríguez Palenzuela, P. & Marcos, J.F. 2008. Herramientas biotecnológicas en fitopatologia. Ed. Mundi-Prensa.- Parker, J. 2009. Molecular aspects of plant disease resistance. Blackwell Publishing Ltd.- Taiz, L., Zeiger, E., Moller, I.M. & Murphy, A. 2015. Plant Physiology and development, Sixth Edition. Sinauer Associates, Inc. Capítulo 23.- Walters, D., Newton, A. & Lyon, G. 2007. Induced resistance for plant defence. A sustainable approach to crop protection. Blackwell Publishing.otection. Blackwell Publishing.

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Plant Biotechnology/610441020
Subjects that continue the syllabus
Cellular Techniques/610441001 Molecular Techniques/610441002 Cell Signaling/610441004
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.