Teaching Guide				
Identifying Data				2020/21
Subject (*)	Chemistry of Natural Products		Code	610509118
Study programme	Mestrado Universitario en Investigación Química e Química Industrial (Plan 2020)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Jimenez Gonzalez, Carlos	E-mail	carlos.jimenez@udc.es	
Lecturers	Jimenez Gonzalez, Carlos Rodriguez Gonzalez, Jaime	E-mail	carlos.jimenez@udc.es jaime.rodriguez@udc.es	
Web	http://www.usc.es/gl/centros/quimica/curso/master.html			
General description	This material is intended for students to acquire a thorough understanding of the Natural Products Chemistry. It starts from their applications, mainly at pharmacological level, following by the importance of their study and then, their classification from the biogenetic point of view. In order to do this, it will display the most important biogenetic routes from which originate the most abundant skeletons. Some modern techniques used today to accelerate their isolation and identification along with the use of genetic studies on new biotechnological strategies in their production is also seen			
Contingency plan	1. Modifications to the contents There will be no changes 2. Methodologies *Teaching methodologies that are maintained All of them *Teaching methodologies that are modified The "magister classes and seminars" activities will maintain the same format and content with the only difference that they will be taught using Teams or the platform that the UDC makes available to the teaching community. 3. Mechanisms for personalized attention to students Email: permanent. Moodle: Daily. According to the need of the students. Teams: Magister class, seminars, tutorials (2-6 h / week). 4. Modifications in the evaluation There will be no changes in either the methodology or the percentages assigned to each of the methodologies. *Evaluation observations: The evaluation will be maintained as indicated in the teaching guide. The only difference will be in the channel used for the tests that will be carried out in Teams or Moodle or a combination of them. 5. Modifications to the bibliography or webgraphy There are no changes in the bibliography.			

Study programme competences / results	
Code	Study programme competences / results
A1	Define concepts, principles, theories and specialized facts of different areas of chemistry.
A3	Innovate in the methods of synthesis and chemical analysis related to the different areas of chemistry

A4	Apply materials and biomolecules in innovative fields of industry and chemical engineering.
B2	Students should apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
B4	Students should be able to communicate their conclusions, and the knowledge and the reasons that support them to specialists and non-specialists in a clear and unambiguous manner
B5	Students must possess learning skills to allow them to continue studying in a way that will have to be largely self-directed or autonomous.
B7	Identify information from scientific literature by using appropriate channels and integrate such information to raise and contextualize a research topic
B10	Use of scientific terminology in English to explain the experimental results in the context of the chemical profession
B11	Apply correctly the new technologies to gather and organize the information to solve problems in the professional activity.
C1	CT1 - Elaborar, escribir e defender publicamente informes de carácter científico e técnico
C3	CT3 - Traballar con autonomía e eficiencia na práctica diaria da investigación ou da actividade profesional.
C4	CT4 - Apreciar o valor da calidade e mellora continua, actuando con rigor, responsabilidade e ética profesional.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Acquisition of advanced knowledge in the chemistry of Natural Products, from both terrestrial and marine origin	AC1	BC2 BC4 BC7	CC1 CC3 CC4
Learning of the most important applications, mainly as drugs and as tools in biomedical research	AC3 AC4	BC2 BC5	CC1 CC4
Learning of the main biogenetic routes and the main metabolites that originate	AC1	BC2 BC7	CC1 CC4
Learning of the modern techniques used for their isolation and identification	AC4	BC10 BC11	CC1 CC4

Contents	
Topic	Sub-topic
CHAPTER 1. Introduction to the study of natural products	Concepts of natural product and secondary metabolite. Main natural sources. Main applications. Importance of natural products in the pharmaceutical industry. Classification and examples.
CHAPTER 2. Main metabolic pathways of the secondary metabolism	General scheme of secondary metabolism, main types of natural products that originate and classification based on metabolic pathways. Main mechanisms of biological pathways. Methods of elucidation of a metabolic route.
CHAPTER 3. Metabolites derived from acetate: poliketides, fatty acids and related compounds	Metabolites derived from acetate: poliketides, fatty acids and related compounds.
CHAPTER 4. Metabolites derived from mevalonate: terpenes and steroids	Metabolites derived from mevalonate: terpenes and steroids.
CHAPTER 5. Metabolites derived from shikimic acid	Biosynthetic origen of shikimic acid. Phenylpropanoids. Metabolites of mixed origin: Flavonoids.
CHAPTER 6. Natural nitrogenous compounds	Aliphatic alkaloids: derivates from lysine and ornithine. Aromatic alkaloids: derivates from phenylalanine/tyrosine and tryptophan. Other estructural frameworks. Biosynthesis of non ribosomal peptides.
CHAPTER 7. Modernas estrategias de aislamiento e identificación	Traditional methods. Dereplication techniques. Biotechnology strategies based on genetic studies: Genome mining, recombinant biosynthesis and combinatorial biosynthesis.

Planning

Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B2 B5 C3 C4	12	24	36
Problem solving	B4 B7 B10 B11	6	17.5	23.5
Case study	B4 B7 B10 B11 C1	0	1	1
Oral presentation	B4 B7 B10 B11 C1	1	0	1
Mixed objective/subjective test	A1 A4 A3 B2 B5	1.5	10	11.5
Personalized attention		2	0	2
(*)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	It will be held 12 sessions of lectures in one group where the theoretical contents of the course will be associated with illustrative examples. It will consist mainly in PowerPoint presentations. Copies of these presentations will be available for the students in advance via the virtual campus of the course. This will allow the students to study ahead the contents of the course and to facilitate the monitoring of explanations
Problem solving	7 sessions in small group seminars where students will present the work proposed by the professor followed by a discussion section. Students will have in advance the proposed exercises and papers via the virtual campus of the course. Attendance at these classes is mandatory
Case study	The student will carry out a work on a topic that was selected by the teacher and he will prepare the corresponding written report that will be given to the teacher for evaluation.
Oral presentation	The student will present in a seminar class the work in the presence of the teacher and the rest of the students.
Mixed objective/subjective test	The final exam will cover all the contents of the course

Personalized attention	
Methodologies	Description
Problem solving	Tutoring scheduled by the professor and coordinated by the Centre. It will be 2 hours per student and will involve the supervision of proposed work, clarifying doubts, etc. Attendance at these classes is mandatory

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Problem solving	B4 B7 B10 B11	They will consist of two components: interactive class in problems solving clases (seminars) and interactive class in very small groups (tutorials). This part within the continuous assessment (N1) will be 40% of the qualification	30
Guest lecture / keynote speech	B2 B5 C3 C4	Attendance at these classes is mandatory. The missed classes must be justified This part within the continuous assessment (N1) will be 10% of the qualification	5
Mixed objective/subjective test	A1 A4 A3 B2 B5	The final exam (N2) will cover all the contents of the course. This part will be 60% of the qualification.	55
Case study	B4 B7 B10 B11 C1	The report assigned to the student by the teacher will be evaluated	5
Oral presentation	B4 B7 B10 B11 C1	The presetation of the work by the student will be evaluated with particular regard to the clarity of the exposition, scientific rigor of the exposed content and that respond correctly to the questions that will be asked after the presentation.	5

Assessment comments

The evaluation of this course will be done by means of the continuous evaluation and completion of a final exam. Access to the exam will be conditioned on the participation in at least 80% of the mandatory classroom teaching activities (seminars and tutorials).
Continuous evaluation (N1) will be 45% of the qualification and the final exam (N2) will cover all the contents of the course. The student's score will result of applying the following formula: Final score = 0.45 x N1 + 0.55 x N2. N1 and N2 are the marks corresponding to the continuous assessment (0-10 scale) and the final exam (0-10 scale), respectively. The repeater students will have the same system of class attendance than those who study the course for

Sources of information	
Basic	- J. Mann (1992). Secondary Metabolism. Oxford: Oxford Science Publications - Pilar Gil Ruiz (). Productos naturales. Pamplona: Universidad Pública de Navarra - J. Alberto Marco (2006). Química de los productos naturales. Madrid: Síntesis - Jonathan Clayden, Nick Greeves, Stuart Warren (2012). Organic Chemistry. New York: University Press - Richard B. Herbert (1989). The biosynthesis of secondary metabolites. London: Chapman and Hall - S. D. Sarker, L. Nahar (2012). Natural Products Isolation. New Jersey: Human Press - Paul M. Dewick (2009). Medicinal Natural Products. A Biosynthetic Approach. 3ª. ed.?, Wiley, Wiltshire
Complementary	- Edwin Haslam (1993). Shikimic Acid: Metabolism and Metabolites. Chichester: John Wiley & Sons - Ana M. Lobo, Ana M. Lourenco (2007). Biossíntese de productos naturais. Lisboa: IST Press

Recommendations
Subjects that it is recommended to have taken before
Advanced Structural Determination/610509103 Structure and Reactivity of Organic Compounds /610509114
Subjects that are recommended to be taken simultaneously
Chemistry of Biomolecules/610509115 Stereoselective Synthesis/610509113
Subjects that continue the syllabus
Other comments
The students should review the theoretical concepts introduced in each chapter using the reference manual and the material provided by the professor. Those students, which have significant difficulties when working the proposed activities, should contact with the professor during the tutorials, in order to analyze the problem and to receive the necessary support. The professor will analyze with those students who do not successfully pass the evaluation, and so wish, their difficulties in learning the course content. Additional material (questions, exercises, tests, etc..) to strengthen the learning of the course might be also provided.