



Teaching Guide				
Identifying Data			2023/24	
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	Spanish			
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	<a href="http://www.usc.es/gl/centros/quimica/curso/master.html">http://www.usc.es/gl/centros/quimica/curso/master.html</a>			
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			

Study programme competences	
Code	Study programme competences
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		
	Acquisition of advanced knowledge in the chemistry of Natural Products, from both terrestrial and marine origin	AC1	BC2 BC4 BC7
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 origin of shikimic acid. Phenylpropanoids. Metabolites of mixed origin: Flavonoids.
CHAPTER 6. Natural nitrogenous compounds	Aliphatic alkaloids: derivatives from lysine and ornithine. Aromatic alkaloids: derivatives from phenylalanine/tyrosine and tryptophan. Other structural frameworks. Biosynthesis of non ribosomal peptides.
CHAPTER 7. Modern strategies of isolation and identification	Traditional methods. Dereplication techniques. Biotechnology strategies based on genetic studies: Genome mining, recombinant biosynthesis and combinatorial biosynthesis.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	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	1	1	2
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.
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	Description	Qualification
Problem solving	B4 B7 B10 B11	They will consist of two components: interactive class in problems solving classes (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	10

Assessment comments
<p>Grading will consist of continuous assessment and a final exam.</p> <p>The final exam will be face-to-face. The date of exam will be determined by the Centre</p> <p>In case of fraud or unethical behavior during the completion of tests or assignments, the UDC regulation as regards academic performance and grading (Normativa de avaliación do rendemento académico dos estudantes e de revisión das cualificacións) will be considered.</p> <p>The assessment of the students will consist of several items:</p> <p>Training assessment (40%) consists of the following items</p> <p>Resolution of problems and practical cases, individual or in group: 15%</p> <p>Accomplishment of reports: 10%</p> <p>Final exam (60%)</p> <p>Assistance to theoretical classes: 5%</p> <p>The final exam will include elements of theoretical type as related to activities developed in the lectures, seminars and tutorial lessons.</p> <p>If the student is absent to the exam, the assessment will be non-presented.</p> <p>An attendance in more than a 80% of the total lessons will be required.</p> <p>If plagiarism is detected, the UDC regulations will apply. As stated in the different applicable regulations for university teaching, an attempt will be made to incorporate the gender perspective in this matter. Work will be done to identify and modify prejudices and sexist attitudes as well as situations of discrimination based on gender and actions and measures will be proposed to correct them and promote values of respect and equality.</p>

Sources of information	
<b>Basic</b>	<ul style="list-style-type: none"> <li>- J. Mann (1992). Secondary Metabolism. Oxford: Oxford Science Publications</li> <li>- Pilar Gil Ruiz (). Productos naturales. Pamplona: Universidad Pública de Navarra</li> <li>- J. Alberto Marco (2006). Química de los productos naturales. Madrid: Síntesis</li> <li>- Jonathan Clayden, Nick Greeves, Stuart Warren (2012). Organic Chemistry. New York: University Press</li> <li>- Richard B. Herbert (1989). The biosynthesis of secondary metabolites. London: Chapman and Hall</li> <li>- S. D. Sarker, L. Nahar (2012). Natural Products Isolation. New Jersey: Human Press</li> <li>- Paul M. Dewick (2009). Medicinal Natural Products. A Biosynthetic Approach. 3ª. ed.?, Wiley, Wiltshire</li> </ul>
<b>Complementary</b>	<ul style="list-style-type: none"> <li>- Edwin Haslam (1993). Shikimic Acid: Metabolism and Metabolites. Chichester: John Wiley &amp; Sons</li> <li>- Ana M. Lobo, Ana M. Lourenco (2007). Biosíntese de produtos naturais. Lisboa: IST Press</li> </ul>



## Recommendations

### Subjects that it is recommended to have taken before

Advanced Structural Determination/610509103

### 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.

(\*)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.