UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2017/18
Subject (*)	Chemistry of Biomolecules		Code	610509115
Study programme	Mestrado Universitario en Investigación Química e Química Industrial (Plan 2017)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	Yearly	First	Optativa	3
Language	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Pazos Chantrero, Elena	E-mail	elena.pazos@udc.es	
Lecturers	Pazos Chantrero, Elena	E-mail	elena.pazos@udc.es	
Web				
General description	This material is intended for students to acquire a thorough understanding of the structure, function and applications of the major biomolecules, mainly proteins, carbohydrates and nucleic acids. It starts from the idea that students have enough knowledge of chemistry to understand various aspects of the molecular behavior of different types of biomolecules. The course will not only deal with structural aspects and the different biological functions of biomolecules, but the study on the different synthetic strategies for their manipulation will also be addressed, as well as the techniques used to modulate and / or modify their biological activity in order to get new tools in biomedical research.			

Study programme competences / results	
Code	Study programme competences / results
A1	Define concepts, principles, theories and specialized facts of different areas of chemistry.
A2	Suggest alternatives for solving complex chemical problems related to the 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.
A9	Promote innovation and entrepreneurship in the chemical industry and in research.
B1	Possess knowledge and understanding to provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context
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 the most important biomolecules (proteins, nucleic acids and sugars).	AC1 AC9	BC1 BC2 BC4 BC7	CC4
Learning of the biogenetic rules and the function of biomolecules	AC2 AC3 AC4	BC5 BC10 BC11	
Learning the more relevant aspects related to the isolation and characterization of biomolecules as well as their synthetic manipulation	AC2 AC4	BC2 BC5 BC7	CC1 CC3

Contents	
Topic	Sub-topic
Chapter 1. Introduction and historical aspects. Basic structure and functions of cells. Most important biomolecules	Different components of the cell. Organization. Structure and function of main biomolecules
CHAPTER 2. Peptides and proteins. Structural aspects. Synthesis and modification. Design of functional proteins. Metalloproteins: types, methods of study, examples and applications	Amino acids and peptides. Proteins and functions. Primary, secondary, tertiary and quaternary structure. Biosynthesis. Chemical synthesis. Modification by chemical methods. Applications.
CHAPTER 3. Nucleic acids. Structural aspects. Synthesis and analysis techniques. Interactions with other nucleic acids. Interactions with small molecules. Interactions with metals. Interactions with proteins and peptides	Structure of nucleotides. Structure and function of the different nucleic acids. Supramolecular chemistry of nucleic acids. Biosynthesis. Synthesis and manipulation of nucleic acids by chemical methods. Interaction with small molecules, proteins and metal complexes
CHAPTER 4. Carbohydrates and their derivatives. Structural and synthesis. Glycoconjugates and its role in cellular communication. Glycocode. Glycotherapy	Monosaccharides, nomenclature, structure and chemistry. Oligosaccharides and polysaccharides, nomenclature, structure. Structural determination of oligo-and polysaccharides. Biosynthesis, chemical synthesis and biological synthesis of oligosaccharides. Glycosides and glycosidase inhibitors: types, incidence in nature, methods of synthesis and biological applications. Glycolipids. Types of structures. Natural incidence. Biosynthesis. Functions. Glycoproteins. Types of structures. Natural incidence. Biosynthesis. Functions. The glycocode concept. Future prospects and scope thereof. Glycotherapy and Glycoconjugates known functions.

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	3	17.5	20.5
Case study	A2 A4 C1	0	1	1
Oral presentation	B1 B4 B7 B10 B11 C1	4	0	4
Mixed objective/subjective test	A1 A4 A3 A9 B1 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	
Oral presentation	
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**
Guest lecture / keynote speech	B2 B5 C3 C4		5
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
Mixed objective/subjective test	A1 A4 A3 A9 B1 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	A2 A4 C1		5
Oral presentation	B1 B4 B7 B10 B11 C1		5

Assessment comments

The evaluation of this course will be done by means of the continuous assessment 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 assessment (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 repeaters will have the same system of class attendance than those who study the course for first time.

Sources of information	
Basic	- Blackburn, M.: Gait, M.J.; Loakes, D.; Williams, D.M. (2006). Nucleic Acids in Chemistry and Biology. Rayal Society of Chemistry - Vranken, D-V; Weiss, G.A. (2012). Introduction to Bioorganic Chemistry and Chemical Biology. Garland Science - Alberts et all (2002). Molecular Biology of the Cell. Garland Science - Davies, B.G.; Fairbanks. A.J. (2004). Carbohydrate Chemistry. Oxford Science publications - Taylor, M.E.; Drickamer, K. (2011). Introduction to Glycobiology. Oxford University press - Hadjiliadis, N.; Sletten, E. (2009). Metal Complex-DNA Interactions. Wiley - Brändén, C-I; Tooze, J. (1999). Introduction to Protein Structure. Garland Science - Gutte, B. (1995). Peptides: Synthesis, Structures and Application. Academic Press - Dr. Norbert Sewald, Prof. em. Dr. Hans-Dieter Jakubke, (2009). Chemistry and Biology. John-Wiley - Chris R. Calladine, Horace R. Drew, Ben F. Luisi and Andrew A. Travers (2004). Understanding DNA, The Molecule & How It Works. Elsevier
Complementary	- Kaim, W. Schwederski, B.,Klein, A (2013). Bioinorganic chemistry, inorganic elements in the chemistry of life: an introduction and guide. John Wiley, Chichester - Driguez, H; Thiem, J. (1997). Glycoscience, Synthesis of Substrate Analogs and Mimetics. Springer-Verlag, New York

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
The Chemistry of Natural Products/610509118 Molecular Biology/610509117 Medicinal Chemistry/610509116
Subjects that continue the syllabus
Other comments

<p>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.</p><p> </p><p>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.</p>

(*)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.