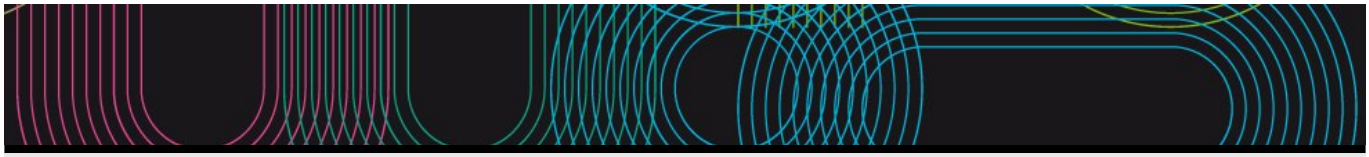

IDENTIFYING DATA				
Molecular Basis of Adaptation to the Marine Environment				
Subject	Molecular Basis of Adaptation to the Marine Environment			
Code	V02M098V01107			
Study programme	(*)Máster Universitario en Bioloxía Mariña			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	San Juan Serrano, María Fuencisla			
Lecturers	García Martín, Óscar San Juan Serrano, María Fuencisla			
E-mail	fsanjuan@uvigo.es			
Web				
General description	Molecular mechanisms underlying the phenomenon of adaptation. Integration of the biochemistry compared.			

Competencies	
Code	
A1	(*)Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, adoito nun contexto de investigación.
A2	(*)Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
A3	(*)Que os estudantes sexan capaces de integrar coñecementos e se enfrontar á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos.
A4	(*)Que os estudantes saiban comunicar as súas conclusións, e os coñecementos e razóns últimas que as sustentan, a públicos especializados e non especializados dun xeito claro e sen ambigüidades.
A5	(*)Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que terá que ser, en grande medida, autodirixido e autónomo.
B2	Búsqueda, análisis e integración de información a partir de diferentes fuentes y capacidad para su interpretación y evaluación
B5	Desarrollo de la habilidad de elaboración, presentación y defensa de trabajos e informes técnicos
B6	Desarrollo de la curiosidad científica, de la iniciativa y la creatividad
C2	Conocimiento de la diversidad de organismos marinos y sus estrategias adaptativas
C3	Conocimiento y comprensión de las interacciones de los organismos marinos y los ecosistemas marinos y costeros
C13	Divulgación de conocimientos de la biología y el medio marinos: programas de formación y docencia; planificación y dirección de acuarios, museos, centros de interpretación ambiental, parques naturales y espacios naturales protegidos
C14	Elaboración, discusión, interpretación, asesoramiento y peritaje de informes científico-técnicos, éticos, legales y socioeconómicos relacionados con el ámbito marino y pesquero
D1	Desarrollo de las capacidades comprensivas, de análisis y síntesis
D2	Desarrollo de la capacidad de razonamiento crítico y autocrítico
D4	Desarrollo de la capacidad para actualizar el conocimiento de forma autónoma
D7	Desarrollo de habilidades para la divulgación de ideas en contextos tanto académicos como no especializados

Learning outcomes	
Expected results from this subject	Training and Learning Results

Knowledge of basic mechanisms and adaptive strategies at molecular level	A1 A2 A3 B2 B6 C2 C3 C13 D1 D2 D4
Integration ability to understand the molecular basis of adaptive phenomena from the perspective of comparative biochemistry.	A2 A3 B6 C2 D1 D2
Ability to evaluate and interpret the effects of environmental changes from marine environment on organisms and their interactions.	A2 A3 B2 C2 C3 C14 D1 D2
Ability to obtain information, analyse it critically and apply it to the interpretation and sustainability of marine environments.	A2 A3 A5 B2 B6 C13 C14 D1 D2 D4
Ability to develop individual and / or team works, and to expose them and discuss them in public.	A3 A4 A5 B2 B5 B6 C13 D1 D2 D4 D7

Contents	
Topic	
Biochemical adaptation: basic mechanisms and strategies.	Biochemical adaptation. Basic mechanisms of the biochemical adaptation. The time of the biochemical adaptation.
Adaptive points of cellular metabolism.	Points of metabolic adaptation in glycolysis. Origin and phylogenetic distribution of the urea cycle. Adaptations of mitochondrial energy metabolism.
Adaptation of enzymes to metabolic functions.	Mechanisms of enzymatic regulation. The enzymes like protective elements.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to the limited oxygen availability.	Anaerobic metabolism of marine invertebrates. Anaerobic metabolism of marine vertebrates. Adaptation to hypoxia.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to salinity.	Osmoregulation in aquatic organisms. Response regulation to osmotic shock.
Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to temperature.	Compensatory mechanisms from poikilotherm organisms to temperature changes. Acclimatization mechanisms to temperature. Adaptation to ice.

Molecular and metabolic adaptation to the physical-chemical factors of the marine environment: Adaptation to pressure.	Effects of the hydrostatic pressure on the biological systems. Mechanisms of perception and compensation to the changes of pressure.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Seminars	4	10	14
Objective questions exam	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	In master sessions the teacher will give the fundamental concepts so that the student understands and can prepare the subject contents.
Seminars	In seminars, students will work aspects or bibliographic data related with subject, and will elaborate coments and oral and/or written presentations.

Personalized assistance

Methodologies	Description
Lecturing	The doubts resolution and necessary orientation in the personal work of the student will be attended through voluntary tutorships.
Seminars	The doubts resolution and necessary orientation in the personal work of the student will be attended through voluntary tutorships.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	The acquired theoretical knowledge will be assessed through a final test exam.	70	A1 A2 A3 A5		C2 C3	D1 D2
Seminars	In the work from seminars, the ability to relate the acquired knowledges and concepts, the correct use of specific terminology and the criticism and synthesis ability will be assessed.	30	A1 A2 A3 A4 A5	B2 B5 B6	C13 C14	D1 D2 D4 D7

Other comments on the Evaluation

The realization of seminars and / or bibliographic work is compulsory for passing the subject.

The final test exam is compulsory for passing the subject. The score in the themes given by each professor should be 3 in order to be take into account in the exam total score . The mean score of the exam will have to be of 3,5 (35% of the assessment of subject) for to sum the score of the seminars assessment.

Sources of information

Basic Bibliography

Complementary Bibliography

Atkinson D.E., **Cellular Energy Metabolism and its Regulation**, 1977

Di Prisco, G., **Life under extreme conditions**, 1991

Ewart K.V., **Fish antifreeze proteins. Molecular aspects of fish and marine biology**, 2002

Gilles E., **Animals and Environmental Fitness: Physiological and Biochemical Aspects of Adaptation and Ecology**, 1ª Ed, 1980

Hochachka, P.W. and Somero G.N., **Strategies of Biochemical adaptation**, 1973

Hochachka, P.W. and Mommsen T.P., **Metabolic Biochemistry**, 1995

Hochachka P.W and Somero G.N., **Biochemical Adaptation**, 2002

Le Gal, Y., **Biochimie Marine**, 1988

Lucas A., **Bioenergetics of Aquatic Animals**, 1997

Mathews-Van Holde, **Bioquímica**, 4ª Ed., 2013

Nelson D.L and Cox M.M., **Lehninger. Principios de Bioquímica**, 6ª Ed., 2014

Salway J., **Metabolism at a glance**, 2004

Somero G.N., Lockwood B.L., Tomanek L., **Biochemical Adaptation: Response to Environmental Challenges from Life's Origins to the Anthropocene**, 1ª Ed, 2017
Urich, K., **Comparative Animal Biochemestry**, 1994

Recommendations

Subjects that continue the syllabus

Physiology of Marine Organisms/V02M098V01106

Subjects that are recommended to be taken simultaneously

Marine Ecology/V02M098V01105
Physiology of Marine Organisms/V02M098V01106
Marine Zoology/V02M098V01103

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide *antelación) by the students and the *profesorado through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep : ALL

* educational Methodologies that modify : ANY

* no face-to-face Mechanism of attention to the students (*tutorías): THE PERSONALISED ASSISTANCE WILL TAKE PLACE IN THE VIRTUAL CLASSROOMS THAT THE PROFESSORS HAVE ENABLED IN HIS RESPECTIVE UNIVERSITIES.

* Modifications (if they proceed) of the contents to give: NOT PROCEED

* additional Bibliography to facilitate the car-learning

* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Pending proofs that keep
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Proofs that modify
[previous Proof] =&*gt; [new Proof]

* New test

* additional Information

- THE CONTENT AND PRESENCIALIDAD OF LECTURING AND SEMINARS WILL BE MAINTAINED THE SAME THAT IN NORMAL CIRCUMSTANCES.

- THE EVALUATION TESTS AND THE WEIGHT OF EACH ONE IN THE NOTE OF THE SUBJECT WILL BE THE SAME THAT IN NORMAL CIRCUMSTANCES.

- IN CASE OF MIXED OR VIRTUAL TEACHING, IT WILL BE IN THE VIRTUAL CLASSROOM THAT THE PROFESSORS HAVE ENABLED