



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2023/2024		
BACHELOR'S DEGREE (BSC)	NATURAL AND ENVIRONMENTAL SCIENCES		
INTEGRATED COURSE	ENVIRONMENTAL GEOCHEMISTRY AND BIOCHEMISTRY - INTEGRATED COURSE		
CODE	22603		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	GEO/08, BIO/10		
HEAD PROFESSOR(S)	VARRICA DANIELA	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	VARRICA DANIELA	Professore Associato	Univ. di PALERMO
CREDITS	9		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	VARRICA DANIELA Tuesday 15:00 16:00 presso lo studio sito in via Archirafi 36 III piano		

DOCENTE: Prof.ssa DANIELA VARRICA

PREREQUISITES	Basic theoretical and computational knowledge of mathematics and chemistry are required to understand environmental geochemical processes and basic knowledge of biology in order to understand the mechanisms of action in biochemical processes.
LEARNING OUTCOMES	<p>By means of the scientific concepts acquired during the course, the student will develop the ability to activate and coordinate surveys aimed at studying the geochemical aspects of natural ecosystems with special emphasis on the natural and anthropogenic processes relevant in determining the stability, movement, and reactivity of elements at the earth surface.</p> <p>The student will be able to independently assess the results of environmental monitoring and the impact of human activities on the environment.</p> <p>Ability to present oral and written topics related to environmental issues with competence and scientific expertise.</p> <p>The expected learning outcomes will be assessed throughout the training program by whole-class discussions and verification tests. The level and degree of learning will be assessed by final examination.</p>
ASSESSMENT METHODS	<p>The final test consists of a conversation aimed to assess skills and subject knowledge gained during the course.</p> <p>The threshold of sufficiency will be achieved when the student shows knowledge and understanding of the topics at least in the general guidelines and has minimal application skills; he/she must equally have exhibits and arguments that enable him to convey his/her knowledge to the examiner. Below this threshold, the examination will be insufficient. Instead, the student manages to interact with the examiner with his/her argumentative and exhibition skills, and the more his/her knowledge and application skills go into detail of the discipline being tested, the more the evaluation will be positive. The final exam score will be done in thirtieth.</p> <p>Excellent (30-30 cum laude). Excellent knowledge of the topics, excellent language skills, good analytical skills, the student is able to apply the knowledge to solve the proposed problems.</p> <p>Very good (26-29). Good mastery of the topics, full property of language. The student is able to apply his/her knowledge to solve proposed problems.</p> <p>Good (24-25). The student reached a basic knowledge of the main topics, and discrete properties of language, with limited ability to independently apply his/her knowledge to the solution of the proposed problems.</p> <p>Satisfactory (21-23). The student does not have full mastery of the main topics of teaching, but he/she possesses the knowledge, satisfactory property language, and poor ability to independently apply the acquired knowledge.</p> <p>Sufficient (18-20). The student has a minimum basic knowledge of the main topics and technical language issues, very little or no ability to independently apply the acquired knowledge.</p> <p>Insufficient - The student does not have an acceptable knowledge of the contents of the topics covered in the course.</p>
TEACHING METHODS	Frontal lectures and laboratory

**MODULE
ENVIRONMENTAL BIOCHEMISTRY**

SUGGESTED BIBLIOGRAPHY

David L. Nelson Michael M. Cox I PRINCIPI DI BIOCHIMICA DI LEHNINGER (Settima edizione) ed. Zanichelli. ISBN 978-88-08-92069-0

M.Lieberman, A. Marks - Biochimica Medica – (II Edizione). Casa Editrice Ambrosiana. ISBN 978-88-08-18217-3

AMBIT	10703-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	51
COURSE ACTIVITY (Hrs)	24

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide the appropriate knowledge and understanding of the molecular basis of biological systems and of the biochemical mechanisms that regulate cellular metabolic activities. The main pathways of energy metabolism (anabolism and catabolism) through which biological macromolecules are assimilated, degraded and used by prokaryotic and eukaryotic organisms (animals and plants) will be presented, as well as the mechanisms of metabolic, hormonal and body mass regulation in the presence of environmental stress inducers. Particular attention will be given to the mechanisms of signal transduction, to the damage by free radicals and to the toxicity of xenobiotic molecules of environmental interest in relation to the loss of control of the biochemical mechanisms that regulate the cycle and programmed cell death.

SYLLABUS

Hrs	Frontal teaching
4	BIOSIGNALING. Receptors and signal transduction mechanisms. Controlled ion channels. Regulation of transcription by nuclear hormone receptors. Cell cycle regulation.
8	ENERGY METABOLISM. Anabolism and catabolism. Principles of metabolic regulation. Metabolism of carbohydrates, lipids and amino acids: biosynthesis and degradation.
4	HORMONAL REGULATION AND INTEGRATION OF METABOLISM IN MAMMALS. The hormones. Hormonal regulation of energy metabolism. Body mass regulation.
3	BIOCHEMISTRY OF CANCER. DNA damage that can cause mutations. Oncogenes. Tumor suppressor genes. Cancer and apoptosis.
3	OXYGEN TOXICITY AND DAMAGE FROM FREE RADICALS. Production of reactive oxygen and nitrogen species and interaction with cellular components. Cellular defense systems against oxygen toxicity.
2	DETOXIFICATION PROCESSES. Phase I reactions. Mechanism of action of cytochrome P450 monooxygenase. Phase II reactions. Other detoxification processes.

MODULE ENVIRONMENTAL GEOCHEMISTRY

Prof.ssa DANIELA VARRICA

SUGGESTED BIBLIOGRAPHY

Dongarra' G. & Varrica D. (2004). Geochimica e Ambiente. EdiSes
Appunti del docente

AMBIT	50175-Doiscipline di scienze della Terra
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

Course objectives are designed to provide students with advanced knowledge of the chemical composition of atmosphere, hydrosphere and lithosphere. Particular attention will be devoted to the distribution of chemical elements in the various geo-sectors and the laws governing their mobility throughout the earth surface.

SYLLABUS

Hrs	Frontal teaching
4	ATMOSPHERE: Origin of the atmosphere. The structure of the atmosphere. Tropospheric temperature gradient. Ozone layer.
6	ATMOSPHERE: Chemical composition of the atmosphere. Pollutants: nitrogen oxides, carbon monoxide and carbon dioxide, sulphur oxides
4	ATMOSPHERE: benzene, dioxin , Asbestos, particulate matter, nanoparticles. The effects of volcanic eruptions. Global warming and climate change. Atmospheric dispersion modeling
2	HYDROSPHERE: Chemical and physical properties of water. Water cycle.
4	HYDROSPHERE: The chemical composition of the seawater. Removal processes.
4	HYDROSPHERE: chemical composition of groundwater. Water-rock interaction.
6	HYDROSPHERE: Carbonate dissolution. Chemical weathering of silicate rocks. Langelier-Ludwig diagram. Eh-pH diagrams and redox equilibria in natural waters.
2	HYDROSPHERE: Rainwater chemistry
2	LITHOSPHERE: Soils geochemistry
4	Environmental geochemistry of isotopes: Radioactive decay. Law of radioactive decay. Radon. Radiocarbon. Use of stable lead isotopes. Nuclear fission
2	Applications of environmental Geochemistry to Medical Geology
Hrs	Workshops
6	Description of tools used in environmental geochemistry
4	Theoretical description: Ion chromatography, ICP-MS and UV-Vis spectrophotometry
4	Determination of carbonate and bicarbonate in water sample by titration
2	Use of the Water Classification Diagrams