



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2022/2023		
MASTER'S DEGREE (MSC)	ANALYSIS AND ENVIRONMENTAL MANAGEMENT		
INTEGRATED COURSE	BIOINDICATORS - INTEGRATED COURSE		
CODE	18671		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	BIO/05		
HEAD PROFESSOR(S)	CAMMARATA MATTEO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	PARISI MARIA GIOVANNA	Professore Associato	Univ. di PALERMO
	CAMMARATA MATTEO	Professore Ordinario	Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>CAMMARATA MATTEO Monday 09:00 11:30 Viale delle Scienze ED 16 Dipartimento della terra e del mare</p> <p>PARISI MARIA GIOVANNA Monday 10:00 12:00 Viale delle Scienze, Edificio 1690128 Palermo Tuesday 11:00 13:00 Polo territoriale di Trapani Sedi di svolgimento delle attività didattiche (Principe di Napoli, TP) Colloquio on line per appuntamento Wednesday 10:00 12:00 Viale delle Scienze, Edificio 1690128 Palermo</p>		

DOCENTE: Prof. MATTEO CAMMARATA

PREREQUISITES	Zoology basic knowledge
LEARNING OUTCOMES	<p>1. Knowledge and comprehension. The student will acquire the skills and will learn the methods to observe, describe and study all the component of animal Welfare, bioindicators and biomarker .</p> <p>2. Applying Knowledge and comprehension. The student will also develop the capacity of deeply understand the specific literature presenting the most recent researches on animal welfare. The student also assesses and quantifies the effects of environmental and anthropic stress on different hierarchical scales of biological organization. This ability will be encouraged by projecting examples of recently published papers during the classes.</p> <p>3. Autonomous thinking Targeted questions will be posed during classes. This will lead the student to the ability required for critically discuss his/her own observations and the conclusions derived.</p> <p>4. Communication ability. Ability to be clear presented and properties Language skills aquired and to disclose with scientific strictness. Aquisition of the relational capacity indispensable to collaborate in multidisciplinary studies in the laboratory and in the field.</p> <p>5. Learning ability. All the activities described above will allow the acquisition of the methodological tools necessary for the student to prosecute his/her studies or to apply his/her competences in a workplace and to autonomously perform indispensable updates.</p>
ASSESSMENT METHODS	<p>EXAM: midterm and final oral exam. The student will be evaluated based on the level of knowledge of the subjects and the ability to link between them, the clarity and the use of a specialized scientific language. EVALUATION CRITERIA -assessment: excellent, grade: 30 - 30 cum laude, excellent knowledge of the topics of the course, excellent use of language, excellent analytical capacity, ability to apply knowledge to problem solving; - assessment: very good, grade: 26-29, good knowledge of the topics of the course, correct use of language, good analytical capacity, ability to apply knowledge to problem solving; - assessment: good, grade: 24-25, good knowledge of the main topics of the course, correct use of language, limited ability to autonomously apply knowledge to problem solving; - assessment: satisfactory, grade: 21-23, partial knowledge of the topics of the course, satisfactory use of language, limited ability to autonomously apply knowledge to problem solving; - assessment: sufficient, grade: 18-20, minimal knowledge of the main topics of the course and of technical language, scarce ability or inability to autonomously apply knowledge to problem solving; - assessment: fail, insufficient knowledge of the topics of the course.</p>
TEACHING METHODS	<p>The didactics will be developed in parallel with the two teachers in relation to their respective competences and integrations, with classroom lessons, exercises and laboratory. During the courses the teachers will also provide students with specific study material and lecture presentations .</p>

MODULE
DEFENCE SYSTEMS AND ANIMAL WELLBEING

Prof. MATTEO CAMMARATA

SUGGESTED BIBLIOGRAPHY

Alcock John ETOLOGIA Zanichelli
Dispensa fornita dal docente su immunita' e ormoni, stress e ambiente
Perche' alle zebre non viene l'ulcera. Robert M. Sapolsky (approfondimento)
Compendio di immunobiologia Comparata. Ottaviani. Piccin.
Materiale didattico e indicazioni sulla legislazione corrente distribuito dal docente

AMBIT	50576-Discipline biologiche
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

To provide the student of the knowledge and the skills required for the observation, the description and the analysis of the processes associated with the immune and stress response including the metazoan behavior. To provide the student of the proper and technical language. To update the student on the state-of-art of the most relevant topics for the study and applications in stress responses and animal welfare and immunobiology responses describing the recent, relevant and most cited articles will be presented during classes.

SYLLABUS

Hrs	Frontal teaching
10	Cases of natural animal histories Behaviour : proximate and remote causes, simple and complex behaviour. Innate and learned behaviours.habituation, sensitization and associative learning. Play activity, consciousness and ritualization
8	stress immunity and disease, Evolution of immunity and the Red Queen hypothesis
8	Stress and Behaviour: Definition of stress, biological and physiological basis, behavioral consequences of stress. Stress and pain, stress and memory, aging and death.
4	Biodiversity and the environment. The European roles for the Protection and Conservation of Biodiversity
4	The necessity and animal freedom Animal welfare: ethological strategies and limitations induced by environmental changes. The human-animal interaction from past to present.
4	Animal Welfare: Directive and regulations, Protection of animals used for scientific purposes, ethical aspects
2	Environmental stress and natural selection
Hrs	Practice
16	Construction of experimental plans for ethological approaches. Selection, experiment setting and observations of animal model . Application of scientific methods to the study of defense systems and animal welfare.

MODULE ZOOLOGY FOR BIOLOGICAL MONITORING AND CONTROL

Prof.ssa MARIA GIOVANNA PARISI

SUGGESTED BIBLIOGRAPHY

Dispense (PDF) relative al programma svolto durante il corso.
Biological Monitoring: Theory and Applications—Bioindicators and Biomarkers for Environmental Quality and Human Exposure Assessment

AMBIT	21017-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide knowledge of the functional mechanisms that are the basis of the interactions between animals and the environment, with particular reference to the marine environment, and to define the parameters of the induced stress both from natural variables that from anthropogenic activities.

The basis for monitoring the quality of the environment is provided e the identification of biomarkers in biological monitoring programs e environmental impact assessment. Students will be directed to the knowledge of bioindicators descriptors of natural systems and biomarkers a different spatial scales to understand the responses to chemical , physical and anthropogenic disturbances in a multidisciplinary context. Finally, methods will be studied for the detection and evaluation of molecular markers to be used in the study of adaptive molecular evolution and responses to stressors. The students they will be encouraged to learn the use of free software, in the study of biomarkers and professional applications

SYLLABUS

Hrs	Frontal teaching
3	Concept of bioindicator and its importance as a tool for analyzing ecosystem complexity. Animal models. Bioindication at different levels of biological organization
3	Main types of stressors Evaluation and quantification of the responses of organisms to environmental stressors. Biomarker of effect ed exposure. Bioaccumulation and biomagnification
3	Environmental pollutants (toxic solvents, alcohols, pesticides). Definition of xenobiotic. Solubility of xenobiotics. The enzymes of xenobiotic metabolism and their localization. Free Radicals: Definition of free radical and chain reaction. Reactive oxygen species (ROS). Oxidative stress
8	Biomarkers classification: Metabolic products, responses in terms of induction / inhibition of protein synthesis, enzymatic responses. Biomarkers of genotoxicity, histopathological and morphological alterations, behavioral biomarkers. Use of Biomarkers to highlight the Stress Syndrome in sentinel organisms and their appropriate use in biomonitoring programs
6	Chemical Exposure Risk and Reach Regulation. Macroinvertebrates and vertebrates as a tool for the evaluation of anthropogenic disorders and stress in the aquatic ecosystem
4	Especially in biomonitoring. Gradients in biodiversity and "hot spots". Alien species and i changes in biodiversity Ecological and biotic indices: theory and applicative aspects Biomarkers and community study. Biotic indices.
4	Molecular marker technology. Population markers and bioindicators. Rates of variation DNA. Analytical methods and techniques for the determination of molecular and biochemical markers
6	Cellular and molecular bioassays and biosensors for environmental monitoring
Hrs	Practice
16	Applications of scientific methods to the study of environmental biomonitoring. Observations of Phyla model specimens of interest. Assessment of biomarkers in the laboratory on bioindicator organisms. Bioinformatics applications.