UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2016/2017
MASTER'S DEGREE (MSC)	MOLECULAR AND HEALTH BIOLOGY
SUBJECT	BIOCHEMICAL MECHANISMS OF CELLULAR FUNCTIONS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50507-Discipline del settore biomolecolare
CODE	15559
SCIENTIFIC SECTOR(S)	BIO/10
HEAD PROFESSOR(S)	GIULIANO MICHELA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GIULIANO MICHELA** Monday 13:30 14:30 Studio personale, Plesso di Biochimica del Dipartimento STEBICEF, Edificio 15, Policlinico universitario, Via del Vespro, 129, piano terra Tuesday 13:30 14:30 Studio della docente, Plesso di Biochimica del Dipartimento STEBICEF, Policlinico universitario, Edificio 15, Via del Vespro, 129, piano terra Wednesday 13:30 14:30 Studio della docente, Plesso di Biochimica del Dipartimento STEBICEF, Policlinico universitario, Edificio 15, Via del Vespro, 129, piano terra Thursday 13:30 14:30 Studio della docente, Plesso di Biochimica del Dipartimento STEBICEF, Policlinico universitario, Edificio 15, Via del Vespro, 129, piano terra

DOCENTE: Prof.ssa MICHELA GIULIANO

PREREQUISITES	Concepts of Biochemistry (basic concepts of protein structure and function, post-translational modifications, protein folding).
LEARNING OUTCOMES	Acquisition of knowledge and advanced tools for designing experimental routes consistent and applicable to scientific research in the field of protein biochemistry and the cellular signal transduction. Gaining the ability to participate in the design of experimental plan and to understand and interpret the results through shared discussion of scientific problems. Acquisition, through personal reading and discussion, of the ability to critically evaluate the scientific and experimental strategies suitable for resolving problems. Students are guided to enrich their judgment through the study and discussion of widespread scientific problems. Gaining the ability to expose results of a scientific problem in a coherent and suitable way even to a non-expert public. Constant monitoring of the ability to deal with a biochemical problem under different aspects, and to upgrade with consultation of scientific publications and data base in biochemical area. This is aimed to the acquisition of the ability to follow doctoral courses, second level master or advanced courses and seminars in the specific fields.
ASSESSMENT METHODS	Oral examination aimed at the investigation of the acquired abilities and skills. The examination consists of at least three questions one of which could be the discussion of a scientific article related to the subjects of the course.
EDUCATIONAL OBJECTIVES	The course aims to provide students with advanced tools for: -Understanding of structure/function relationship of biological molecules, in particular of the proteins, and its role in the control of cellular processes; --Understanding the ability of cells to integrate signals from cell membrane and to develop consistent and adequate metabolic or cellular responses; --- Acquire a good skill of the scientific method of investigation.
TEACHING METHODS	The course includes lectures.
SUGGESTED BIBLIOGRAPHY	Essendo un corso di approfondimento, vengono forniti agli studenti i necessari strumenti per lo studio della disciplina; in particolare vengono fornite le diapositive proposte in aula corredate dalla bibliografia di riferimento per uno studio critico e approfondito. Being an in-depth course, the necessary tools for the study of the discipline, consisting in the slides presented in the classroom accompanied by relevant bibliography for a critical study, are provided to the students.

SYLLABUS

Hrs	Frontal teaching
2	Presentation of the course and analysis of objectives. The problem of proteostasis. Regulators and controllers of the proteostasis in the cellular environment. The quinary as the fifth protein structural level.
10	Subcellular localization of proteins and quality control. Mitochondrial import: The complexes of the mitochondrial translocase and their specific roles. Import pathway of proteins with pre-sequence and with sorting signal. Import of beta-barrel proteins and carriers for metabolites. Mitochondrial quality control. Different mitochondrial UPR levels. The matrix proteases. Mitochondrial misfolded protein degradation. ROS as inducers of reversible post-translational modifications. Mitochondrial fusion and fission. Nuclear import and export: introduction to the structure of the nuclear pore. Description of the process and the proteins involved in nuclear import. Unconventional systems for nuclear import. Reticular import. SRP particle. The ER role in quality control. The calnexin-calreticulin cycle. The UPR. activation and proteins involved. The UPR phases. Crosstalk UPR / apoptosis and proteins involved.
10	Protein folding. The compromise stability-protein flexibility. Energy of folding. Thermodynamic funnel . Intermediates on and off pathways. Terminally misfolded intermediates. The principles of folding in the cell. Classification of protein chaperones. Structure and mechanism of action of HSP70. The ATP hydrolysis cycle in chaperones. The group I and II chaperonines. HSP90. Conformational changes and ATP cycle. HSP90 post-translational modifications and nuclear roles. The principles of the pathologies from misfolding. The assumptions on the conformational switch. Biochemical basis dell'Alzheimer. Beta-amyloid structures. The misfolding of alpha-synuclein and Parkinson disease. The role of oxidative stress. Prion disease. Differences between cellular PrP and Scrapie. Formation of different forms of cellular and pathological PrP. Intrinsically unstructured proteins, moonlighting proteins and protein chameleon. Thermodynamics of IDPs. Functions associated with unstructured domains.
8	Protein degradation systems. The degradation machinery of the cell. Structures and functions of the 20S and 26S proteasome. Degradation and activation by proteolysis. The ubiquitination process. The enzymes of the ubiquitination. Classification of E3 ligase enzymes. The degradation by default of 20S proteasome. Autophagy as an alternative degrading system. Cross-talk proteasome / autophagy. The lysosomal degradation.
8	Post-translational modifications of proteins. The combinatorial code of post-translational modifications. The mono- and poly- ubiquitination. sumoylation and ubiquitination: two mutually exclusive changes. The regulation of Nf-kB system. The post-translational modification by acetylation. Enzymes involved and regulatory significance. The acetyloma. Methylation: the methyloma, significance of methylation of non-histone proteins. Notes on the histone code. Prenylation, poly-ADP ribosylation of transcription factors and their roles in transcriptional regulation.

SYLLABUS

Hrs	Frontal teaching
10	Signal transduction. Differences in cell signalling pathways and networks. Roles of scaffold proteins in cell signalling. Examples of scaffold: AKAP, homer. The role of beta-arrestin proteins in the diversification of signal transduction associated receptors to seven transmembrane helices. The networks in cell signalling. critics and insulin pathway nodes. Proliferative and cell death signal transduction. Transduction pathways of the death signal. Intrinsic and extrinsic apoptosis, necropoptosis. An example of study of the activation of NF-kB factor. The autophagic route: pro survival or pro-death, crosstalk between autophagy and apoptosis. An example of a autophagy signal study of in experimental models of cancer cells in vitro.