UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	BIOTECHNOLOGIES FOR INDUSTRIES AND SCIENTIFIC RESEARCH
SUBJECT	SYSTEMIC BIOLOGY
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50596-Discipline biologiche
CODE	19752
SCIENTIFIC SECTOR(S)	BIO/13
HEAD PROFESSOR(S)	ROMANO VALENTINO Cultore della Materia Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**ROMANO VALENTINO** Wednesday 15:00 17:00 Studio docente Dipartimento STEBICEF - Viale delle Scienze edicifio 16 piano terra corridoio docente

DOCENTE: Prof. VALENTINO ROMANO

PREREQUISITES	The knowledge that must be possessed by the student at the beginning of the course of Systems Biology (delivered to the second semester of the academic year) are those ones acquired during the first half of the attendance at other courses of the Degree in Biotechnology for the Industry and Scientific Research, i.e., "Functional genomics" "Advanced Molecular Biology" and "Biology of cell differentiation".
LEARNING OUTCOMES	Knowledge and ability to understand At the end of the course of Systems Biology, the student will acquire specialist theoretical knowledge and, in particular, the theoretical principles and methodology of several omic sciences and their impact for biomedicine, ecology and research in the areas of Developmental Biology, neuroscience and evolution. Ability to apply knowledge and understanding The student will be able to apply the knowledge acquired in preventive, diagnostic, therapeutic and theoretical and aplied biological research. Through the illustration of the various case studies treated in the course, the student will learn to use the knowledge on complex biological systems and the importance of the interaction of a multiplicity of factors acting at the various levels of biological organization from the genome to the whole organism and how these interactions are influenced by environmental factors. Consultation and use of some databases and softwares (free access) of interest for genomic medicine Autonomy of judgment The student will become aware of the growing importance of omic research in the scientific context of the evolution of biological and biomedical thought, which is increasingly informed by a non-deterministic view of the relationship between etiological factors and phenotype. In this perspective the student will acquire an awareness of the role of complexity, uncertainty and probability in the study of biological systems and will be able to formulate hypotheses, collect and critically evaluate the omic data toward a solution of problems. Moreover, it will be able to evaluate which are the structural and functional alterations of the genome that are more likely to express themselves phenotypically. Communication skills The student will acquire the ability to communicate and express issues related to the topics covered in the course. Learning skills The student will be able to collect, select, organize and interpret correctly and autonomously the basic concepts of Systems Biology through the consultation of articles in popular scientific journals (eg the Sciences) and specialist, especially in English, and of the numerous resources available on the Internet, integrating them with the topics that will be dealt with in the classroom. The student will also be started to use some bioinformatic technologies and databases freely accessible on the Internet.
ASSESSMENT METHODS	The tests that contribute to the assessment of the student are 3: (a) a presentation ppt on a topic assigned by the teacher to be given after the beginning of the lessons ("in itinere test") lasting 15 ', (b) a multiple choice test with 31 quizzes to be undertaken after the end of the lessons lasting 60 '(c) a practical test on the computer to be undertaken at the end of the lessons lasting up to 15'. The final score in thirtieths will be an average of the scores obtained in each of the three aforementioned tests. The above three tests are reserved only for students who will follow at least 75% of the lessons. Students who will follow a number of lessons less than 75% will have to take only the oral exam on the day of the verbalization of the grade. The student has the faculty not to undertake the above three tests (a, b, c) or not to accept the evaluation obtained. In this case the student will have to take an oral exam. All students who will have to take the oral exam will have to answer questions regarding the program, with reference to the teaching material provided (slides of the lessons and various notes) and recommended (textbooks, articles, websites, etc.). The evaluations described above are aimed at assessing whether the student (i) has knowledge and understanding of the topics, (i) has acquired interpretative competence and independent judgment of concrete cases, (iii) has both in possession of adequate analytical and exhibition capacity. The exam is passed with the vote of 18 which corresponds to the student's possession of the minimum knowledge of the teaching contents, limited to the main topics. Progressively higher grades (from 19 up to a maximum of "30 e lode") will be assigned on the basis of the preparation and skills shown by the student in the performance of the aforementioned tests.
EDUCATIONAL OBJECTIVES	To acquaint students with the theoretical principles and technologies used in the various omics and in the "synthetic biology" and their relevance for the study and clinical management of human pathologies and the study of important biological processes such as development, evolution, neuroscience with the presentation of specific application examples.
TEACHING METHODS	Lectures and Bioinformatics Laboratory
SUGGESTED BIBLIOGRAPHY	

	Ginsburg G.S. & Willard H.E. - Essentials of genomics and personalized medicine - Elsevier 2010 Articoli scientifici - Materialo vario disponibile in Internet (videos, databases, softwares etc.). Le slides delle lezioni

SYLLABUS

Hrs	Frontal teaching
4	Introduction to Systems Biology: Definitions of System and Systems Biology - Complexity in Biological Systems - Levels of Biological Organization and their Emerging Properties - Quantitative (Statistical and Mathematical) and Computational Methods Used in the Study of Biological Systems - "Top-Down" and "bottom-up" approaches - Epistemological aspects of Systems biology Informazioni su Google TraduttoreCommunityPer cellulariTutto su GooglePrivacy e TerminiGuidaInvia commenti Fai clic per modificare e visualizzare le traduzioni alternative
2	Basics of descriptive statistics
2	Introduction to statistical inference
10	Omics and related technologies - Structural and functional genomics - Microbiomics - Metagenomics - Proteomics - Metabolomics - Cellomics - Connectomics - Bibiliomics - Other omics - Single-cell omics - Multi-omics - Databases for omic data - The annotation problem - The biomaRt package in R
6	Models and data analysis - Types of models: in vivo, in vitro, computational, textual, graphical, statistical, mathematical - Models of the cell, organs, whole organisms
10	Biological networks. Introduction to the graph theory – Topological analyses of biological networks and related statistical methods – Networks of genes, RNAs, proteins, metabolites and hybrid networks - Modules and motifs in biological networks and methods used for their identification - Dynamic analysis of biological networks: boolean models and their computational implementation – Cytoscape software – The Boolnet package in di R.
4	Synthetic biology. Classification of the main applications of Synthetic Biology: (i) bioengineering, ii) synthetic genomics, iii) protocells, iv) unnatural molecular biology v) in silico approaches. Forward & reverse engineering - Synthesis of biofuels, oil, rubber, aromatic biomedical substances, - Synthesis of organisms for bioremediation of contamineted waters and soils – 3-D printing of tissues and organs – Artificial life - Minimal life
4	Systems medicine. Personalized medicine - Network medicine – Diseasome – Identification of biomarkers, therapeutical targets and related drugs and their clinical use - Presentation of specific case studies (autism, cancer and other diseases) – Construction and use of classifiers for the genetic and phenotypic stratification of patients.
4	Emerging disciplines derived from Systems Biology (short description) : Systems neurosciences - Developmental systems biology – Echological and Evolutionary systems biology

Hrs	Practice
2	Introduction to R programming