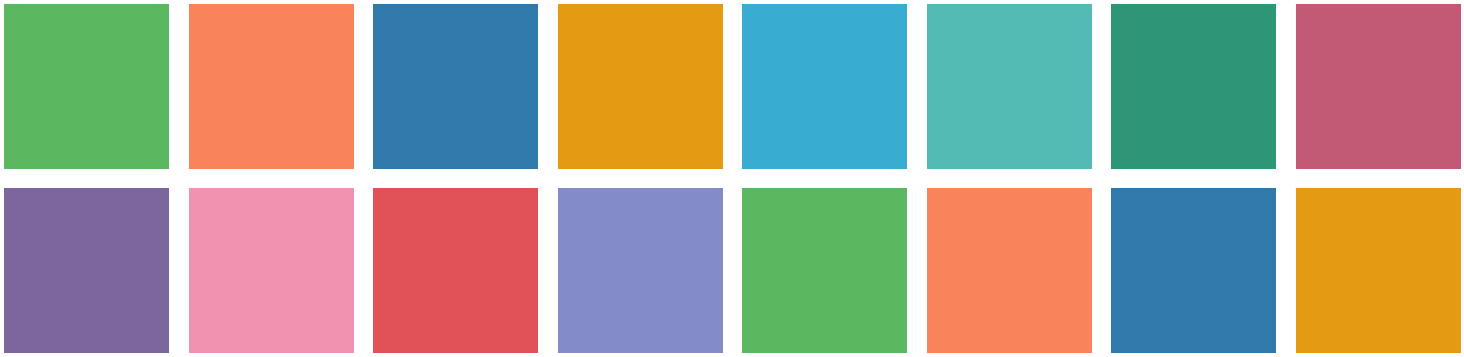
UNIVERSITÀ
DEGLI STUDI
DI TORINO

010077

COURSES BROCHURE



Master Program in Molecular Biotechnology

Indice

Analytical Chemistry

Chimica Analitica

Academic year:	2017/2018
Course ID:	BIO0133
Teacher:	Prof. Claudio Medana
Teacher contacts:	0116705241, *claudio.medana@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/01 - chimica analitica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written

PREREQUISITES
Basic knowledge of extractive and separation techniques. Principles of mass spectrometry. Elements of analytical chemistry, organic chemistry and biochemistry.

PROPEDEUTIC FOR
This teaching is a point of arrival. It is not propaedeutical.

COURSE OBJECTIVES

The teaching is part of the general objective of the course to provide knowledge and skills in the field of analytical biological chemistry, with particular reference to the knowledge and understanding of instrumental analytical methodologies currently in use in the laboratories of chromatography-mass spectrometry:

1) Detailed knowledge of extractive procedures of different classes of biomolecules (based on investigation of structure-chemical physics properties relationships).
2)Learning of instrumental analysis techniques (GC-MS and HPLC-MS).
3)Learning of basic mechanisms of mass spectra interpretation both of electronic impact and electrospray for a reliable identification of biological molecules.
4)Detailed definition of analytical pattern of particular complexity like those concerning the MS analysis of proteins.

COURSE AIMS

Knowledge of analysis procedures of different classes of biological molecules. Sample preparation and clean-up, chromatography and MS skills, in particular in impurity profiling and quantitation and in proteomic analysis.

COURSE DELIVERY

5 CFU (40 h) lectures.

LEARNING ASSESSMENT METHODS

Written examination. Multiple questions requiring short and targeted answers.

SUPPORT ACTIVITIES

The presentations slides toghether with depth study papers are available in the e-learnig UniTO moodle website.

SYLLABUS

LC-MS concepts. Chemical structure of drugs and biomolecules. ionization of biomolecules, pKa.

Preanalytical phase: Biomolecules concentration level. Extraction, Clean-up. Deproteinization. Matrix effect. Liquid-liquid extraction. Solid Phase Extraction. Immunoaffinity extraction. Molecular imprinted polymers. SPE examples: mixed mode, SCX, SAX, RAM, MIP, low-volume.

Chromatography: principles. Chromatographic parameters: efficiency, selectivity, capacity factor, resolution. Van Deemter equation. GC: derivatization, detectors. LC: instrumentation, stationary and mobile phases, detectors. SFC. CE.

Mass Spectrometry. Introduction. EI fragmentation. Odd and even electron ions. N rule. Sigma bond and alpha cleavage. Rearrangements. Chemical Ionization, PTR, ESI, NSI, APCI, APPI, MALDI, DESI, ambient ionization techniques. ICP-MS. LC-MS fundamentals. LC-MS applications. Peptidomics, Proteomics and Metabolomics.

SUGGESTED TEXTBOOKS AND READINGS

Jurgen H. Gross, Spettrometria di massa, EdiSES 2016 (Mass Spectrometry, Springer-Verlag 2011)

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=ois6

Biochemistry

Biochimica

Academic year:	2017/2018
Course ID:	BIO0108B
Teacher:	Carola Ponzetto
Teacher contacts:	0116334566, *carola.ponzetto@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/10 - biochimica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

COURSE OBJECTIVES

English

Biochemistry
Educational Aims

The aim of this course is to give an overview of the most recent advances in cancer 's metabolism, an area of research that has gained considerable interest since metabolic imaging can significantly impact patient management by improving tumor staging, restaging, radiation treatment planning, and monitoring of tumor response to therapy.

Italiano

Biochimica
Obiettivi formativi

Lo scopo di questo corso è quello di fornire un quadro dei più recenti progressi nel campo del metabolismo del cancro, un area di ricerca che ha assunto particolare interesse per la possibilità, trasferendo queste conoscenze al perfezionamento dell'imaging metabolico, di contribuire in maniera significativa alla diagnostica e al monotoraggio della risposta alla terapia.

COURSE AIMS

English

Biochemistry
Expected results

It is expected that the student will become acquainted with 1) the molecular mechanism underlying the metabolic alterations linked in cancer to the activation of oncogenes, to the loss of tumor suppressors, or the lesions in metabolic genes, 2) the technical opportunities for non-invasive imaging of these metabolic alterations, 3) the potential clinical applications of these techniques

Italiano

Biochimica
Risultati attesi

E' atteso che lo studente apprenda:

- i meccanismi molecolari alla base delle deviazioni metaboliche che si accompagnano nel cancro all' attivazione di oncogeni, alla perdita di funzione di oncosoppressori, o alle lesioni di geni metabolici,
- le possibilità tecniche per effettuare l'imaging di questi metaboliti anomali, 3) le possibili applicazioni cliniche di queste tecniche.

COURSE DELIVERY

English

Biochemistry

The exam will consist in the oral presentation (max 30 min), using power point slides, of a recent scientific article chosen from a list proposed by the teacher. The students are invited to start their presentation with an adequate introduction. After the oral presentation there will be a session of questions based on three review articles indicated by the teacher.

Italiano

Biochimica

L'esame consisterà nella presentazione approfondita di un articolo recente, scelto tra una lista di possibili articoli suggeriti dalla docente, inquadrando l'argomento mediante un'introduzione adeguata. Tempo a disposizione max 30min. Segue quindi una sessione di domande su tre reviews su Cancer and Metabolism fornite dalla docente

SYLLABUS

English

Tumor metabolism has gained considerable interest in the field of imaging since in recent years biochemical studies have revealed that the activation of specific oncogenes (or the loss of tumor soppressors) lead to precise metabolic alterations.

In this course metabolism will be revisited in light of the adaptations imposed by the activation of oncogenes, the loss of tumor suppressors, or the mutations of metabolic genes.
The imaging techniques available to measure the metabolism of glucose, lipids and aminoacids will be discussed. Examples of the usefulness of metabolic imaging in diagnostics and in monitoring the response to therapy will be given.

Italiano

Il metabolismo tumorale ha assunto nuovo interesse nel campo dell'imaging in quanto negli ultimi dieci anni studi biochimici hanno rivelato che all'attivazione di determinati oncogeni (o alla perdita di oncosoppressori) corrispondono precise alterazioni metaboliche.
In questo corso il metabolismo verrà rivisitato alla luce degli adattamenti imposti dall'attivazione di oncogeni, dalla perdita di oncosoppressori, o dalla mutazione di enzimi metabolici .
Verranno quindi discusse le tecniche di imaging per il determinare metabolismo del glucoso,dei lipidi e degli aminoacidi.
Verranno forniti esempi dell'utilità dell' imaging metabolico in diagnostica e nel monitoraggio della risposta alla terapia.

SUGGESTED TEXTBOOKS AND READINGS

English

Original scientific articles will be illustrated during classes. Power point presentations of the lectures will be made available to the students. A list of recent articles will be provided, from which each student will select one for the oral presentation. A list of reviews on Cancer and Metabolism will be provided.

Italiano

Biochimica

Testi consigliati

Verranno illustrati a lezione articoli originali. I power point delle lezioni saranno resi disponibili agli studenti. Una lista di lavori recenti verrà fornita dalla docente, da cui ciascun studente sceglierà un articolo da illustrare durante la presentazione orale. Verrà inoltre fornita una lista di Reviews sull'argomento.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=kg2h

Biology of Regeneration and Development

Biologia Della Rigenerazione e Dello Sviluppo

Academic year:	2017/2018
Course ID:	BIO0175
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	
Credits/recognition:	10
Course SSD (disciplinary sector):	
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Innovative experimental models in developmental biology and pathology
- Stem cell biology

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=rla3

Innovative experimental models in developmental biology and pathology

Innovative experimental models in developmental biology and pathology

Academic year:	2017/2018
Course ID:	BIO0175
Teachers:	Prof. Giorgio Roberto MERLO Prof. Daniela TAVERNA
Teacher contacts:	011-6706449, *giorgioroberto.merlo@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	Written

COURSE OBJECTIVES

Reexamine embryonic development focusing on homeostasis, stem cells, tissue and organ maintenance, complex cellular and molecular interactions.

Learn about modern advanced techniques for genome modification (conditional targeting, genome editing) and their use.

Deepen the knowledge on cellular and animal models, in vivo and in vitro experiments, combinations of experimental techniques, tissue engineering, 3D models, organoids.

Explore emerging strategies: gene correction and editing, gene therapy, miRNA and non-coding RNAs, optogenetics, in vivo reprogramming, etc.

COURSE AIMS

Acquire the ability to design a modern experimental approach, leading to a deeper knowledge in biology and biomedicine.

Acquire the ability to connect topics and subjects from advanced genetics, developmental biology and stem cell biology, disease state. With special emphasis towards genetic diseases, inborn developmental defects and cancer.

Acquire good knowledge on the main signalling systems, and on the main cellular processes underlying development and tissue maintenance.

Become confident on the experimental design, the (short- and long-term objectives, the choice of the appropriate model, the read-out, the specificity, the temporal and spatial resolution, etc…

COURSE DELIVERY

Teaching is divided in two parts:

- About 8-10 frontal lessons, for a total of about 30 hrs., with slide presentations by the teacher. A highly interactive format will be adopted, in which students are invited to raise questions, to provide answers, to put forth motivated opinions. All the slides are made available for the students, on line.
- About 4 meeting, for a total of about 12 hrs, in which scientific articles from recent literature will be chosen, and used to illustrate the experimental approach, the background and the conclusions, the interpretation, the future perspectives. During these meetings, the students are invited top pair-up and chose article to be presented in the form of "Journal Club" followed by discussion. The same student pairs will be invited to chose a maximum of 3 articles with a logical connection between them, to be used to prepare a brief dissertation as their final test.

LEARNING ASSESSMENT METHODS

During lessons, the teacher interacts with the students, asking questions and soliciting answers and calling for a motivated comment on a specific subject. This activity is regarded as very useful and warrants a steady progression.

The final test is in the form of a written dissertation, prepared by individual students or better by pairs of them, and is organized in two parts

- Outline of a research project, starting from few initial queries or preliminary data. The project should be short and concise, but introduce modern techniques and demonstrate a link between topics illustrated in class.
- A critical examination of a set of 2-3 recent research articles, that should touch on at least two topics illustrated in class, and show a clear link between them. In addition to illustrating the content of the articles, in this part of the test the students must take the opportunity and further advance on the knowledge on the chosen topics, way beyond what has already been taught.

The final score is given considering the chosen scientific material, the overall illustration, but mainly the ability of connect topics presented in class with novel emerging issues, and expand on these. A discussion with the students on the final dissertation is also possible, although not always necessary.

SUPPORT ACTIVITIES

The teacher is always available for the students for 30 min. after each lesson. The teacher is also available for discussing issues related to the course subject, upon appointment.

In order to prepare the final dissertation (written test) the teacher assists the students on chosing appropriate articles and topics, and may solicit a short presentation to all the other students with slides and discussion.

SYLLABUS

PROGRAM

Embryonic development : techniques, models, experimental strategies, key questions.

Animal models, from Drosophila to Mouse, advantages, disadvantages, applications

Models with specific applications (for imaging, Gain-of-function, in vivo reporters).

Experimental strategies that combine in vivo and in vitro approaches.

Models of genetic and developmental diseases.

Use of viruses and gene transduction (AAV, Retrovirus, Lentivirus, RCAS)

Tissue engineering, 3D models, cells-on.chip, organoids.

Use of early-response gene for mapping neuronal activity

Optogenetics and related strategies

Trans-neuronal tracing.

Genome Modification I, standard

Genome Modification II, advanced

Conditional methods. Gene-editing methods

Alternative ways to manipulate the genome (Zn-nuclease, TALEN, Crispr-Cas9).

How to study micro-RNAs and non-coding RNAs

SUGGESTED TEXTBOOKS AND READINGS

There is no specific textbook that can be suggested. All slides and presentation shown in class are available on line, on the dedicated page.

During lessons, specific reference to published articles is made, with references. These can be downloaded from PubMed

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=284u

Stem cell biology

Stem cell biology

Academic year:	2017/2018
Course ID:	BIO0175
Teachers:	Prof. Fiorella ALTRUDA Dott. Vincenzo Calautti
Teacher contacts:	0116706414, *fiorella.altruda@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES

English: Understanding the contents of the course requires solid background in General Biology, Molecular and Cellular Biology, Molecular Genetics, Basic Computing. Italiano: La comprensione dei contenuti del corso richiede di aver acquisito solide basi di Biologia Generale, Genetica Generale, Biologia Molecolare, Genetica Molecolare, Biologia Cellulare e Informatica di Base.

COURSE OBJECTIVES

- English

The course aims at providing the essential knowledge to understand stem cell biology and stem cell therapeutic applications. The biology of normal (embryonic, tissue specific) and pathological (tumor initiating cells) stem cell types and their signaling mechanisms will be analyzed in depth. Specific emphasis will be given to the most recent advancement in stem cell-based therapies.

- Italiano

Lo scopo del corso e' quello di trasmettere ai discenti i fondamenti concettuali e gli aggiornamenti necessari per comprendere gli sviluppi piu' recenti della biologia delle cellule staminali e delle loro possibili applicazioni terapeutiche. In particolare, verra' trattata approfonditamente la biologia di vari tipi di cellule staminali normali (embrionali, tessuto-specifiche) e patologiche (cellule staminali tumorali), e sui loro meccanismi di segnalazione. Particolare enfasi verra' posta su come tradurre in applicazioni terapeutiche le attali conoscenze sulla biologia cellulare e molecolare delle cellule staminali.

COURSE AIMS

- English

The student is expected to learn the main biological properties of embryonic, iPS and tissue-specific stem cells, the molecular bases underlying stem cell functions, and the actual or prospective stem cell therapeutic applications.

- Italiano

Ci si attende che lo studente apprenda le proprietà biologiche di base delle cellule staminali embrionali, adulte e

pluripotenti indotte, le basi molecolari della staminalità, e le applicazioni terapeutiche in corso e potenziali dei vari tipi di cellule staminali.

COURSE DELIVERY

- English

24 hours Lectures

16 hours Seminars

- Italiano

Lezioni frontali 24 ore

Seminari 16 ore

LEARNING ASSESSMENT METHODS

- English

The students will undergo both a written test and an oral presentation. The evaluation of each test is expressed as a grade of out of 30. The arithmetic mean between the two tests represents the final score of the module. The written test consists of four open questions, in which the student is expected to report on four major areas of stem cell biology (e. g. pluripotency, stem cells and aging, cancer stem cells, somatic stem cells). The oral test consists of a 20' presentation followed by a question/answer sectionof 5-10', focused on one or more scientific papers chosen by the studens and subjected to the teacher's approval. Criteria for evauation of the oral presentations include: novelty, biological significance, translational/therapeutic potential of scientific findings, critical evaluation of data and methods.

- Italiano

Gli studenti sosterranno sia una prova scritta che una prova orale. La valutazione di ogni prova sara' espressa in trentesimi. La media aritmetica tra i risultati delle due prove costituira' la valutazione finale del modulo. La prova scritta consiste di quattro domande aperte in cui lo studente deve trattare sinteticamente quattro temi principali della biologia delle cellule staminali (ad esempio, la pluripotenza, il ruolo delle cellule staminali nell'invecchiamento, cellule staminali e tumori, e descrivere un tipo di cellule staminali somatiche). La prova orale consiste in una presentazione orale di 20' seguita da una sezione domanda/risposta di 5-10' in cui lo studente espone e discute uno o piu' articoli scientifici da lui scelti con l'approvazione dell'insegnante. I criteri per la valutazione della prova orale includono l'innovativita' e significato biologico dei temi presentati, il loro potenziale traslazionale e/o terapeutico, la valutazione critica dei dati e delle metodologie.

SYLLABUS

- English

"Stemness"

Germ line stem cells, Embryonic stem cells, Pluripotency, Multilineage Differentiation.

Tissue-specific stem cells: Experimental models of epithelial self-renewal; the epidermis and the skin adnexa; intestinal stem cells;

Role of the "niche" in stem cell maintenance and differentiation. Role of microvescicles in stem cell regulation.

Stem cells and Aging.

The "cancer stem cell" hypothesis

Stem cell identification: phenotypic markers versus functional assays

Reprogramming of somatic cells into pluripotent stem cells (iPS cells)

Molecular signaling underlying stem cell self-renewal, differentiation and senescence.

Current stem cell therapeutic applications

Stem cells and anti-cancer therapies

Use of drugs and small molecules for stem cell therapeutic manipulations

Mathematical models of stem cell-based tissue homeostasis and regeneration.

- Italiano

Definizione di staminalità.

Cellule staminali della linea germinale, cellule staminali embrionali: pluripotenza, differenziamento multilinea.

Identificazione delle cellule staminali: marcatori fenotipici e saggi funzionali.

Cellule staminali tessuto-specifiche; Modelli di autorinnovamento degli epiteli: l'epidermide e gli annessi cutanei; cellule staminali e autorinnovamento dell'epitelio intestinale.

Ruolo della "nicchia" nella biologia delle cellule staminali tessuto-specifiche. Ruolo delle microvescicole nella regolazione delle cellule staminali.

Invecchiamento e cellule staminali.

Teoria delle cellule staminali tumorali

Riprogrammazione di cellule somatiche a cellule pluripotenti e analisi delle reti di segnalazione che sottostanno allo stato di pluripotenza.

Segnali molecolari che regolano l'autorinnovamento, il differenziamento e la senescenza delle cellule staminali.

Attuali applicazioni terapeutiche di cellule staminali.

Cellule staminali e terapia antineoplastica.

Uso di farmaci e piccole molecole nella manipolazione terapeutica delle cellule staminali.

Modelli matematici di omeostasi e rigenerazione tissutale basati sull'attività delle cellule staminali.

SUGGESTED TEXTBOOKS AND READINGS

- English

Alberts et al., Molecular Biology of the Cell (6th edition), McGraw-Hill.

Original scientific papers provided by the teacher.

- Italiano

Alberts et al., Biologia Molecolare della Cellula, sesta edizione (Zanichelli).

Articoli originali forniti a lezione.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=4e26

Chemistry

Chimica

Academic year:	2017/2018
Course ID:	BIO0133
Teacher:	
Teacher contacts:	
Year:	2nd year
Type:	
Credits/recognition:	10
Course SSD (disciplinary sector):	
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Analytical Chemistry
- Physical Chemistry

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=mivr

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Analytical Chemistry

Chimica Analitica

Academic year:	2017/2018
Course ID:	BIO0133
Teacher:	Prof. Claudio Medana
Teacher contacts:	0116705241, *claudio.medana@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/01 - chimica analitica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written

PREREQUISITES
Basic knowledge of extractive and separation techniques. Principles of mass spectrometry. Elements of analytical chemistry, organic chemistry and biochemistry.

PROPEDEUTIC FOR

This teaching is a point of arrival. It is not propaedeutical.

COURSE OBJECTIVES

The teaching is part of the general objective of the course to provide knowledge and skills in the field of analytical biological chemistry, with particular reference to the knowledge and understanding of instrumental analytical methodologies currently in use in the laboratories of chromatography-mass spectrometry:

1) Detailed knowledge of extractive procedures of different classes of biomolecules (based on investigation of structure-chemical physics properties relationships).
2)Learning of instrumental analysis techniques (GC-MS and HPLC-MS).
3)Learning of basic mechanisms of mass spectra interpretation both of electronic impact and electrospray for a reliable identification of biological molecules.
4)Detailed definition of analytical pattern of particular complexity like those concerning the MS analysis of proteins.

COURSE AIMS

Knowledge of analysis procedures of different classes of biological molecules. Sample preparation and clean-up, chromatography and MS skills, in particular in impurity profiling and quantitation and in proteomic analysis.

COURSE DELIVERY

5 CFU (40 h) lectures.

LEARNING ASSESSMENT METHODS

Written examination. Multiple questions requiring short and targeted answers.

SUPPORT ACTIVITIES

The presentations slides toghether with depth study papers are available in the e-learnig UniTO moodle website.

SYLLABUS

LC-MS concepts. Chemical structure of drugs and biomolecules. ionization of biomolecules, pKa.

Preanalytical phase: Biomolecules concentration level. Extraction, Clean-up. Deproteinization. Matrix effect. Liquid-liquid extraction. Solid Phase Extraction. Immunoaffinity extraction. Molecular imprinted polymers. SPE examples: mixed mode, SCX, SAX, RAM, MIP, low-volume.

Chromatography: principles. Chromatographic parameters: efficiency, selectivity, capacity factor, resolution. Van Deemter equation. GC: derivatization, detectors. LC: instrumentation, stationary and mobile phases, detectors. SFC. CE.

Mass Spectrometry. Introduction. EI fragmentation. Odd and even electron ions. N rule. Sigma bond and alpha cleavage. Rearrangements. Chemical Ionization, PTR, ESI, NSI, APCI, APPI, MALDI, DESI, ambient ionization techniques. ICP-MS. LC-MS fundamentals. LC-MS applications. Peptidomics, Proteomics and Metabolomics.

SUGGESTED TEXTBOOKS AND READINGS

Jurgen H. Gross, Spettrometria di massa, EdiSES 2016 (Mass Spectrometry, Springer-Verlag 2011)

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=ois6

Physical Chemistry

Chimica Fisica

Academic year:	2017/2018
Course ID:	BIO0133
Teacher:	Prof. Gianmario Martra
Teacher contacts:	011 670 7538, *gianmario.martra@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/02 - chimica fisica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

Prerequisites
- basic knowledge in Physical-Chemistry (structure of matter; intermolecular interactions; thermodynamic of molecular systems; main molecular spectroscopic methods) - basic knowledge in Physiscs (nautire of electromagnetic radiation, electric dipoles; coulomb interactions; elastic and inelastic interactions) - basic knowledge in biochemistry

Prerequisiti
- conoscenze di chimica-fisica di base (struttura della materia; interazioni intermolecolari; termodinamica dei sistemi molecolari; principali metodi di spettroscopia molecolare) - conoscenze di fisica di base, in particolare in riferimento a: natura della radiazione elettromagnetica; dipolo elettrici; interazioni coulombiane, interazioni elastiche ed anelastiche - conoscenze di biochimica strutturale di base

COURSE OBJECTIVES

Course objectives

The objectives proosed to the studentd as targets of this course are aimed to the achievements of good capabilities dealing with:
- establishment of relationships between the features of amphiphlic molecules/self-assembled amphiphilic molecules and their functional behaviours relevant for their use in nanobiotechnology
- establishment of relationships between features of inorganic nanoparticles and their functional behaviours relevant for their use in nanobiotechnology
- selection and aplication of proper experimental methods for the study of nanobiotecnological systems

Obiettivi formativi

Il corso di propone di formare gli studenti allo sviluppo delle seguenti capacità:
- istituire correlazioni tra proprietà di molecole anfifiliche e loro aggregatie rispettivi comportamenti funzionali di interesse in campo nanobiotecnologico
- istituire correlazioni tra proprietà di nanoparticelle inorganiche e loro comportamenti funzionali di interesse in campo nanobiotecnologico
- individuare le metodologie sperimentali più adatte allo studio di nanosistemi e del loro comportamento in

relazione agli utilizzi in campo biotecnologico

COURSE AIMS

Results of learning outcomes

Knowledge of and expertise in:
- main methods for the preparation of nanomaterials of interest in the
field of biotechnology
- fundamental aspects of physical and physical-chemical features of nanomaterials at the basis of their possible exploitation in nanobiotechnology
- fundamental aspects of the combined use of nanoparticles and biomacromolecules
- experimental methods for the characterization of nanobiotechnologycal systems, and selection of the most proper ones in dependence on specific features of the systems
- electron microscopy, and capability to design the proper observation methods for the investigation of samples of biological/biotechnological interest.

Risultati dell'apprendimento attesi

Acquisizione di:
- Conoscenza dei principali metodi di preparazione di nanomateriali per applicazioni nel campo biotecnologico
- Padronanza degli aspetti fondamentali delle proprietà fisiche e chimicofisiche
che caratterizzano nanomateriali per applicazioni
nanobiotecnologiche.
- Padronanza degli aspetti fondamentali che caratterizzano l'abbinamento/interazione di biomolecole a nanomateriali per scopi tecnologici
- Conoscenza dei principali metodi di caratterizzazione di sistemi nanobiotecnologici, e capacità di scegliere i piu' adatti a seconda del tipo di sistema
- Conoscenza dei metodi di microscopia elettronica e capacità di individuare le modalità di osservazione più adatte a sistemi di interesse biotecnologico

COURSE DELIVERY

Traditional

LEARNING ASSESSMENT METHODS

Learning assessment methods

Written examination, usually based on 5 open questions

Modalità di verifica dell'apprendimento
Esame scritto, che di norma prevede 5 domande aperte

SYLLABUS

Syllabus

This course is devoted to the knowledge and understanding of physical-chemical features of naomaterials at the basis of their functional behaviours which can be exploited for biotechnological applications.
The topics will then deal with:
"soft" nanomaterials
- self-assembling of amphiphilic molecules resulting in the formation of micelles
- relationships between compositional and structural features of amphiphilic molecules and structure and functional behaviour of micelles

- methods for the characterization of micelles-based nanomaterials
- cases-study related to actual or potential application of self-assembled soft materials in biotechnology (e.g, drug delivery, gene therapy)

"hard" nanomaterials
- oxide nanoparticles (typically made of silica), hybridized with fluorophores, intented for applications in "in vitro" and "in vivo" optical imaging: preparation, characterization, surface functionalization for targeting, possible uses
- metal nanoparticles(typically made of gold): origin and dependences of peculiar optical behaviours (plasmon resonance, effect on the emission features of nearby fluorophores), possible uses in cellular and molecular biology
TImaging of nanoparticles: electron microscopy
Scanning electron microscopy: principles; signals to be exploited for the formation of images; type of information present in the images depending on teh signal collected; sample preparation; uses in biology/biotechnology
Transmission electron microscopy: principles; origin and importance of the high resolution, sample preparation; uses in biology/biotechnology
Chemical analysis by energy dispersion spectroscopy of X-rays emitted by samples impinged by a beam of accelerated electrons: principles; uses in biology/biotechnology

Programma

Questo insegnamento è dedicato alla conoscenza e comprensione di caratteristiche chimico-fisiche di nanomateriali che sono alla base di comportamenti funzionali degli stessi di interesse per applicazioni in campo biotecnologico.
Gli argomenti trattati riguardano quindi:
nanomateriali "soft"
- fenomeni di self-assembling di molecole anfifiliche a formare sistemi micellari
- interrelazioni tra caratteristiche di molecole anfifiliche e struttura e funzionalità di aggregati micellari
- metodi di caratterizzazione di sistemi micellari
- esempi di applicazioni esistenti (drug delivery da micelle di copolimeri a blocchi)e di indirizzi di ricerca e sviluppo relativi ad utilizzi biotecnologici di sistemi micellari (vettori per terapia genica)
nanomateriali "hard"
- nanoparticelle ossidiche, tipicamente silicee, ibridizzate con fluorofori per imaging ottico in vitro ed in vivo: caratteristiche, preparazione, metodi di caratterizzazione, funzionalizzazione di superficie per targeting
- nanoparticelle metalliche (tipicamente di Au), natura e dipendenze del comportamento ottico (risonanza plasmonica; effetti nei confronti di fluorofori), utilizzo di tale comportamento per applicazioni biomolecolari
Tecniche di imaging di nanoparticelle: microscopia elettronica
Microscopia elettronica a scansione: principi, caratteristiche, segnali utilizzabili per la formazioni di immagini e relativo contenuto informativo; preparazione dei campioni. Esempi di utilizzo in ambito biologico/biotecnologico
Microscopia elettronica in trasmissione: principi, caratteristiche; origine ed importanza della possibilità di ottenere elevate risoluzioni; preparazione dei campioni. Esempi di utilizzo in ambito biologico/biotecnologico
Analisi chimica tramite spettrometria a dispersione di energia di raggi X caratteristici emessi dai campioni durante le osservazioni di microscopia elettronica. Esempi di utilizzo in ambito biologico/biotecnologico

SUGGESTED TEXTBOOKS AND READINGS

- I.A. Israelechvili, Intermolecular and surface forces, Wiley&Sons, Chichester-UK, 1999, second edition

- J.J. Bozzola, L.D. Russel, Electron Microscopy. Principles and Techniques for Biologists. Secon Edition; Jones and Bartlett Publishers, Boston, 1999

- William & Carter, Transmission electron Microscopy, Interscientia, San Diego, 2002, seconda edizione

- scientific papers, uploaded on the webpage of the course

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9has

Computational genomics and epigenomics

Computational genomics and epigenomics

Academic year:	2017/2018
Course ID:	BIO0154
Teacher:	Prof. Paolo PROVERO
Teacher contacts:	0116706438, *paolo.provero@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wgzx

Computational Genomics and Epigenomics

Genomica ed Epigenomica Computazionale

Academic year:	2017/2018
Course ID:	BIO0143
Teacher:	Prof. Paolo PROVERO Prof. Ferdinando DI CUNTO
Teacher contacts:	0116706438, *paolo.provero@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

COURSE OBJECTIVES

English

The aim of the course is to provide the students with the main concepts and tools used in the computational analysis of gene expression and its transcriptional regulation

Italiano

Il modulo si propone di dotare gli studenti dei concetti e strumenti principali per l'analisi computazionale di dati concernenti l'espressione genica e la sua regolazione trascrizionale.

COURSE AIMS

English

The students will be able to

- understand the problems tackled and the methods used in analyzinggene expression and regulation data on a genomic scale, also through the critical reading of articles selected from the primary literature
- analyze gene expression data to obtain lists of differentially expressed genes
- analyze ChIP-seq data for transcription factor binding sites or epigenetic modifications of DNA
- analyze the functional enrichment of gene lists obtained with the methods described above

Italiano

Gli studenti saranno in grado di

- comprendere le problematiche affrontate e le metodologie usate nello studio di dati di espressione e regolazione genica su scala genomica, anche attraverso la lettura critica di lavori tratti dalla letteratura primaria
- analizzare dati di espressione genica per ricavare liste di geni differenzialmente espressi
- analizzare dati di ChIP-seq relativi a siti di legame di fattori di trascrizione o modificazioni epigenetiche del DNA
- analizzare liste di geni ottenute con i metodi descritti sopra dal punto di vista dell'arricchimento funzionale

LEARNING ASSESSMENT METHODS

English

Written test and oral presentation of an article from the literature

Italian

Esame scritto e presentazione orale di un lavoro di letteratura

SUPPORT ACTIVITIES

English

Data analysis exercises in computer room

Italian

Esercitazioni di analisi dati in aula informatica

SYLLABUS

English

1. Analysis of gene expression data

- class comparison
- class discovery
- functional enrichment of gene lists
- molecular classification of pathologies

2. Analysis of gene regulation data

- analysis of ChIP-seq data
- evolution and variation of gene regulation
- evolution and variation of gene expression

Italiano

1. Analisi di dati di espressione genica:

- class comparison
- class discovery
- arricchimento funzionale di liste di geni
- classificazione molecolare delle patologie

2. Analisi di dati di regolazione genica

- analisi di dati di ChIP-seq
- evoluzione e variazione della regolazione genica
- evoluzione e variazione dell'espressione genica

SUGGESTED TEXTBOOKS AND READINGS

English

Slides and selected articles including:

Schmidt, D., Schwalie, P. C., Wilson, M. D., Ballester, B., Gonçalves, A., Kutter, C., … Odom, D. T. (2012). Waves of retrotransposon expansion remodel genome organization and CTCF binding in multiple mammalian lineages. Cell, 148(1-2), 335–48. doi:10.1016/j.cell.2011.11.058

Lappalainen, T., Sammeth, M., Friedländer, M. R., 't Hoen, P. a C., Monlong, J., Rivas, M. a, … Dermitzakis, E. T. (2013). Transcriptome and genome sequencing uncovers functional variation in humans. Nature, 501(7468), 506–11. doi:10.1038/nature12531

Brawand, D., Soumillon, M., Necsulea, A., Julien, P., Csárdi, G., Harrigan, P., … Kaessmann, H. (2011). The evolution of gene expression levels in mammalian organs. Nature, 478(7369), 343–348. doi:10.1038/nature10532

Heinz, S., Romanoski, C. E., Benner, C., Allison, K. A., Kaikkonen, M. U., Orozco, L. D., & Glass, C. K. (2013). Effect of natural genetic variation on enhancer selection and function. Nature. doi:10.1038/nature12615

Italiano

Slides del docente e articoli selezionati per la lattura critica, tra cui:

Schmidt, D., Schwalie, P. C., Wilson, M. D., Ballester, B., Gonçalves, A., Kutter, C., … Odom, D. T. (2012). Waves of retrotransposon expansion remodel genome organization and CTCF binding in multiple mammalian lineages. Cell, 148(1-2), 335–48. doi:10.1016/j.cell.2011.11.058

Lappalainen, T., Sammeth, M., Friedländer, M. R., 't Hoen, P. a C., Monlong, J., Rivas, M. a, … Dermitzakis, E. T. (2013). Transcriptome and genome sequencing uncovers functional variation in humans. Nature, 501(7468), 506–11. doi:10.1038/nature12531

Brawand, D., Soumillon, M., Necsulea, A., Julien, P., Csárdi, G., Harrigan, P., … Kaessmann, H. (2011). The evolution of gene expression levels in mammalian organs. Nature, 478(7369), 343–348. doi:10.1038/nature10532

Heinz, S., Romanoski, C. E., Benner, C., Allison, K. A., Kaikkonen, M. U., Orozco, L. D., & Glass, C. K. (2013). Effect of natural genetic variation on enhancer selection and function. Nature. doi:10.1038/nature12615

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=zmoc

Computational genomics and Gene Networks

Computational genomics and Gene Networks

Academic year:	2017/2018
Course ID:	BIO0154
Teacher:	
Teacher contacts:	
Year:	
Type:	Distinctive
Credits/recognition:	10
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Computational genomics and epigenomics
- Interactions and Gene Networks

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=arsu

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Computational genomics and epigenomics

Computational genomics and epigenomics

Academic year:	2017/2018
Course ID:	BIO0154
Teacher:	Prof. Paolo PROVERO
Teacher contacts:	0116706438, *paolo.provero@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wgzx

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Interactions and Gene Networks

Interactions and Gene Networks

Academic year:	2017/2018
Course ID:	BIO0154
Teacher:	Prof. Emilio HIRSCH Prof. Emanuela TOLOSANO
Teacher contacts:	0116706425, *emilio.hirsch@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9dlx

Data analysis

Data analysis

Academic year:	2017/2018
Course ID:	BIO0157
Teacher:	Prof. Raffaele Adolfo CALOGERO Prof. Paolo PROVERO
Teacher contacts:	*raffaele.calogero@unito.it*
Year:	
Type:	Distinctive
Credits/recognition:	6
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=s42g

Drug Discovery: basic principles

Drug Discovery: basic principles

Academic year:	2017/2018
Course ID:	BIO0156
Teacher:	Dott. Sonja Visentin
Teacher contacts:	0116708337 (Via Quarello) - 0116707663 (Via P. Giuria), *sonja.visentin@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/08 - chimica farmaceutica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Understanding the contents of the course requires solid background in peptides/protein structure, and basic knowledge of organic and analytical chemistry

COURSE OBJECTIVES

The main objective of the course is to provide students with the basics of drug discovery and understanding the relationship between the chemical structure of molecules and their pharmacological activity. Moreover, the course prefigures to provide the student with a highly professionalized competence in the field of business , national and international pharmaceutical research centers, on the different aspects of instrumental analysis in the different phases of the discovery, development and production process of the pharmaceutical industry.

COURSE AIMS

At the end of the course, students should be able to have learned the various stages that make up the pipeline of drug discovery and understand the chemical and physical properties of the molecules in the pharmaceutical field

COURSE DELIVERY

The course will be delivered through frontal lectures using the Moodle platform

Lessons: 40 hours

Credits: 5

An educational visit to a pharmaceutical company (in 2015-2016/2016-2017,Chiesi Farmaceutici , Parma,) if possible, will be organized.

LEARNING ASSESSMENT METHODS

The exam is divided in two parts:

- writing a scientific article about a drug assigned to each candidate at least 15 days before the examination date, using a track provided by the teacher (max 27/30)

- Oral exam on the program

The unit of measure: thirty/30

SYLLABUS

- Introduction to drug discovery ; identification of the target and the ligand ; virtual screening ; drug discovery based on fragments ; transformations of lead ; isosterism and bioisosterism ; Introduction to QSAR ; synthesis of peptides and SPPS ; Combinatorial Approach to Drug Discovery ; example of study .
- Physico-chemical properties of molecules and their influence on the interaction between drugs and their targets :

- type of bond and their strength, intermolecular forces, ionization, lipophilicity
- Relevance of the structures of proteins and DNA drug-receptor interaction
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Molecular Descriptors involved in the determination of the ADME profile of potential drugs
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Structure- activity relationship and drug design
- Drug Discovery for biotechnological drugs
- Nanotechnology for drug delivery

SUGGESTED TEXTBOOKS AND READINGS

Burger's Medicinal Chemistry and Drug Discover

Author: Donald Abraham and David Rotella
Publisher: Wiley
ISBN: 978-0-470-27815-4

Pharmaceutical Analysis
Author: David Watson
Publisher: Elsevier
ISBN: 9780702051296

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=5m70

Functional Genomics

Academic year:	2017/2018
Course ID:	BIO0167
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	
Credits/recognition:	8
Course SSD (disciplinary sector):	BIO/13 - biologia applicata BIO/17 - istologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Molecular Dynamics of Cellular Processes
- The Genetic Basis of Cancer

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=l4m5

Molecular Dynamics of Cellular Processes

Molecular Dynamics of Cellular Processes

Academic year:	2017/2018
Course ID:	BIO0167
Teachers:	Prof. Sara CABODI Prof. Mara BRANCACCIO
Teacher contacts:	011-6706422, *sara.cabodi@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Optional
Type of examination:	Oral

PREREQUISITES
Good knowledge in molecular and cellular biology

COURSE OBJECTIVES

The aim of the course is to deepen the knowledge on the molecular mechanisms relevant to cellular homeostasis, which are of particular relevance and interest in the field of cellular biology. The aims are to provide new knowledge based on high impact research published in recent years in international journals. Teaching also aims to stimulate students' interest in recent and leading edge research in the field of cellular biology and cancer research through critical reading and collective discussion of highly relevant scientific articles

COURSE AIMS

At the end of the course the student:

- will know in detail and in depth the molecular mechanisms underlying the cellular processes studied

- will acquire the ability to read and criticize other relevant scientific articles where new discoveries are presented and discussed

- will have the ability to critically evaluate the scientific research presented during lessons

-can acquire the ability to read articles in English and structure scientific presentations by identifying key concepts and major issues

COURSE DELIVERY

To achieve the learning objectives of this course 40 hours of frontal lessons are used, with a high degree of interactivity to stimulate student involvement in discussing the topics presented.

LEARNING ASSESSMENT METHODS

Verification of learning involves a final oral exam that involves discussing the topics presented in the lesson

SYLLABUS

The program is based on the deepening of key scientific issues coming out in recent publications.

The topics covered will address the molecular mechanisms underlying the tumorigenic and metastasis processes in which various cellular functionalities are involved, including cell adhesion, matrix interaction, proliferation, survival, and stemness.

A particular interest will be focused on the ability of cancer cells to induce changes in the micro-environment and to send signals and induce systemic changes

SUGGESTED TEXTBOOKS AND READINGS

Scientific publications selected and provided by the teacher.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=5c9j

The Genetic Basis of Cancer

The Genetic Basis of Cancer

Academic year:	2017/2018
Course ID:	BIO0167
Teacher:	Prof. Alberto Bardelli
Teacher contacts:	0119933235, *alberto.bardelli@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	3
Course SSD (disciplinary sector):	BIO/17 - istologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES
To understand the contents of the class, students should have a solid background on General Biology, Genetics, Cell Biology, Molecular Biology, Molecular Genetics.

COURSE OBJECTIVES

The class aims at teaching students on the molecular basis of human cancer onset and progression. In particular, the course is focused on the most common genetic alterations (somatic mutations, genetic amplifications, deletions and translocations) present in solid tumors. Moreover, the course elaborates in depth about proto-oncogenes, oncogenes and tumor suppressor genes. Other discussed subjects are also the tissue specificity of the mutational profile of cancer genes and the role of genome instability in tumor progression. Notions about causes and mechanisms regulating cell transdifferentiation in physiology and pathology as initial steps of cancer onset are reviewed. Finally, the role of genomic alterations in personalized cancer target therapy are examined.

COURSE AIMS

At the end of the course students must demonstrate knowledge on the topics of the lessons and the most recent literature regarding the role of genetic alterations in onset, progression, diagnosis and therapy of human cancers. In addition, student must be able to critically evaluate experimental approaches (in vitro and in vivo) that are the basis of current knowledge in this field of research.

COURSE DELIVERY

Frontal lessons, 2 hours per week

LEARNING ASSESSMENT METHODS

Oral examination. The oral tests will be evaluated based on critical thinking skills, the quality of the presentation and knowledge of the subjects of the course. The critical discussion of a scientific publication is an integral part of the exam. The vote will be expressed as a fraction of 30 (eventually cum laude) and will represent the average of the marks of the other Functional Genomics courses.

SUPPORT ACTIVITIES

Laboratory activities carried out by the students for their thesis are considered as practical exercises.

SYLLABUS

Cancer: a genetic disease The causes of cancer Genetic alterations and tumor progression Cancer genes: Oncogenes, Tumor Suppressor genes, Gatekeepers and Caretakers Cell and animal models to study tumor progression Genetic profiling of human tumors Genetic basis of targeted cancer therapy Genetic alterations: diagnosis and personalized treatment

SUGGESTED TEXTBOOKS AND READINGS

The course deals with scientific topics in constant development and accordingly it is not possible to indicate a reference text. Attendance is highly recommended.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wvtp

Genomics and Epigenomics

Genomica ed epigenomica

Academic year:	2017/2018
Course ID:	BIO0143
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	
Credits/recognition:	10
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

Course modules:

- Computational Genomics and Epigenomics
- Genomics and Epigenomics of Gene Regulation

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=l58v

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Computational Genomics and Epigenomics

Genomica ed Epigenomica Computazionale

Academic year:	2017/2018
Course ID:	BIO0143
Teachers:	Prof. Paolo PROVERO Prof. Ferdinando DI CUNTO
Teacher contacts:	0116706438, *paolo.provero@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

COURSE OBJECTIVES

English

The aim of the course is to provide the students with the main concepts and tools used in the computational analysis

of gene expression and its transcriptional regulation

Italiano

Il modulo si propone di dotare gli studenti dei concetti e strumenti principali per l'analisi computazionale di dati concernenti l'espressione genica e la sua regolazione trascrizionale.

COURSE AIMS

English

The students will be able to

- understand the problems tackled and the methods used in analyzinggene expression and regulation data on a genomic scale, also through the critical reading of articles selected from the primary literature
- analyze gene expression data to obtain lists of differentially expressed genes
- analyze ChIP-seq data for transcription factor binding sites or epigenetic modifications of DNA
- analyze the functional enrichment of gene lists obtained with the methods described above

Italiano

Gli studenti saranno in grado di

- comprendere le problematiche affrontate e le metodologie usate nello studio di dati di espressione e regolazione genica su scala genomica, anche attraverso la lettura critica di lavori tratti dalla letteratura primaria
- analizzare dati di espressione genica per ricavare liste di geni differenzialmente espressi
- analizzare dati di ChIP-seq relativi a siti di legame di fattori di trascrizione o modificazioni epigenetiche del DNA
- analizzare liste di geni ottenute con i metodi descritti sopra dal punto di vista dell'arricchimento funzionale

LEARNING ASSESSMENT METHODS

English

Written test and oral presentation of an article from the literature

Italian

Esame scritto e presentazione orale di un lavoro di letteratura

SUPPORT ACTIVITIES

English

Data analysis exercises in computer room

Italian

Esercitazioni di analisi dati in aula informatica

SYLLABUS

English

1. Analysis of gene expression data

- class comparison

- class discovery
- functional enrichment of gene lists
- molecular classification of pathologies

2. Analysis of gene regulation data

- analysis of ChIP-seq data
- evolution and variation of gene regulation
- evolution and variation of gene expression

Italiano

1. Analisi di dati di espressione genica:

- class comparison
- class discovery
- arricchimento funzionale di liste di geni
- classificazione molecolare delle patologie

2. Analisi di dati di regolazione genica

- analisi di dati di ChIP-seq
- evoluzione e variazione della regolazione genica
- evoluzione e variazione dell'espressione genica

SUGGESTED TEXTBOOKS AND READINGS

English

Slides and selected articles including:

Schmidt, D., Schwalie, P. C., Wilson, M. D., Ballester, B., Gonçalves, A., Kutter, C., … Odom, D. T. (2012). Waves of retrotransposon expansion remodel genome organization and CTCF binding in multiple mammalian lineages. Cell, 148(1-2), 335–48. doi:10.1016/j.cell.2011.11.058

Lappalainen, T., Sammeth, M., Friedländer, M. R., 't Hoen, P. a C., Monlong, J., Rivas, M. a, … Dermitzakis, E. T. (2013). Transcriptome and genome sequencing uncovers functional variation in humans. Nature, 501(7468), 506–11. doi:10.1038/nature12531

Brawand, D., Soumillon, M., Necsulea, A., Julien, P., Csárdi, G., Harrigan, P., … Kaessmann, H. (2011). The evolution of gene expression levels in mammalian organs. Nature, 478(7369), 343–348. doi:10.1038/nature10532

Heinz, S., Romanoski, C. E., Benner, C., Allison, K. A., Kaikkonen, M. U., Orozco, L. D., & Glass, C. K. (2013). Effect of natural genetic variation on enhancer selection and function. Nature. doi:10.1038/nature12615

Italiano

Slides del docente e articoli selezionati per la lattura critica, tra cui:

Schmidt, D., Schwalie, P. C., Wilson, M. D., Ballester, B., Gonçalves, A., Kutter, C., … Odom, D. T. (2012). Waves of retrotransposon expansion remodel genome organization and CTCF binding in multiple mammalian lineages. Cell, 148(1-2), 335–48. doi:10.1016/j.cell.2011.11.058

Lappalainen, T., Sammeth, M., Friedländer, M. R., 't Hoen, P. a C., Monlong, J., Rivas, M. a, … Dermitzakis, E. T. (2013). Transcriptome and genome sequencing uncovers functional variation in humans. Nature, 501(7468), 506–11.

doi:10.1038/nature12531

Brawand, D., Soumillon, M., Necsulea, A., Julien, P., Csárdi, G., Harrigan, P., … Kaessmann, H. (2011). The evolution of gene expression levels in mammalian organs. Nature, 478(7369), 343–348. doi:10.1038/nature10532

Heinz, S., Romanoski, C. E., Benner, C., Allison, K. A., Kaikkonen, M. U., Orozco, L. D., & Glass, C. K. (2013). Effect of natural genetic variation on enhancer selection and function. Nature. doi:10.1038/nature12615

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=zmoc

Genomics and Epigenomics of Gene Regulation

Genomica ed Epigenomica della Regolazione Genica

Academic year:	2017/2018
Course ID:	BIO0143
Teachers:	Prof. Pier Paolo Pandolfi De Rinaldis Prof. Valeria POLI
Teacher contacts:	*pierpaolo.pandolfiderinaldis@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5 CFU
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

Prerequisites
This class requires basic knowledge of the epigenetic mechanisms regulating gene expression as well as of the mechanisms of post-transcriptional regulation via RNA interference and microRNAs.

Prerequisiti
La frequenza di questo insegnamento presuppone una conoscenza di base dei meccanismi epigenetici di regolazione dell'espressione genica e dei meccanismi di regolazione post-trascrizionale da parte dell'interferenza dell'RNA e dei micro-RNA.

COURSE OBJECTIVES

LEARNING OBJECTIVES

This course aims at providing students with updated information on the molecular basis of epigenetic regulation of the activities of genetic material, in particular transcription, through the interaction of DNA-binding proteins (transcription factors, readers) and enzymes that covalently modify the chromatin (writers, erasers). Concepts of spatial regulation of transcription and nuclear architecture will also be discussed, as well as the mechanisms regulating the activities of microRNAs and the role of RNA interference in gene expression regulation. Finally, the main known roles of non-coding RNAs will be discussed. Last but not least, all this knowledge will be put to use for the understanding of their most advanced biotechnological and biomedical applications, and in particular the development of epigenetic drugs and the use of RNA interference techniques in the treatment of acquired or inherited diseases.

OBIETTIVI FORMATIVI

Questo insegnamento si prefigge di fornire agli studenti informazioni aggiornate sulle basi molecolari della regolazione epigenetica delle attivita' del materiale genico, in particolare la trascrizione, tramite l'interazione di proteine che legano il DNA (fattori trascrizionali, readers) ed enzimi che modificano covalentemente la cromatina (writers, erasers). Si discuteranno inoltre concetti di regolazione spaziale della trascrizione e di architettura nucleare, e si approfondira' la conoscenza dei meccanismi che regolano l'attivita' dei microRNA e in generale il ruolo dell' interferenza dell'RNA nella reglazione dell'espressione genica. Infine, si discuteranno i principali ruoli noti

degli RNA non codificanti. Non ultimo, tutte queste conoscenze verranno messe a frutto per la comprensione delle loro piu' avanzate applicazioni biotecnologiche e biomediche, e in particolare lo sviluppo di farmaci epigenetici e l'uso di tecniche di interferenza dell'RNA nella terapia delle malattie acquisite o erededitarie.

COURSE AIMS

LEARNING OUTCOMES

Aside from knowing the topics illustrated during the lessons, at the end of the course students will have to demonstrate that they are able to interconnect the knowledge gained about the different topics and have mastered the most recent literature on the processes studied and their alterations in pathological processes. In addition, students must be able to critically evaluate experimental approaches (in vitro and in vivo) that are the basis of the current knowledge in this field of research.

RISULTATI DELL'APPRENDIMENTO ATTESI

Oltre a conoscere gli argomenti oggetto delle lezioni, al termine dell'insegnamento lo studente dovrà dimostrare di essere in grado di collegare tra loro le conoscenze acquisite sui diversi argomenti e di aver acquisito padronanza con la più recente letteratura relativa ai processi studiati e alle loro alterazioni in processi patologici. Inoltre, dovra' essere in grado di valutare criticamente gli approcci sperimentali (in vitro e in vivo) che sono alla base delle conoscenze attuali in questo ambito di ricerca.

COURSE DELIVERY

COURSE STRUCTURE

The course will consist for 80% of platform lectures, and for 20% of critical reading sessions, compulsory.

MODALITÀ DI INSEGNAMENTO

L'insegnamento si svolgera' 80% mediante lezioni frontali e 20% mediante le sessioni di lettura critica, la cui frequenza e' obbligatoria.

LEARNING ASSESSMENT METHODS

COURSE GRADE DETERMINATION

After the completion of the platform lectures, there will be several sessions of critical reading of the relevant literature, as follows: students will be ablt o choose one paper from a provided list of articles, and will present it to the class, followed by a discussion of contents, implications, experimental approach and perspectives. At the end, scores in 30th will be assigned (up to 30/30 + laudem=31/30). These will contribute 30% of the final score.

The final test will be oral, aiming at determining the acquired knowledge, the degree of understanding and the ability to connect different problems. Une of the questions will be about one of the papers discussed during the crtical readinf sessions, chosen by the teacher. Scoring will be in 30th (up to 30/30 + laudem=31/30). The final score will be a weighted mean between the score obtained in the critical reading session (30% of the final score) and that obtained in the oral exam (70% of the final score).

MODALITÀ DI VERIFICA DELL'APPRENDIMENTO

Al termine delle lezioni frontali, si svolgeranno quattro o più sessioni di lettura critica di articoli scientifici inerenti agli

argomenti trattati a lezione. Gli studenti potranno scegliere ognuno un articolo scientifico tra una lista di lavori consigliati, e dovranno esporlo criticamente alla classe, seuito da una discussione dei contenuti, degli approcci usati e delle prospettive. Verranno assegnati dei punteggi in trentesimi (fino a 30/30 e Lode = 31/30) che faranno media ponderata con il punteggio ottenuto nel successivo esame orale, pesando per circa il 30% rispetto al voto finale.

L'esame, orale, sara' volto a determinare le conoscenze acquisite, il loro grado di approfondimento e la capacita' acquisita dallo studente di collegare le diverse tematiche tra di loro. Almeno una delle domande vertera' su uno degli articoli presentati in classe, a scelta del docente. La votazione sara' in trentesimi (fino a 30/30 e Lode) e il punteggio finale sara' una media ponderata tra i punteggi ottenuti per la parte delle letture critiche (30% del voto finale) e l'esame orale (70% del voto finale).

SUPPORT ACTIVITIES

SUPPORT ACTIVITIES

All slides used during the lectures and the bibliographic material will be provided on the Campusnet platform or directly to the students at class.

Personal consulting/tutoring available previous email appointment.

ATTIVITÀ DI SUPPORTO

Tutte le diapositive usate nel corso delle lezioni e il materiale bibliografico verra' messo a disposizione degli studenti sulla piattaforma Campusnet o direttamente in classe.
Attivita' di tutoraggio e' prevista su base individuale con l'insegnante, previo appuntamento.

SYLLABUS

GENOMES AND EPIGENOMES:

Epigenetics and transcription

•Revision of hopefully known concepts related to chromatin and transcription – the bases •TF: how the activation domains work – demonstration of the recruitment mechanism •Enhansosomes and repressosomes: new concepts •The histone code and its interpretation – writers/readers/erasers •Long and short range transcriptional repression •DNA methylation/demethylation (regulation, functions) •Epigenetic reprogramming during development •Epigenetic mutantions/modifications and cancer and as therapeutic targets •New thoughts: is there an epigenetic memory across generations? •New concepts in the gene expression factory •Nuclear architecture and transcription •Transcriptional insulators

The RNA WORLD:

Non-coding RNAs, transcriptional an post-transcriptional control and EPIGENETICS

•The mechanism of the RNA interference •microRNAs: biogenesis, transc. and post-transc. regulation, biological roles, alterations in disease (e.g. cancer) •Not just micro: other short dsRNAs and their roles •Transcriptional regulation •Long non-coding RNAs •Competing endogenous RNAs …. and more

SUGGESTED TEXTBOOKS AND READINGS

READING MATERIALS

Alberts - MOLECULAR BIOLOGY OF THE CELL - ZANICHELLI

CRAIG EAL., MOLECULAR BIOLOGY - PEARSON

Scientific papers provided in class.

TESTI CONSIGLIATI E BIBLIOGRAFIA

Alberts - MOLECULAR BIOLOGY OF THE CELL - ZANICHELLI

CRAIG EAL., MOLECULAR BIOLOGY - PEARSON
Articoli scientifici assegnati a lezione.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=0v1n

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Genomics and Epigenomics of Gene Regulation

Genomica ed Epigenomica della Regolazione Genica

Academic year:	2017/2018
Course ID:	BIO0143
Teacher:	Prof. Pier Paolo Pandolfi De Rinaldis Prof. Valeria POLI
Teacher contacts:	*pierpaolo.pandolfiderinaldis@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5 CFU
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

Prerequisites
This class requires basic knowledge of the epigenetic mechanisms regulating gene expression as well as of the mechanisms of post-transcriptional regulation via RNA interference and microRNAs.

Prerequisiti
La frequenza di questo insegnamento presuppone una conoscenza di base dei meccanismi epigenetici di regolazione dell'espressione genica e dei meccanismi di regolazione post-trascrizionale da parte dell'interferenza dell'RNA e dei micro-RNA.

COURSE OBJECTIVES

LEARNING OBJECTIVES

This course aims at providing students with updated information on the molecular basis of epigenetic regulation of the activities of genetic material, in particular transcription, through the interaction of DNA-binding proteins (transcription factors, readers) and enzymes that covalently modify the chromatin (writers, erasers). Concepts of spatial regulation of transcription and nuclear architecture will also be discussed, as well as the mechanisms regulating the activities of microRNAs and the role of RNA interference in gene expression regulation. Finally, the main known roles of non-coding RNAs will be discussed. Last but not least, all this knowledge will be put to use for the understanding of their most advanced biotechnological and biomedical applications, and in particular the development of epigenetic drugs and the use of RNA interference techniques in the treatment of acquired or inherited diseases.

OBIETTIVI FORMATIVI

Questo insegnamento si prefigge di fornire agli studenti informazioni aggiornate sulle basi molecolari della regolazione epigenetica delle attivita' del materiale genico, in particolare la trascrizione, tramite l'interazione di proteine che legano il DNA (fattori trascrizionali, readers) ed enzimi che modificano covalentemente la cromatina (writers, erasers). Si discuteranno inoltre concetti di regolazione spaziale della trascrizione e di architettura nucleare, e si approfondira' la conoscenza dei meccanismi che regolano l'attivita' dei microRNA e in generale il ruolo dell' interferenza dell'RNA nella reglazione dell'espressione genica. Infine, si discuteranno i principali ruoli noti

degli RNA non codificanti. Non ultimo, tutte queste conoscenze verranno messe a frutto per la comprensione delle loro piu' avanzate applicazioni biotecnologiche e biomediche, e in particolare lo sviluppo di farmaci epigenetici e l'uso di tecniche di interferenza dell'RNA nella terapia delle malattie acquisite o erededitarie.

COURSE AIMS

LEARNING OUTCOMES

Aside from knowing the topics illustrated during the lessons, at the end of the course students will have to demonstrate that they are able to interconnect the knowledge gained about the different topics and have mastered the most recent literature on the processes studied and their alterations in pathological processes. In addition, students must be able to critically evaluate experimental approaches (in vitro and in vivo) that are the basis of the current knowledge in this field of research.

RISULTATI DELL'APPRENDIMENTO ATTESI

Oltre a conoscere gli argomenti oggetto delle lezioni, al termine dell'insegnamento lo studente dovrà dimostrare di essere in grado di collegare tra loro le conoscenze acquisite sui diversi argomenti e di aver acquisito padronanza con la più recente letteratura relativa ai processi studiati e alle loro alterazioni in processi patologici. Inoltre, dovra' essere in grado di valutare criticamente gli approcci sperimentali (in vitro e in vivo) che sono alla base delle conoscenze attuali in questo ambito di ricerca.

COURSE DELIVERY

COURSE STRUCTURE

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LEARNING ASSESSMENT METHODS

COURSE GRADE DETERMINATION

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SUGGESTED TEXTBOOKS AND READINGS

READING MATERIALS

Alberts - MOLECULAR BIOLOGY OF THE CELL - ZANICHELLI

CRAIG EAL., MOLECULAR BIOLOGY - PEARSON

Scientific papers provided in class.

TESTI CONSIGLIATI E BIBLIOGRAFIA

Alberts - MOLECULAR BIOLOGY OF THE CELL - ZANICHELLI

CRAIG EAL., MOLECULAR BIOLOGY - PEARSON
Articoli scientifici assegnati a lezione.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=0v1n

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Image and Signal Analysis

Analisi delle Immagini e dei Segnali

Academic year:	2017/2018
Course ID:	BIO0105
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	
Credits/recognition:	10
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Image and Signal Analysis I
- Image and Signal Analysis II

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=t8ax

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Image and Signal Analysis I

Analisi delle Immagini e dei Segnali I

Academic year:	2017/2018
Course ID:	BIO0105
Teacher:	Prof. Ferdinando DI CUNTO
Teacher contacts:	0116706616 / 0116706409, *ferdinando.dicunto@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=o4h4

Image and Signal Analysis II

Analisi delle Immagini e dei Segnali II

Academic year:	2017/2018
Course ID:	BIO0105
Teacher:	Prof. Raffaele Adolfo CALOGERO
Teacher contacts:	*raffaele.calogero@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=t1qp

Image and Signal Analysis I

Analisi delle Immagini e dei Segnali I

Academic year:	2017/2018
Course ID:	BIO0105
Teacher:	Prof. Ferdinando DI CUNTO
Teacher contacts:	0116706616 / 0116706409, *ferdinando.dicunto@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=o4h4

Image and Signal Analysis II

Analisi delle Immagini e dei Segnali II

Academic year:	2017/2018
Course ID:	BIO0105
Teacher:	Prof. Raffaele Adolfo CALOGERO
Teacher contacts:	*raffaele.calogero@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	INF/01 - informatica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=t1qp

Imaging: Optical/PET/SPECT/X RAY

PET/SPECT - X RAY

Academic year:	2017/2018
Course ID:	BIO0111
Teacher:	Prof. Desiree' DEANDREIS Prof. Enzo TERRENO
Teacher contacts:	n/d, *desiree.deandreis@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES
Gli studenti dovranno possedere le conoscenze di base della chimica generale/inorganica e biologia molecolare
Basic principles of general/ inorganic chemistry and molecular biology are required.

COURSE OBJECTIVES

L'insegnamento si prefigge l'obiettivo di fornire agli studenti le conoscenze di base di alcune tecnologie diagnostiche basate sull'acquisizione di immagini su organismi viventi quali le tecniche di imaging ottiche e quelle che utilizzando radiazioni ionizzanti (PET/SPECT/CT). Per ogni tecnologia saranno presentati: i principi base della tecnica, le caratteristiche dei rispettivi agenti di contrasto o traccianti, le principali applicazioni (anche in ambito teranostico) precliniche e cliniche.

This teaching module aims at offering the basic knowledge of some in vivo diagnostic imaging technologies based on the use of both non ionizing radiations (optical imaging) and ionizing radiations (PET/SPECT/CT) . Each technique will be presented in terms of: basic principles, contrast agents or tracers involved, most relevant preclinical and clinical applications, including those ones supporting therapeutic treatments.

COURSE AIMS

L'insegnamento di questo modulo consentirà agli studenti di conoscere gli elementi fondamentali delle tecnologie di imaging in vivo trattate, permettendo loro di valutarne criticamente i punti di forza e i limiti.

In riferimento agli obiettivi generali del corso, la formazione degli studenti si arricchirà con le seguenti competenze:

Conoscenza e capacità di comprensione:

- descrivere i meccanismi alla base delle diverse tecnologie trattate nel corso;

- valutare con senso critico i vantaggi e i limiti delle tecniche descritte;

- progettare un agente di contrasto o un tracciante per affrontare un'esigenza preclinica/clinica

Autonomia di giudizio

- scegliere la tecnica più adatta ad una ben definita esigenza clinica o necessità preclinica.

- valutare quale agente di contrasto o tracciante possa avere la maggiore probabilità di successo diagnostico

Abilità comunicative

- apprendere la terminologia tecnica corretta

The main learning outcome will be the acquisition of the fundamental aspects of the in vivo imaging technologies presented in the teaching module.

Referring to the general outcomes of the course, the students will acquire the following competences:

Understanding

- to describe the basic mechanisms of the imaging technologies;

- to critically evaluate advantages and limitations of the techniques;

- to design the more appropriate contrast agent or a tracer for a given preclinical/clinical need.

Judgment independency

- to choice the most suitable technique for a given given preclinical/clinical need;

- to assess which contrast agentor tracer may have the highest diagnostic potential for a given preclinical/clinical need.

Communicative skills

- to learn the correct technical terminology.

COURSE DELIVERY

L'insegnamento è strutturato in 40 ore di didattica frontale, suddivise in lezioni da 2 ore in base al calendario accademico. La didattica frontale si costituisce di lezioni teoriche e possibili seminari tenuti da esperti dell'argomento. La frequenza è obbligatoria.

The teaching module consists of 40 hours of lessons organized in units of 2 h each scheduled according to the academic calendar. The units include theoretical lessons as well as seminars given by experts in the field.

The attendance is mandatory.

LEARNING ASSESSMENT METHODS

La verifica della preparazione degli studenti avverrà con un esame orale. Gli argomenti oggetto d'esame rifletteranno quelli trattati durante l'insegnamento.

L'esame, oltre a verificare la conoscenza e la comprensione degli argomenti trattati, si pone l'obiettivo di verificare le competenze descritte nella sezione "Risultati dell'apprendimento attesi": le domande, infatti, comprenderanno elementi descrittivi ma anche critici. Necessario al superamento dell'esame è un corretto utilizzo della terminologia e una chiara e sintetica esposizione che esponga i collegamenti logici tra gli aspetti considerati.

Students learning will be verified by an oral exam. The questions will regard the topics presented and discussed in the module.

Besides verifying the learning level, the exam aims at checking the effective competences acquired (see Learning outcomes section above): in fact, the questions will comprise descriptive and comparative elements. The use of a correct terminology and a clear and concise exposition of the arguments are fundamental factors for a positive result of the test.

SYLLABUS

Parte I: Optical imaging

- Principi base della fotoluminescenza – Principali tecniche di acquisizione

- Classi di agenti di contrasto ottici

- Principali applicazioni precliniche/cliniche

Parte II: PET/SPECT/X-rays

- Principi base delle metodiche impieganti radiazioni ionizzanti (principi fisici di radioattività e raggi x e strumentazione)

- Differenti tipi di tracciante e via metabolica coinvolta

- Principi della somministrazione dei mezzi di contrasto per le acquisizioni CT

- Principali indicazioni pre-cliniche e cliniche delle tecniche impieganti radiazioni ionizzanti

Part II: Optical imaging

- Basics of photoluminescence – Acquisition techniques and instrumentation

- Optical contrast agents

- Main preclinical/clinical applications

Part II: PET/SPECT/XRAYS

- Basics of ionizing radiation techniques (radionuclides and x rays physic principles and instrumentation)

- Different types of tracers and metabolic way involved.

- Principles of CT contrast agent and acquisition

- Main preclinical/clinical applications.

SUGGESTED TEXTBOOKS AND READINGS

Non sono consigliati specifici testi. Il docente metterà a disposizione attraverso la piattaforma moodle il materiale presentato opportunamente integrato con la letteratura scientifica rilevante.

There are no specific books recommended. The teacher will make available on the Moodle platform the material presented during the module, properly integrated with the relevant scientific literature.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=6nef

In vitro diagnostics: molecular profiling of proliferative processes

In vitro diagnostics: molecular profiling of proliferative processes

Academic year:	2017/2018
Course ID:	BIO0171
Teacher:	Prof. Roberto PIVA
Teacher contacts:	011.6336860, *roberto.piva@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	MED/08 - anatomia patologica
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=rr1o

In vivo diagnostics

In vivo diagnostics

Academic year:	2017/2018
Course ID:	BIO0155
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	Distinctive
Credits/recognition:	11
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica MED/03 - genetica medica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- In vivo diagnostics: MRI/OI/US/PAI
- In vivo diagnostics: PET/SPECT/CT

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=mitj

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In vivo diagnostics: MRI/OI/US/PAI

In vivo diagnostics: MRI/OI/US/PAI

Academic year:	2017/2018
Course ID:	BIO0155
Teachers:	Prof. Enzo TERRENO Dott. Walter DASTRU' Dott. Francesca Reineri
Teacher contacts:	011 6706452, *enzo.terreno@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	6
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Basics of Physics (elecromagnetism, optics). Fundamentals of Nuclear magnetic Resonance (how the NMR signal is

formed? NMR active nuclei) Fundamental of Organic Chemistry (functional groups) and Inorganic chemistry (metal complexes). Conoscenze di Fisica di base (elettromagnetismo, ottica). Fondamenti di risonanza magnetica nucleare (come si forma il segnale NMR, nuclei NMR attivi) Conoscenze di base di chimica Organica e Inorganica (gruppi funzionali in chimica organica, complessi metallici).

COURSE OBJECTIVES

The overarching goal of the course is giving to biotechnologists the fundamental knowledge for the comprehension of the main diagnostic imaging techniques. In particular, this part of the course aims to explain the basis of Magnetic Resonance Imaging (MRI) and to show the main applications of this technique in both clinical an pre-clinical studies.

L'insegnamento si inserisce nel generale obiettivo del corso di studio di fornire al biotecnologo le conoscenze necessarie per la comprensione delle principali tecniche di imaging diagnostico. In particolare, l'insegnamento si propone di fornire le basi dell'imaging di risonanza magnetica, di mostrare le principali applicazioni diagnostiche di questa tecnica sia a livello di applicazioni cliniche che nella ricerca.

COURSE AIMS

At the end of the course, the student should know:

- how the main MRI sequences work

- the main parameters of the sequences, and should be able to modify these parameters in order improve MR images

- which different contrast agents can be used for MRI and their effect on images

- which information can be obtained about different pathologies, using MRI-MRS techniques.

- basics of Optical, US, and photoacoustic imaging and comparative analysis with MRI/MRS

Al termine dell'insegnamento lo studente dovrà essere in grado di:

- Conoscere il funzionamento delle principali sequenze MRI

- Conoscere i parametri di acquisizione delle sequenze e modificarli per migliorare la qualità delle immagini

- Conoscere l'azione delle principali categorie di agenti di contrasto

- Sapere quali informazioni possono essere ricavate, mediante le tecniche MRI-MRS, riguardo diverse patologie

- Conoscere i principi base dell'imaging ottico, US e fotoacustico e confrontare le potenzialità di queste tecniche con MRI/MRS.

COURSE DELIVERY

Il corso consiste in lezioni frontali e esercitazioni pratiche

The Course will consist of lectures and practical classes .

LEARNING ASSESSMENT METHODS

Knowledge acquisition will be assessed by either an oral or written examination in which students will be asked

questions about the main topics of the course. The use of correct terminology and clarity of the exposition will be also evaluated.

La preparazione dello studente verrà verificata con un esame orale o scritto. Nel corso dell'esame verrà valutata, oltre alla conoscenza della materia anche l'uso della corretta terminologia e la chiarezza dell'esposizione degli argomenti

SYLLABUS

Part I: MRI/MRS

- Image construction using magnetic field gradients
- Different pulse sequences for MRI
- What is contrast in MRI and how can be enhanced (without contrast agents). repetition time (TR) and echo time (TE) parameters.
- Paramagnetic contrast agents (T1 and T2 CAs)
- CEST and smart contrast agents (pH responsive agents)
- In vivo Magnetic Resonance Spectroscopy of heteronuclei (13C-MRS, 31P-MRS, 19F-MRS)
- In vivo MRS for treatment response and detection of disease (13C hyperpolarized CAs)
- Diffusion MRI: a biomarker for early detection of treatment response in cancer disease

Part II: Optical imaging

- Basics of photoluminescence – Acquisition techniques and instrumentation
- Optical contrast agents
- Main preclinical/clinical applications

Part III: Ultrasound imaging

- Basics of ultrasound and their interaction with matter – Formation of an echografic image
- US contrast agents
- Main preclinical/clinical applications

Part IV: Photoacoustic imaging

- Basics of photoacoustic imaging and image formation
- PAI contrast agents
- Main preclinical/clinical applications

Parte I: MRI/MRS

- Principi di formazione dell'immagine in MRI mediante gradienti di campo magnetico

- Sequenze di impulso

- Il contrasto nelle immagini MRI, come può essere variato (parametri TR e TE).

- Agenti di contrasto paramagneytici in MRI

- Agenti di contrasto CEST, agenti responsivi di pH

- Spettroscopia NMR in vivo: spettri di eteronuclei (13C, 19F, 31P)

- Spettroscopia NMR in vivo per il rilevamento precoce dell'efficienza di un trattamento terapeutico e per la diagnosi (agenti di contrasto iperpolarizzati)

Diffusion MRI

Parte II: Optical imaging

- Principi base della fotoluminescenza – Principali tecniche di acquisizione

- Classi di agenti di contrasto ottici

- Principali applicazioni precliniche/cliniche

Parte III: Imaging a Ultrasuoni

- Principi base degli ultrasuoni e della loro interazione con la materia – Formazione di un'immagine ecografica

- Classi di agenti di contrasto ecografici

- Principali applicazioni precliniche/cliniche

Parte IV: Imaging fotoacustico

- Principi dell'effetto fotoacustico e ottenimento dell'immagine

- Classi di agenti di contrasto per PAI ;

- Principali applicazioni precliniche/cliniche

SUGGESTED TEXTBOOKS AND READINGS

- Joseph P. Hornak website: http://www.cis.rit.edu/htbooks/mri/

- Hashemi. R.H.; Bradley, Jr. W.G.; Lisanti, C.J. MRI. The Basics.

- Weishaupt, D.; Köchli, V.D.; Marincek, B. How Does MRI Work?

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wbs4

In vivo diagnostics: PET/SPECT/CT

In vivo diagnostics: PET/SPECT/CT

Academic year:	2017/2018
Course ID:	BIO0155
Teachers:	Prof. Enzo TERRENO Prof. Desiree' DEANDREIS
Teacher contacts:	011 6706452, *enzo.terreno@unito.it*
Year:	
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/36 - diagnostica per immagini e radioterapia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=i1kp

In vivo diagnostics: MRI/OI/US/PAI

In vivo diagnostics: MRI/OI/US/PAI

Academic year:	2017/2018
Course ID:	BIO0155
Teacher:	Prof. Enzo TERRENO Dott. Walter DASTRU' Dott. Francesca Reineri
Teacher contacts:	011 6706452, *enzo.terreno@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	6
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES

Basics of Physics (elecromagnetism, optics). Fundamentals of Nuclear magnetic Resonance (how the NMR signal is formed? NMR active nuclei) Fundamental of Organic Chemistry (functional groups) and Inorganic chemistry (metal complexes). Conoscenze di Fisica di base (elettromagnetismo, ottica). Fondamenti di risonanza magnetica nucleare (come si forma il segnale NMR, nuclei NMR attivi) Conoscenze di base di chimica Organica e Inorganica (gruppi funzionali in chimica organica, complessi metallici).

COURSE OBJECTIVES

The overarching goal of the course is giving to biotechnologists the fundamental knowledge for the comprehension of the main diagnostic imaging techniques. In particular, this part of the course aims to explain the basis of Magnetic Resonance Imaging (MRI) and to show the main applications of this technique in both clinical an pre-clinical studies.

L'insegnamento si inserisce nel generale obiettivo del corso di studio di fornire al biotecnologo le conoscenze necessarie per la comprensione delle principali tecniche di imaging diagnostico. In particolare, l'insegnamento si propone di fornire le basi dell'imaging di risonanza magnetica, di mostrare le principali applicazioni diagnostiche di questa tecnica sia a livello di applicazioni cliniche che nella ricerca.

COURSE AIMS

At the end of the course, the student should know:

- how the main MRI sequences work

- the main parameters of the sequences, and should be able to modify these parameters in order improve MR images

- which different contrast agents can be used for MRI and their effect on images

- which information can be obtained about different pathologies, using MRI-MRS techniques.

- basics of Optical, US, and photoacoustic imaging and comparative analysis with MRI/MRS

Al termine dell'insegnamento lo studente dovrà essere in grado di:

- Conoscere il funzionamento delle principali sequenze MRI
- Conoscere i parametri di acquisizione delle sequenze e modificarli per migliorare la qualità delle immagini
- Conoscere l'azione delle principali categorie di agenti di contrasto
- Sapere quali informazioni possono essere ricavate, mediante le tecniche MRI-MRS, riguardo diverse patologie
- Conoscere i principi base dell'imaging ottico, US e fotoacustico e confrontare le potenzialità di queste tecniche con MRI/MRS.

COURSE DELIVERY

Il corso consiste in lezioni frontali e esercitazioni pratiche

The Course will consist of lectures and practical classes .

LEARNING ASSESSMENT METHODS

Knowledge acquisition will be assessed by either an oral or written examination in which students will be asked questions about the main topics of the course. The use of correct terminology and clarity of the exposition will be also evaluated.

La preparazione dello studente verrà verificata con un esame orale o scritto. Nel corso dell'esame verrà valutata, oltre alla conoscenza della materia anche l'uso della corretta terminologia e la chiarezza dell'esposizione degli argomenti

SYLLABUS

Part I: MRI/MRS

- Image construction using magnetic field gradients
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- US contrast agents

- Main preclinical/clinical applications

Part IV: Photoacoustic imaging

- Basics of photoacoustic imaging and image formation

- PAI contrast agents

- Main preclinical/clinical applications

Parte I: MRI/MRS

- Principi di formazione dell'immagine in MRI mediante gradienti di campo magnetico
- Sequenze di impulso
- Il contrasto nelle immagini MRI, come può essere variato (parametri TR e TE).
- Agenti di contrasto paramagneytici in MRI
- Agenti di contrasto CEST, agenti responsivi di pH
- Spettroscopia NMR in vivo: spettri di eteronuclei (13C, 19F, 31P)
- Spettroscopia NMR in vivo per il rilevamento precoce dell'efficienza di un trattamento terapeutico e per la diagnosi (agenti di contrasto iperpolarizzati)

Diffusion MRI

Parte II: Optical imaging

- Principi base della fotoluminescenza – Principali tecniche di acquisizione

- Classi di agenti di contrasto ottici

- Principali applicazioni precliniche/cliniche

Parte III: Imaging a Ultrasuoni

- Principi base degli ultrasuoni e della loro interazione con la materia – Formazione di un'immagine ecografica

- Classi di agenti di contrasto ecografici

- Principali applicazioni precliniche/cliniche

Parte IV: Imaging fotoacustico

- Principi dell'effetto fotoacustico e ottenimento dell'immagine

- Classi di agenti di contrasto per PAI ;

- Principali applicazioni precliniche/cliniche

SUGGESTED TEXTBOOKS AND READINGS

- Joseph P. Hornak website: http://www.cis.rit.edu/htbooks/mri/
- Hashemi. R.H.; Bradley, Jr. W.G.; Lisanti, C.J. MRI. The Basics.
- Weishaupt, D.; Köchli, V.D.; Marincek, B. How Does MRI Work?

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wbs4

In vivo diagnostics: PET/SPECT/CT

In vivo diagnostics: PET/SPECT/CT

Academic year:	2017/2018
Course ID:	BIO0155
Teacher:	Prof. Enzo TERRENO Prof. Desiree' DEANDREIS
Teacher contacts:	011 6706452, *enzo.terreno@unito.it*
Year:	
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/36 - diagnostica per immagini e radioterapia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=i1kp

Innovative experimental models in developmental biology and pathology

Innovative experimental models in developmental biology and pathology

Academic year:	2017/2018
Course ID:	BIO0175
Teacher:	Prof. Giorgio Roberto MERLO Prof. Daniela TAVERNA
Teacher contacts:	011-6706449, *giorgioroberto.merlo@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	Written

COURSE OBJECTIVES

Reexamine embryonic development focusing on homeostasis, stem cells, tissue and organ maintenance, complex cellular and molecular interactions.

Learn about modern advanced techniques for genome modification (conditional targeting, genome editing) and their use.

Deepen the knowledge on cellular and animal models, in vivo and in vitro experiments, combinations of experimental techniques, tissue engineering, 3D models, organoids.

Explore emerging strategies: gene correction and editing, gene therapy, miRNA and non-coding RNAs, optogenetics, in vivo reprogramming, etc.

COURSE AIMS

Acquire the ability to design a modern experimental approach, leading to a deeper knowledge in biology and biomedicine.

Acquire the ability to connect topics and subjects from advanced genetics, developmental biology and stem cell biology, disease state. With special emphasis towards genetic diseases, inborn developmental defects and cancer.

Acquire good knowledge on the main signalling systems, and on the main cellular processes underlying development and tissue maintenance.

Become confident on the experimental design, the (short- and long-term objectives, the choice of the appropriate model, the read-out, the specificity, the temporal and spatial resolution, etc…

COURSE DELIVERY

Teaching is divided in two parts:

- About 8-10 frontal lessons, for a total of about 30 hrs., with slide presentations by the teacher. A highly

interactive format will be adopted, in which students are invited to raise questions, to provide answers, to put forth motivated opinions. All the slides are made available for the students, on line.

- About 4 meeting, for a total of about 12 hrs, in which scientific articles from recent literature will be chosen, and used to illustrate the experimental approach, the background and the conclusions, the interpretation, the future perspectives. During these meetings, the students are invited top pair-up and chose article to be presented in the form of "Journal Club" followed by discussion. The same student pairs will be invited to chose a maximum of 3 articles with a logical connection between them, to be used to prepare a brief dissertation as their final test.

LEARNING ASSESSMENT METHODS

During lessons, the teacher interacts with the students, asking questions and soliciting answers and calling for a motivated comment on a specific subject. This activity is regarded as very useful and warrants a steady progression.

The final test is in the form of a written dissertation, prepared by individual students or better by pairs of them, and is organized in two parts

- Outline of a research project, starting from few initial queries or preliminary data. The project should be short and concise, but introduce modern techniques and demonstrate a link between topics illustrated in class.
- A critical examination of a set of 2-3 recent research articles, that should touch on at least two topics illustrated in class, and show a clear link between them. In addition to illustrating the content of the articles, in this part of the test the students must take the opportunity and further advance on the knowledge on the chosen topics, way beyond what has already been taught.

The final score is given considering the chosen scientific material, the overall illustration, but mainly the ability of connect topics presented in class with novel emerging issues, and expand on these. A discussion with the students on the final dissertation is also possible, although not always necessary.

SUPPORT ACTIVITIES

The teacher is always available for the students for 30 min. after each lesson. The teacher is also available for discussing issues related to the course subject, upon appointment.

In order to prepare the final dissertation (written test) the teacher assists the students on chosing appropriate articles and topics, and may solicit a short presentation to all the other students with slides and discussion.

SYLLABUS

PROGRAM

Embryonic development : techniques, models, experimental strategies, key questions.

Animal models, from Drosophila to Mouse, advantages, disadvantages, applications

Models with specific applications (for imaging, Gain-of-function, in vivo reporters).

Experimental strategies that combine in vivo and in vitro approaches.

Models of genetic and developmental diseases.

Use of viruses and gene transduction (AAV, Retrovirus, Lentivirus, RCAS)

Tissue engineering, 3D models, cells-on.chip, organoids.

Use of early-response gene for mapping neuronal activity

Optogenetics and related strategies

Trans-neuronal tracing.

Genome Modification I, standard

Genome Modification II, advanced

Conditional methods. Gene-editing methods

Alternative ways to manipulate the genome (Zn-nuclease, TALEN, Crispr-Cas9).

How to study micro-RNAs and non-coding RNAs

SUGGESTED TEXTBOOKS AND READINGS

There is no specific textbook that can be suggested. All slides and presentation shown in class are available on line, on the dedicated page.

During lessons, specific reference to published articles is made, with references. These can be downloaded from PubMed

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=284u

Interactions and Gene Networks

Interactions and Gene Networks

Academic year:	2017/2018
Course ID:	BIO0154
Teacher:	Prof. Emilio HIRSCH Prof. Emanuela TOLOSANO
Teacher contacts:	0116706425, *emilio.hirsch@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9dlx

Interactions and gene networks

Interazioni e reti geniche

Academic year:	2017/2018
Course ID:	BIO0115
Teacher:	Prof. Emilio HIRSCH Prof. Emanuela TOLOSANO
Teacher contacts:	0116706425, *emilio.hirsch@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	Oral

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=1yzo

Management of biotech companies

PRINCIPI DI GESTIONE DELLE IMPRESE BIOTECNOLOGICHE

Academic year:	2017/2018
Course ID:	BIO0116
Teacher:	Prof. Giacomo Büchi Paolo Giuseppe Domenico Rambelli
Teacher contacts:	011.670.60.09, *giacomo.buchi@unito.it*
Year:	1st year
Type:	Related or integrative
Credits/recognition:	6
Course SSD (disciplinary sector):	SECS-P/08 - economia e gestione delle imprese
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

English
Notion on basic economics/Business Economics and Forms for Business Entities (first year)

Italiano
Nozione economiche di base/Economia e forme di impresa (primo anno).

COURSE OBJECTIVES

English

The teaching allows the learning of basic economic skills concerning the management of the biotechnological companies.

Italiano

L'insegnamento permette l'apprendimento delle conoscenze economiche di base con particolare riferimento alla gestione delle imprese biotecnologiche.

COURSE AIMS

English

Expected outcomes of the teaching are the capability to understand the logic of biotechnological companies' management and the ability to identify and apprehend general and biotech sector specific problems. The student will also acquire basic skills in innovation management, technology evaluation of an entrepreneurial idea and on marketing sectorial problems.

Italiano

Al termine dell'insegnamento lo studente acquisisce consapevolezza dei problemi, sia di ordine generale sia specifici del settore biotech, anche legati alla redazione del business plan e alla protezione della proprietà industriale di rilievo per il settore biotech.

COURSE DELIVERY

English

Frontal lecture with slides.

Italiano

Lezioni frontali mediante l'utilizzo di slide.

LEARNING ASSESSMENT METHODS

English

Written test and optionally oral examination if decided by the professors.

Italiano

Metodi di valutazione (prova scritta ed eventualmente orale a discrezione del docente).

SUPPORT ACTIVITIES

English

Video.
Exercise on patent DBs.

Italiano

Esercitazioni sulla redazione del business plan.
Visione video ed esercitazione su banche dati brevettuali.

SYLLABUS

English

1) Development and management of biotechnological companies in Italy.
2) The industrial property in the development of a new product from the ides to marketing.
Patents for industrial inventions vs trade secret; novelty search and freedom to operate search.
Patentability requirements: novelty, inventive step, lawfulness, industrial application.
Procedures to obtain an Italian and European patent; international patent application.
The patent as an intangible asset; assignment and licensing, joint ownership; inventions of the employee: fair bonus, compulsory license.
Legal actions relating to intellectual property, revocation action and action for infringement.
Corporate brand: requirements for the protection of trademarks and designs.
Product and process patent; new use of a known substance; patents on medicinal products; supplementary Protection certificate.
EEC Directive on biotechnological inventions (Art. 1-7): patentability of naturally existing substances: microorganisms, genes; non patentable inventions due to unlawfulness; deposit of biological material for the purpose of a sufficient disclosure.
Plant variety protection.
Case study: protection of a peptide and an antibody.
3) Research, invention, innovation as starting element of a business planning activity.
Innovation Management, Project management and Marketing.

Key elements of a biotech business plan:

- team;
- market and niche concept;
- technology defensible technologies;
- ways to access markets.

The business model concept.
Business plan evaluation and the due diligence concept.
Way out concept.

4) From research to start-ups:

- the performance analysis of the business data on the annual financial statements;
- the organization and the general principles relating to the businesses;
- strategic planning and business development.

Italiano

1) Sviluppo e gestione delle imprese biotecnologiche in Italia.
2) La proprietà industriale nello sviluppo di un nuovo prodotto: dall'idea al mercato.
Brevetto di invenzione vs segreto di fabbrica; ricerche di novità e per libertà di attuazione.
Requisiti di validità del brevetto: novità, attività inventiva, liceità, applicazione industriale.
Procedure per ottenere un brevetto italiano, Europeo e domanda di brevetto internazionale.
Il brevetto come bene immateriale; cessione e licenza, comproprietà; invenzioni del dipendente.
Equo premio, licenza obbligatoria.
Azioni giudiziarie in materia di proprietà intellettuale, azione di revoca ed azione di contraffazione.
Marchio d'impresa: requisiti per la protezione dei marchi. Disegni e modelli.
Brevetti di prodotto e procedimento; nuovo uso di una sostanza nota: brevetti per farmaci; prolungamento della durata del brevetto farmaceutico (SPC).
Direttiva CEE sulle invenzioni biotecnologiche (Art. 1-7): protezione di sostanze esistenti in natura, microrganismi, geni.; invenzioni non brevettabili per carenza di liceità; deposito di materiale biologico ai fini della sufficienza di descrizione.
Protezione delle varietà vegetali.
Case study: protezione di un peptide e di un anticorpo.
3) Ricerca, invenzione e innovazione come elementi fondamentali della pianificazione imprenditoriale.
Innovation Management, Project management e Marketing.
Gli elementi fondamentali del business plan:

- team;
- Il mercato ed il concetto di "nicchia";
- la tecnologia ed il concetto di "tecnologia difendibile";
- le modalità di accesso al mercato.

Il concetto di business model.
4) Come valutare il business della start up:

- l'economicità del business;
- l'organizzazione aziendale. i principi generali riferiti alle imprese;
- la pianificazione strategica e lo sviluppo dell'impresa.

SUGGESTED TEXTBOOKS AND READINGS

English

Teaching materials prepared by the professor (in English).

Academic texts:

- Büchi G., Di Fazio C., Pellicelli M. Economia Aziendale: temi e metodi per le Facoltà scientifiche, FrancoAngeli, 2008.
- Vanzetti A., Di Cataldo V., Manuale di Dirittto Industriale, Giuffré Editore, 2009.

Articles:

Garud, R., Tuertscher, P., Van de Ven, A.H.
Perspectives on Innovation Processes,
The Academy of Management Annals, 2013, 7(1): 775-819.

Kevin J., Scanlon, Mark A.
Commercializing medical technology
Cytotechnology, 2007, Apr; 53(1-3): 107–112.
Published online 2007 Feb 28. doi: 10.1007/s10616-007-9056-5

Pisano G.P.
Can science be a business? Lessons from biotech.
Harvard Business Review, 2006, Oct 84 (10):114-24, 150.

"White book From Research to Market: Key Issues of Technology transfer from public research centers" on line
http://www.biocat.cat/en/publications/white-book

IPR Help Desk
Fact sheets: Intellectual property in Biotechnology
On line https://www.iprhelpdesk.eu/FS_IP_in_Biotechnology

Durai A. Li B, Metkar S., Pelayo M., Phillips N.
Challenges in the biotech start-ups - heath care nuts
Kellog School of management, Fall 2006, HIMT 453.
On line: http://www.kellogg.northwestern.edu/biotech/faculty/articles/startupc hallenges.pdf

Kolchinsky P.
The entrepreneur's guide to a biotech startup.
On line: http://www.evelexa.com/

Sabatier V., Mangematin, V., Rousselle T.
From Recipe to Dinner: Business Model Portfolios in the European Biopharmaceutical Industry.
Long Range Planning, 2010, 43(2–3): 431-447.

Italiano

Materiali didattici predisposti a cura del docente (in inglese).

Testi consigliati:

1) Büchi G., Di Fazio C., Pellicelli M. Economia Aziendale: temi e metodi per le Facoltà scientifiche. F. Angeli 2008.

2) Manuale di Dirittto Industriale di A. Vanzetti e V. Di Cataldo , Giuffré Editore

Articoli:

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http://www.kellogg.northwestern.edu/biotech/faculty/articles/startupcha llenges.pdf

Kolchinsky P.
The entrepreneur's guide to a biotech startup.
On line: http://www.evelexa.com/

Sabatier V., Mangematin, V., Rousselle T.
From Recipe to Dinner: Business Model Portfolios in the European Biopharmaceutical Industry.
Long Range Planning, 2010, 43(2–3): 431-447.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=7x5c

Metals in medicine

Metals in medicine

Academic year:	2017/2018
Course ID:	BIO0177
Teacher:	Dott. Daniela Delli Castelli
Teacher contacts:	*daniela.dellicastelli@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Elective
Credits/recognition:	3
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=gv5i

Methods of drug discovery

Metodologie del Drug discovery

Academic year:	2017/2018
Course ID:	BIO0141B
Teacher:	Dott. Sonja Visentin
Teacher contacts:	0116708337 (Via Quarello) - 0116707663 (Via P. Giuria), *sonja.visentin@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/08 - chimica farmaceutica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Understanding the contents of the course requires solid background in peptides/protein structure, and basic knowledge of organic and analytical chemistry

COURSE OBJECTIVES

The main objective of the course is to provide students with the basics of drug discovery and understanding the relationship between the chemical structure of molecules and their pharmacological activity. Moreover, the course prefigures to provide the student with a highly professionalized competence of business and national pharmaceutical research centers, on the different aspects of instrumental analysis in the different phases of the discovery, development and production process of the pharmaceutical industry.

COURSE AIMS

At the end of the course, students should be able to have learned the various stages that make up the pipeline of drug discovery and understand the chemical and physical properties of the molecules in the pharmaceutical field

COURSE DELIVERY

The course will be delivered through frontal lectures using the Moodle platform

Lessons: 40 hours

Credits: 5

An educational visit to a pharmaceutical company (in 2015-2016/2016-2017,Chiesi Farmaceutici , Parma,) if possible, will be organized.

LEARNING ASSESSMENT METHODS

The exam is divided in two parts:

- writing a scientific article about a drug assigned to each candidate at least 15 days before the examination date, using a track provided by the teacher (max 27/30)
- Oral exam on the program

The unit of measure: thirty/30

SYLLABUS

- Introduction to drug discovery ; identification of the target and the ligand ; virtual screening ; drug discovery based on fragments ; transformations of lead ; isosterism and bioisosterism ; Introduction to QSAR ; synthesis of peptides and SPPS ; Combinatorial Approach to Drug Discovery ; example of study .
- Physico-chemical properties of molecules and their influence on the interaction between drugs and their targets :

- type of bond and their strength, intermolecular forces, ionization, lipophilicity
- Relevance of the structures of proteins and DNA drug-receptor interaction
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Molecular Descriptors involved in the determination of the ADME profile of potential drugs
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Structure- activity relationship and drug design
- Drug Discovery for biotechnological drugs
- Nanotechnology for drug delivery

SUGGESTED TEXTBOOKS AND READINGS

Burger's Medicinal Chemistry and Drug Discover

Author: Donald Abraham and David Rotella

Publisher: Wiley
ISBN: 978-0-470-27815-4

Pharmaceutical Analysis
Author: David Watson
Publisher: Elsevier
ISBN: 9780702051296

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=phd2

Molecular Dynamics of Cellular Processes

Molecular Dynamics of Cellular Processes

Academic year:	2017/2018
Course ID:	BIO0167
Teacher:	Prof. Sara CABODI Prof. Mara BRANCACCIO
Teacher contacts:	011-6706422, *sara.cabodi@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Optional
Type of examination:	Oral

PREREQUISITES
Good knowledge in molecular and cellular biology

COURSE OBJECTIVES

The aim of the course is to deepen the knowledge on the molecular mechanisms relevant to cellular homeostasis, which are of particular relevance and interest in the field of cellular biology. The aims are to provide new knowledge based on high impact research published in recent years in international journals. Teaching also aims to stimulate students' interest in recent and leading edge research in the field of cellular biology and cancer research through critical reading and collective discussion of highly relevant scientific articles

COURSE AIMS

At the end of the course the student:

- will know in detail and in depth the molecular mechanisms underlying the cellular processes studied

- will acquire the ability to read and criticize other relevant scientific articles where new discoveries are presented and discussed

- will have the ability to critically evaluate the scientific research presented during lessons

-can acquire the ability to read articles in English and structure scientific presentations by identifying key concepts and major issues

COURSE DELIVERY

To achieve the learning objectives of this course 40 hours of frontal lessons are used, with a high degree of interactivity to stimulate student involvement in discussing the topics presented.

LEARNING ASSESSMENT METHODS

Verification of learning involves a final oral exam that involves discussing the topics presented in the lesson

SYLLABUS

The program is based on the deepening of key scientific issues coming out in recent publications.

The topics covered will address the molecular mechanisms underlying the tumorigenic and metastasis processes in which various cellular functionalities are involved, including cell adhesion, matrix interaction, proliferation, survival, and stemness.

A particular interest will be focused on the ability of cancer cells to induce changes in the micro-environment and to send signals and induce systemic changes

SUGGESTED TEXTBOOKS AND READINGS

Scientific publications selected and provided by the teacher.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=5c9j

Molecular Imaging Techniques

Tecniche di Imaging Molecolare

Academic year:	2017/2018
Course ID:	BIO0111
Teacher:	
Teacher contacts:	
Year:	2nd year
Type:	
Credits/recognition:	9
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica CHIM/06 - chimica organica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Imaging: Optical/PET/SPECT /X RAY
- MRI/NMR
- Ultrasound Imaging

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=8z1h

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Imaging: Optical/PET/SPECT /X RAY

PET/SPECT - X RAY

Academic year:	2017/2018
Course ID:	BIO0111
Teachers:	Prof. Desiree' DEANDREIS Prof. Enzo TERRENO
Teacher contacts:	n/d, *desiree.deandreis@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES
Gli studenti dovranno possedere le conoscenze di base della chimica generale/inorganica e biologia molecolare

Basic principles of general/ inorganic chemistry and molecular biology are required.

COURSE OBJECTIVES

L'insegnamento si prefigge l'obiettivo di fornire agli studenti le conoscenze di base di alcune tecnologie diagnostiche basate sull'acquisizione di immagini su organismi viventi quali le tecniche di imaging ottiche e quelle che utilizzando radiazioni ionizzanti (PET/SPECT/CT). Per ogni tecnologia saranno presentati: i principi base della tecnica, le caratteristiche dei rispettivi agenti di contrasto o traccianti, le principali applicazioni (anche in ambito teranostico) precliniche e cliniche.

This teaching module aims at offering the basic knowledge of some in vivo diagnostic imaging technologies based on the use of both non ionizing radiations (optical imaging) and ionizing radiations (PET/SPECT/CT) . Each technique will be presented in terms of: basic principles, contrast agents or tracers involved, most relevant preclinical and clinical applications, including those ones supporting therapeutic treatments.

COURSE AIMS

L'insegnamento di questo modulo consentirà agli studenti di conoscere gli elementi fondamentali delle tecnologie di imaging in vivo trattate, permettendo loro di valutarne criticamente i punti di forza e i limiti.

In riferimento agli obiettivi generali del corso, la formazione degli studenti si arricchirà con le seguenti competenze:

Conoscenza e capacità di comprensione:

- descrivere i meccanismi alla base delle diverse tecnologie trattate nel corso;

- valutare con senso critico i vantaggi e i limiti delle tecniche descritte;

- progettare un agente di contrasto o un tracciante per affrontare un'esigenza preclinica/clinica

Autonomia di giudizio

- scegliere la tecnica più adatta ad una ben definita esigenza clinica o necessità preclinica.

- valutare quale agente di contrasto o tracciante possa avere la maggiore probabilità di successo diagnostico

Abilità comunicative

- apprendere la terminologia tecnica corretta

The main learning outcome will be the acquisition of the fundamental aspects of the in vivo imaging technologies presented in the teaching module.

Referring to the general outcomes of the course, the students will acquire the following competences:

Understanding

- to describe the basic mechanisms of the imaging technologies;

- to critically evaluate advantages and limitations of the techniques;

- to design the more appropriate contrast agent or a tracer for a given preclinical/clinical need.

Judgment independency

- to choice the most suitable technique for a given given preclinical/clinical need;

- to assess which contrast agentor tracer may have the highest diagnostic potential for a given preclinical/clinical need.

Communicative skills

- to learn the correct technical terminology.

COURSE DELIVERY

L'insegnamento è strutturato in 40 ore di didattica frontale, suddivise in lezioni da 2 ore in base al calendario accademico. La didattica frontale si costituisce di lezioni teoriche e possibili seminari tenuti da esperti dell'argomento. La frequenza è obbligatoria.

The teaching module consists of 40 hours of lessons organized in units of 2 h each scheduled according to the academic calendar. The units include theoretical lessons as well as seminars given by experts in the field.

The attendance is mandatory.

LEARNING ASSESSMENT METHODS

La verifica della preparazione degli studenti avverrà con un esame orale. Gli argomenti oggetto d'esame rifletteranno quelli trattati durante l'insegnamento.

L'esame, oltre a verificare la conoscenza e la comprensione degli argomenti trattati, si pone l'obiettivo di verificare le competenze descritte nella sezione "Risultati dell'apprendimento attesi": le domande, infatti, comprenderanno elementi descrittivi ma anche critici. Necessario al superamento dell'esame è un corretto utilizzo della terminologia e una chiara e sintetica esposizione che esponga i collegamenti logici tra gli aspetti considerati.

Students learning will be verified by an oral exam. The questions will regard the topics presented and discussed in the module.

Besides verifying the learning level, the exam aims at checking the effective competences acquired (see Learning outcomes section above): in fact, the questions will comprise descriptive and comparative elements. The use of a correct terminology and a clear and concise exposition of the arguments are fundamental factors for a positive result of the test.

SYLLABUS

Parte I: Optical imaging

- Principi base della fotoluminescenza – Principali tecniche di acquisizione

- Classi di agenti di contrasto ottici

- Principali applicazioni precliniche/cliniche

Parte II: PET/SPECT/X-rays

- Principi base delle metodiche impieganti radiazioni ionizzanti (principi fisici di radioattività e raggi x e strumentazione)

- Differenti tipi di tracciante e via metabolica coinvolta

- Principi della somministrazione dei mezzi di contrasto per le acquisizioni CT

- Principali indicazioni pre-cliniche e cliniche delle tecniche impieganti radiazioni ionizzanti

Part II: Optical imaging

- Basics of photoluminescence – Acquisition techniques and instrumentation

- Optical contrast agents

- Main preclinical/clinical applications

Part II: PET/SPECT/XRAYS

- Basics of ionizing radiation techniques (radionuclides and x rays physic principles and instrumentation)

- Different types of tracers and metabolic way involved.

- Principles of CT contrast agent and acquisition

- Main preclinical/clinical applications.

SUGGESTED TEXTBOOKS AND READINGS

Non sono consigliati specifici testi. Il docente metterà a disposizione attraverso la piattaforma moodle il materiale presentato opportunamente integrato con la letteratura scientifica rilevante.

There are no specific books recommended. The teacher will make available on the Moodle platform the material presented during the module, properly integrated with the relevant scientific literature.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=6nef

MRI/NMR

MRI/NMR

Academic year:	2017/2018
Course ID:	BIO0111
Teachers:	Dott. Walter DASTRU' Dott. Francesca Reineri
Teacher contacts:	0116706493 o 0116706477, *walter.dastru@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	2
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Basics of Physics (elecromagnetism). Fundamentals of Nuclear magnetic Resonance (how the NMR signal is formed? NMR active nuclei) Fundamental of Organic Chemistry (functional groups) and Inorganic chemistry (metal complexes). Conoscenze di Fisica di base (elettromagnetismo). Fondamenti di risonanza magnetica nucleare (come si forma il segnale NMR, nuclei NMR attivi) Conoscenze di base di chimica Organica e Inorganica (gruppi funzionali in chimica organica, complessi metallici).

COURSE OBJECTIVES

The overarching goal of the course is giving to biotechnologists the fundamental knowledge for the comprehension of the main diagnostic imaging techniques. In particular, this part of the course aims to explain the basis of Magnetic Resonance Imaging (MRI) and to show the main applications of this technique in both clinical an pre-clinical studies.

L'insegnamento si inserisce nel generale obiettivo del corso di studio di fornire al biotecnologo le conoscenze necessarie per la comprensione delle principali tecniche di imaging diagnostico. In particolare, l'insegnamento si propone di fornire le basi dell'imaging di risonanza magnetica, di mostrare le principali applicazioni diagnostiche di questa tecnica sia a livello di applicazioni cliniche che nella ricerca.

COURSE AIMS

At the end of the course, the student

- Should know how the main MRI sequences work

- Should know the main parameters of the sequences and should be able to modify these parameters in order improve MR images

- Should know which different contrast agents can be used for MRI and their effect on images

- Should know which information can be obtained about different pathologies, using MRI-MRS techniques.

Al termine dell'insegnamento lo studente dovrà essere in grado di:

- Conoscere il funzionamento delle principali sequenze MRI

- Conoscere i parametri di acquisizione delle sequenze e modificarli per migliorare la qualità delle immagini

- Conoscere l'azione delle principali categorie di agenti di contrasto

- Sapere quali informazioni possono essere ricavate, mediante le tecniche MRI-MRS, riguardo diverse patologie

COURSE DELIVERY

Il corso consiste in lezioni frontali (22h) e esercitazioni pratiche(2h)

The Course will consist of lectures (22h) and practical classes (2h).

LEARNING ASSESSMENT METHODS

Knowledge acquisition will be assessed by either an oral or written examination in which students will be asked questions about the main topics of the course. The use of correct terminology and clarity of the exposition will be also evaluated.

La preparazione dello studente verrà verificata con un esame orale o scritto. Nel corso dell'esame verrà valutata, oltre alla conoscenza della materia anche l'uso della corretta terminologia e la chiarezza dell'esposizione degli argomenti.

SUPPORT ACTIVITIES

During the course students can count on a teacher for support with any questions/problems, one afternoon a week, upon making an appointment.

Durante tutta la durata del corso gli studenti potranno contare sul supporto dei docenti per ogni domanda/problema, un pomeriggio alla settimana, previo appuntamento.

SYLLABUS

- Image construction using magnetic field gradients

- Different pulse sequences for MRI

- What is contrast in MRI and how can be enhanced (without contrast agents). repetition time (TR) and echo time (TE) parameters.

- Paramagnetic contrast agents (T1 and T2 CAs)

- CEST and smart contrast agents (pH responsive agents).

- In vivo Magnetic Resonance Spectroscopy of heteronuclei (13C-MRS, 31P-MRS, 19F-MRS)

- In vivo MRS for treatment response and detection of disease (13C hyperpolarized CAs)

- Diffusion MRI: a biomarker for early detection of treatment response in cancer disease

- Principi di formazione dell'immagine in MRI mediante gradienti di campo magnetico

- Sequenze di impulso

- Il contrasto nelle immagini MRI, come può essere variato (parametri TR e TE).

- Agenti di contrasto paramagneytici in MRI

- Agenti di contrasto CEST, agenti responsivi di pH

- Spettroscopia NMR in vivo: spettri di eteronuclei (13C, 19F, 31P)

- Spettroscopia NMR in vivo per il rilevamento precoce dell'efficienza di un trattamento terapeutico e per la diagnosi (agenti di contrasto iperpolarizzati)

Diffusion MRI

SUGGESTED TEXTBOOKS AND READINGS

- Joseph P. Hornak website: http://www.cis.rit.edu/htbooks/mri/

- Hashemi. R.H.; Bradley, Jr. W.G.; Lisanti, C.J. MRI. The Basics.

- Weishaupt, D.; Köchli, V.D.; Marincek, B. How Does MRI Work?

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=ilcx

Ultrasound Imaging

Imaging Ottico ed Ultrasuoni

Academic year:	2017/2018
Course ID:	BIO0111
Teacher:	Prof. Giancarlo CRAVOTTO
Teacher contacts:	011 670 7183, *giancarlo.cravotto@unito.it*
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	
Course SSD (disciplinary sector):	CHIM/06 - chimica organica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=q4hc

Molecular Immunology

Immunologia Molecolare

Academic year:	2017/2018
Course ID:	BIO0114
Teacher:	Prof. Federica CAVALLO
Teacher contacts:	011 670 6457, *federica.cavallo@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	MED/04 - patologia generale
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES

Prerequisites
Having a solid background in genetics, molecular biology and basic immunology; possibility to attend lessons on an ongoing basis

Prerequsiti
Possedere una solida preparazione in genetica, biologia molecolare e immunologia di base; possibilità di presenziare alle lezioni in modo continuativo.

COURSE OBJECTIVES

English

The teaching aims are:

- providing the tools to interpret the molecular mechanisms of the natural and adaptive immune response and of the pathogenesis of diseases in which the immune system is involved;
- providing an advanced biotechnological up-dating about the main immunological techniques used in the laboratory practice;
- providing the competencies to presenting to the audience a scientific concept and discussing it

Italiano

L'insegnamento vuol fornire allo studente:

- gli strumenti per interpretare i meccanismi molecolari della risposta immunitaria naturale e adattativa e della patogenesi delle malattie nelle quali il sistema immunitario è coinvolto;
- un aggiornamento biotecnologico avanzato riguardo le principali tecniche immunologiche utilizzate nella pratica di laboratorio;
- le competenze per presentare al pubblico un concetto scientifico e discuterne.

COURSE AIMS

English

The student who has followed the teaching course will have understood the main molecular mechanisms by which the immune system contributes to the prevention, healing and sometimes the development of diseases. The student will also have acquired the methodological tools to understand the main immunological techniques used in laboratory practice and to present and discuss a scientific concept.

Italiano

Lo studente che abbia seguito l'insegnamento avrà compreso i principali meccanismi molecolari attraverso i quali il sistema immunitario contribuisce alla prevenzione, guarigione e talvolta sviluppo delle patologie. Lo studente avrà inoltre acquisito gli strumenti metodologici per comprendere le principali tecniche immunologiche utilizzate nella pratica di laboratorio e presentare e discutere un concetto scientifico.

COURSE DELIVERY

English

The teaching course consists of lectures - which include the oral presentations of each student, and subsequent open discussion - and solving of easy questions related to the topics discussed during the lessons.

Italiano

L'insegnamento si articola in lezioni frontali (comprendenti le presentazioni orali di ciascuno studente, e successiva discussione aperta) e la risoluzione di facili quesiti relativi agli argomenti discussi durante le lezioni.

LEARNING ASSESSMENT METHODS

English

The teaching course grade determination consists in the evaluation of three aspects:

1. Check "in itinere" the level of student attention/participation: During the lessons the students respond in writing to easy questions on the fundamental aspects of the topics covered during the lesson. For each correct answer is assigned a point; the questions are in total 30-35.

2. Verification of the capacity to present and critically analyse a scientific concept: each student presents, in 15 minutes, a paper (published in the last year and provided by the teacher) related to the main topics of the program and discusses it by answering questions from the teacher and the other students. The teacher assigns a mark in grades from 1 to 30 on the basis of:

- Quality of information and bibliographic references supplied
- Clarity of the document (slides)
- Oral skill in communicating the message (presentation should be in English)
- Ability to use the time given correctly
- General comment given by classmates

3. Final assessment of learning: at the end of the course students take a test with multiple-choice questions. It is given a mark in grades form 1 to 30.

The final grade will be the arithmetic mean of these three marks.

Italiano

La modalità di verifica dell'apprendimento consta nella valutazione di tre aspetti:

1. Verifica in itinere del livello di attenzione/partecipazione degli studenti: durante le lezioni gli studenti rispondono per iscritto a facili domande sugli aspetti fondamentali degli argomenti trattati durante la lezione. Per ogni risposta

esatta viene assegnato un punto; le domande sono in totale 30-35.

2. Verifica della capacità espositiva e di analisi critica di un concetto scientifico: ciascuno studente presenta in 15 minuti un articolo (pubblicato nell'ultimo anno e fornito dall'insegnante) relativo ad un argomento del programma e lo discute rispondendo alle domande dei colleghi e dell'insegnante. Al termine dell'esposizione l'insegnante assegna un punteggio in trentesimi sulla base di:

- Qualità delle informazioni fornite e relative referenze bibliografiche
- Chiarezza del documento (diapositive presentate)
- Abilità nel comunicare il messaggio (la presentazione dovrebbe essere fatta in inglese)
- Utilizzo corretto del tempo a disposizione
- Giudizio generale dato dagli altri studenti.

3. Verifica finale dell'apprendimento: alla fine dell'insegnamento gli studenti sostengono un test con domande a risposta multipla. Viene assegnato un voto in trentesimi.

Il voto finale sarà la media matematica di questi tre voti.

SUPPORT ACTIVITIES

English

For the students that show deficiencies in the prerequisites, support is offered individually or in small groups outside lesson.

Italiano

Per chi dimostrasse delle carenze nei prerequisiti, viene offerta assistenza individuale o a piccoli gruppi fuori dall'orario di lezione.

SYLLABUS

English

- Signalling pathways downstream of the receptors of the innate immune response; inflammasomes and autophagosomes
- Signal transduction downstream of type I and II cytokine receptors
- Molecular mechanisms of the V(D)J recombination and central tolerance
- Signalling pathways downstream of the antigen receptors of T and B cells; costimulatory receptors and immune checkpoints
- Molecular mechanisms of antigen presentation on MHC class I and II molecules; the enhanceosomes of the MHC molecules
- Molecular mechanisms of somatic hypermutation and class-switch recombination
- Molecular mechanisms of the hypersensitivities
- The detection, measurement, and characterization of antibodies and their use as research and diagnostic tools
- Isolation of lymphocytes and characterization of their specificity, frequency and function
- Detection of immunity in vivo

Italiano

- Le vie di segnalazione a valle dei recettori della risposta innata; inflammasoni e autofagosomi
- La trasduzione del segnale a valle dei recettori delle citochine di tipo I e II
- Meccanismi molecolari della ricombinazione V(D)J e della tolleranza centrale
- Le vie di segnalazione a valle dei recettori per l'antigene dei linfociti T e dei linfociti B; recettori di costimolazione e chekpoints immunitari
- Meccanismi molecolari della presentazione degli antigeni sulle molecole MHC di classe I e di classe II; gli

enhansosomi delle molecole MHC
- Meccanismi molecolari della ipermutazione somatica e della commutazione di classe
- Meccanismi molecolari delle ipersensibilità
- Rilevamento, misurazione e caratterizzazione degli anticorpi, e loro uso nella terapia e nella diagnostica
- Isolamento dei linfociti e caratterizzazione della loro specificità, frequenza e funzione.
- La determinazione dell'immunità in vivo.

SUGGESTED TEXTBOOKS AND READINGS

English

- Janeway's Immunobiology, 9th edition, K Murphy, Garland Science
- Cellular and Molecular Immunology, Sixth Edition, AK Abbas et al., Elsevier Saunders
- The Immune System, Fourth Edition, P Parham, Garland Science

Italiano

- Janeway's Immunobiology, Eighth edition, K Murphy, Garland Science
- Cellular and Molecular Immunology, Sixth Edition, AK Abbas et al., Elsevier Saunders
- The Immune System, Fourth Edition, P Parham, Garland Science

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=gat1

Molecular Therapy in Nephrology

Terapie molecolari in Nefrologia

Academic year:	2017/2018
Course ID:	BIO0144
Teacher:	Prof. Benedetta BUSSOLATI
Teacher contacts:	0116706453, *benedetta.bussolati@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/14 - nefrologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=acm9

Molecular Therapy in Neurology

Terapia Molecolare in Neurologia

Academic year:	2017/2018
Course ID:	BIO0144
Teacher:	Prof. Alessandro Mauro
Teacher contacts:	0116636327-0323514370, *alessandro.mauro@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/26 - neurologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=y5km

MRI/NMR

MRI/NMR

Academic year:	2017/2018
Course ID:	BIO0111
Teacher:	Dott. Walter DASTRU' Dott. Francesca Reineri
Teacher contacts:	0116706493 o 0116706477, *walter.dastru@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	2
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Basics of Physics (elecromagnetism). Fundamentals of Nuclear magnetic Resonance (how the NMR signal is formed? NMR active nuclei) Fundamental of Organic Chemistry (functional groups) and Inorganic chemistry (metal complexes). Conoscenze di Fisica di base (elettromagnetismo). Fondamenti di risonanza magnetica nucleare (come si forma il segnale NMR, nuclei NMR attivi) Conoscenze di base di chimica Organica e Inorganica (gruppi funzionali in chimica organica, complessi metallici).

COURSE OBJECTIVES

The overarching goal of the course is giving to biotechnologists the fundamental knowledge for the comprehension of the main diagnostic imaging techniques. In particular, this part of the course aims to explain the basis of Magnetic Resonance Imaging (MRI) and to show the main applications of this technique in both clinical an pre-clinical studies.

L'insegnamento si inserisce nel generale obiettivo del corso di studio di fornire al biotecnologo le conoscenze necessarie per la comprensione delle principali tecniche di imaging diagnostico. In particolare, l'insegnamento si propone di fornire le basi dell'imaging di risonanza magnetica, di mostrare le principali applicazioni diagnostiche di questa tecnica sia a livello di applicazioni cliniche che nella ricerca.

COURSE AIMS

At the end of the course, the student

- Should know how the main MRI sequences work

- Should know the main parameters of the sequences and should be able to modify these parameters in order improve MR images

- Should know which different contrast agents can be used for MRI and their effect on images

- Should know which information can be obtained about different pathologies, using MRI-MRS techniques.

Al termine dell'insegnamento lo studente dovrà essere in grado di:

- Conoscere il funzionamento delle principali sequenze MRI

- Conoscere i parametri di acquisizione delle sequenze e modificarli per migliorare la qualità delle immagini

- Conoscere l'azione delle principali categorie di agenti di contrasto

- Sapere quali informazioni possono essere ricavate, mediante le tecniche MRI-MRS, riguardo diverse patologie

COURSE DELIVERY

Il corso consiste in lezioni frontali (22h) e esercitazioni pratiche(2h)

The Course will consist of lectures (22h) and practical classes (2h).

LEARNING ASSESSMENT METHODS

Knowledge acquisition will be assessed by either an oral or written examination in which students will be asked questions about the main topics of the course. The use of correct terminology and clarity of the exposition will be also evaluated.

La preparazione dello studente verrà verificata con un esame orale o scritto. Nel corso dell'esame verrà valutata, oltre alla conoscenza della materia anche l'uso della corretta terminologia e la chiarezza dell'esposizione degli argomenti.

SUPPORT ACTIVITIES

During the course students can count on a teacher for support with any questions/problems, one afternoon a week, upon making an appointment.

Durante tutta la durata del corso gli studenti potranno contare sul supporto dei docenti per ogni domanda/problema, un pomeriggio alla settimana, previo appuntamento.

SYLLABUS

- Image construction using magnetic field gradients

- Different pulse sequences for MRI

- What is contrast in MRI and how can be enhanced (without contrast agents). repetition time (TR) and echo time (TE) parameters.

- Paramagnetic contrast agents (T1 and T2 CAs)

- CEST and smart contrast agents (pH responsive agents).

- In vivo Magnetic Resonance Spectroscopy of heteronuclei (13C-MRS, 31P-MRS, 19F-MRS)

- In vivo MRS for treatment response and detection of disease (13C hyperpolarized CAs)

- Diffusion MRI: a biomarker for early detection of treatment response in cancer disease

- Principi di formazione dell'immagine in MRI mediante gradienti di campo magnetico

- Sequenze di impulso

- Il contrasto nelle immagini MRI, come può essere variato (parametri TR e TE).

- Agenti di contrasto paramagneytici in MRI

- Agenti di contrasto CEST, agenti responsivi di pH

- Spettroscopia NMR in vivo: spettri di eteronuclei (13C, 19F, 31P)

- Spettroscopia NMR in vivo per il rilevamento precoce dell'efficienza di un trattamento terapeutico e per la diagnosi (agenti di contrasto iperpolarizzati)

Diffusion MRI

SUGGESTED TEXTBOOKS AND READINGS

- Joseph P. Hornak website: http://www.cis.rit.edu/htbooks/mri/

- Hashemi. R.H.; Bradley, Jr. W.G.; Lisanti, C.J. MRI. The Basics.

- Weishaupt, D.; Köchli, V.D.; Marincek, B. How Does MRI Work?

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=ilcx

Pathologic basis of disease

Pathologic basis of disease

Academic year:	2017/2018
Course ID:	BIO0176
Teacher:	Juan Carlos CUTRIN
Teacher contacts:	- - - -, *juancarlos.cutrin@unito.it*
Year:	2nd year
Type:	Elective
Credits/recognition:	5
Course SSD (disciplinary sector):	MED/04 - patologia generale
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=zeqm

Pharmacological Biotechonology

Biotecnologie Farmacologiche

Academic year:	2017/2018
Course ID:	BIO0141A
Teacher:	Prof. Carola EVA
Teacher contacts:	0116706608/7718, *carola.eva@unito.it*
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/14 - farmacologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=g624

Pharmacology and Drug Therapies

Farmacologia a Terapie Farmacologiche

Academic year:	2017/2018
Course ID:	BIO0141
Teacher:	
Teacher contacts:	
Year:	2nd year
Type:	
Credits/recognition:	7
Course SSD (disciplinary sector):	
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Methods of drug discovery
- Pharmacological Biotechonology

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=nsm9

Methods of drug discovery

Metodologie del Drug discovery

Academic year:	2017/2018
Course ID:	BIO0141B
Teacher:	Dott. Sonja Visentin
Teacher contacts:	0116708337 (Via Quarello) - 0116707663 (Via P. Giuria), *sonja.visentin@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/08 - chimica farmaceutica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
Understanding the contents of the course requires solid background in peptides/protein structure, and basic knowledge of organic and analytical chemistry

COURSE OBJECTIVES

The main objective of the course is to provide students with the basics of drug discovery and understanding the relationship between the chemical structure of molecules and their pharmacological activity. Moreover, the course prefigures to provide the student with a highly professionalized competence of business and national pharmaceutical research centers, on the different aspects of instrumental analysis in the different phases of the discovery, development and production process of the pharmaceutical industry.

COURSE AIMS

At the end of the course, students should be able to have learned the various stages that make up the pipeline of drug discovery and understand the chemical and physical properties of the molecules in the pharmaceutical field

COURSE DELIVERY

The course will be delivered through frontal lectures using the Moodle platform

Lessons: 40 hours

Credits: 5

An educational visit to a pharmaceutical company (in 2015-2016/2016-2017,Chiesi Farmaceutici , Parma,) if possible, will be organized.

LEARNING ASSESSMENT METHODS

The exam is divided in two parts:

- writing a scientific article about a drug assigned to each candidate at least 15 days before the examination date, using a track provided by the teacher (max 27/30)
- Oral exam on the program

The unit of measure: thirty/30

SYLLABUS

- Introduction to drug discovery ; identification of the target and the ligand ; virtual screening ; drug discovery based on fragments ; transformations of lead ; isosterism and bioisosterism ; Introduction to QSAR ; synthesis of peptides and SPPS ; Combinatorial Approach to Drug Discovery ; example of study .
- Physico-chemical properties of molecules and their influence on the interaction between drugs and their targets :

- type of bond and their strength, intermolecular forces, ionization, lipophilicity
- Relevance of the structures of proteins and DNA drug-receptor interaction
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Molecular Descriptors involved in the determination of the ADME profile of potential drugs
- Principles of Pharmacodynamics Pharmacokinetics (ADMET)
- Structure- activity relationship and drug design
- Drug Discovery for biotechnological drugs
- Nanotechnology for drug delivery

SUGGESTED TEXTBOOKS AND READINGS

Burger's Medicinal Chemistry and Drug Discover

Author: Donald Abraham and David Rotella

Publisher: Wiley
ISBN: 978-0-470-27815-4

Pharmaceutical Analysis
Author: David Watson
Publisher: Elsevier
ISBN: 9780702051296

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=phd2

Pharmacological Biotechonology

Biotecnologie Farmacologiche

Academic year:	2017/2018
Course ID:	BIO0141A
Teacher:	Prof. Carola EVA
Teacher contacts:	0116706608/7718, *carola.eva@unito.it*
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/14 - farmacologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=g624

Phisiology

Fisiologia

Academic year:	2017/2018
Course ID:	BIO0136
Teacher:	Prof. Filippo TEMPIA
Teacher contacts:	0116708169, *filippo.tempia@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/09 - fisiologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=3xpo

Phisiology

Fisiologia

Academic year:	2017/2018
Course ID:	BIO0108A
Teacher:	Prof. Filippo TEMPIA
Teacher contacts:	0116708169, *filippo.tempia@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/09 - fisiologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

PREREQUISITES
Conoscenze di fisica, biochimica, biologia molecolare, biologia cellulare, istologia. Verranno forniti dei cenni di anatomia degli apparati che saranno trattati nel corso. Knowledge of physics, biochemistry, molecular biology, cellular biology, histology, anatomy. Notions of anatomy will be provided when necessary.

COURSE OBJECTIVES

English

The student must know the mechanisms responsible for cellular and molecular events at the basis of physiological signals, integrating information deriving from preceding classes (cellular biology, molecular biology, biochemistry).

The student must understand the organizational principles at the basis of physiological functions and their integration.

The student must acquire the scientific approach necessary for the study of the function of the organs of the human body, through examples of physiological systems.

Italiano

Lo studente deve conoscere i meccanismi responsabili dei fenomeni cellulari e molecolari alla base dei segnali fisiologici, integrando le conoscenze trasmesse da corsi precedenti (biologia cellulare, biologia molecolare, biochimica).

Lo studente deve comprendere i principi organizzativi generali alla base delle funzioni fisiologiche e la loro integrazione.

Lo studente deve apprendere l'approccio scientifico necessario per lo studio delle modalità di funzionamento dei diversi organi del corpo umano, mediante alcuni esempi di sistemi fisiologici.

COURSE AIMS

English

At the end of the learning process, the student must show knowledge of the cellular and molecular mechanisms of biological signals. The student must show an understanding of the principles of organization of physiological functions and the mechanisms of their integration. The student must demonstrate the capacity to utilize the scientific approach to describe physiological functions.

Italiano

Al termine dell'apprendimento lo studente dovrà dimostrare di conoscere i meccanismi cellulari e molecolari dei segnali biologici. Dovrà inoltre dimostrare di aver compreso i principi organizzativi alla base delle funzioni fisiologiche e i meccanismi della loro integrazione. Lo studente dovrà essere in grado di utilizzare l'approccio scientifico nel descrivere i meccanismi delle funzioni fisiologiche.

COURSE DELIVERY

English

L'insegnamento è costituito da 40 ore di lezione frontale.

Italiano

The course is constituted by 40 hours of frontal lesson.

LEARNING ASSESSMENT METHODS

English

The evaluation is based on two test:

1. a written test with true/false answers; the grade is based on the number of exact (+1), null (0) and wrong (-1) answers, so that, statistically, zero level of knowledge (random answers) results in grade zero. The pass grade is half of the maximal score (for example, with 32 questions the maximal grade is 32/32 and the pass grade is 16/32).

2. an oral examination with admission upon passing the written test on the same exam day; in the oral examination the student must show to know in depth the subjects taught in the class and to be able to present them with logic and according to the scientific method.

The final grade is determined from the results of the written test and the oral examination.

Italiano

La valutazione dell'esame si basa sue due prove:

1. un test scritto con risposte vero/falso; la valutazione si basa sul numero di risposte esatte (+1 punto), nulle (0 punti) ed errate (-1 punto), in modo che statisticamente una conoscenza zero (risposte date a caso) dia punteggio zero. La sufficienza è la metà del punteggio massimo (per esempio, con 32 domande il punteggio massimo è 32/32 e la sufficienza è 16/32).

2. un esame orale a cui si accede con il superamento del test scritto nello stesso appello di esame; nella prova orale lo studente dovrà dimostrare di conoscere approfonditamente gli argomenti trattati a lezione e di saperli esporre con logica e rigore scientifico.

Il voto complessivo deriva dai risultati del test scritto e della prova orale.

SYLLABUS

English

- Introduction to the study of the nervous system
    - Principles of organization of the nervous system
- Biophysics and cellular physiology
    - Biophysics of excitable membranes
    - Synaptic transmission
    - Synaptic plasticity
- Plastic changes of the nervous system
    - Formation of neural circuits
    - Activity-dependent modification of brain circuits
    - Repair and regeneration in the nervous system
- Sensory physiology
    - General physiology of sensory receptors
    - Somatosensory system
    - Pain and analgesia
    - Hearing and balance
    - Vision
    - Taste and olfaction
- Motor control
    - Spinal motor circuits
    - Brainstem and control of posture
    - Cortical control of volontary movement
    - Basal ganglia
    - Cerebellum
    - Ocular movements
- Higher nervous functions
    - Learning and memory
    - Sleep-wake cycle
    - Emotion, motivation and reward
    - Cognitive functions
    - Language

Italiano

- Introduzione allo studio del sistema nervoso
    - Principi di organizzazione del sistema nervoso
- Biofisica e fisiologia cellulare
    - Biofisica delle membrane eccitabili.
    - Trasmissione sinaptica.
    - Plasticità sinaptica
- Modificazioni plastiche del sistema nervoso
    - Formazione dei circuiti nervosi
    - modificazioni attività-dipendenti del sistema nervoso
    - Riparazione e rigenerazione nel sistema nervoso
    - Fisiologia sensoriale
    - Fisiologia generale dei recettori sensoriali.
    - Sensibilità somatica.
    - Dolore e analgesia.
    - Udito ed equilibrio.

    - Visione.
    - Gusto e olfatto.
- Controllo motorio
    - Circuiti motori spinali
    - Tronco encefalico e controllo della postura
    - Controllo corticale dei movimenti volontari
    - Gangli della base
    - Cervelletto
    - Movimenti oculari
- Funzioni nervose superiori
    - Apprendimento e memoria.
    - Ciclo sonno-veglia.
    - Motivazione e ricompensa.
    - Emozioni.
    - Funzioni cognitive.
    - Linguaggio.

SUGGESTED TEXTBOOKS AND READINGS

Purves – "Neuroscienze" – Zanichelli (3a edizione-traduzione della 4a edizione in lingua inglese)
Kandel, Schwartz, Jessel, Siegelbaum, Hudspeth "Principles of neural science" – McGraw Hill (5th edition)
D'Angelo, Peres – "Fisiologia. Molecole, cellule e sistemi" – Edi-Ermes
Conti "Fisiologia Medica" (I vol.) – Edi-Ermes, 2a edizione

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Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=huip

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Physical Chemistry

Chimica Fisica

Academic year:	2017/2018
Course ID:	BIO0133
Teacher:	Prof. Gianmario Martra
Teacher contacts:	011 670 7538, *gianmario.martra@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	CHIM/02 - chimica fisica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

Prerequisites
- basic knowledge in Physical-Chemistry (structure of matter; intermolecular interactions; thermodynamic of molecular systems; main molecular spectroscopic methods) - basic knowledge in Physiscs (nautire of electromagnetic radiation, electric dipoles; coulomb interactions; elastic and inelastic interactions) - basic knowledge in biochemistry

Prerequisiti
- conoscenze di chimica-fisica di base (struttura della materia; interazioni intermolecolari; termodinamica dei sistemi molecolari; principali metodi di spettroscopia molecolare) - conoscenze di fisica di base, in particolare in riferimento a: natura della radiazione elettromagnetica; dipolo elettrici; interazioni coulombiane, interazioni elastiche ed anelastiche - conoscenze di biochimica strutturale di base

COURSE OBJECTIVES

Course objectives

The objectives proosed to the studentd as targets of this course are aimed to the achievements of good capabilities dealing with:
- establishment of relationships between the features of amphiphlic molecules/self-assembled amphiphilic molecules and their functional behaviours relevant for their use in nanobiotechnology
- establishment of relationships between features of inorganic nanoparticles and their functional behaviours relevant for their use in nanobiotechnology
- selection and aplication of proper experimental methods for the study of nanobiotecnological systems

Obiettivi formativi

Il corso di propone di formare gli studenti allo sviluppo delle seguenti capacità:
- istituire correlazioni tra proprietà di molecole anfifiliche e loro aggregatie rispettivi comportamenti funzionali di interesse in campo nanobiotecnologico
- istituire correlazioni tra proprietà di nanoparticelle inorganiche e loro comportamenti funzionali di interesse in campo nanobiotecnologico
- individuare le metodologie sperimentali più adatte allo studio di nanosistemi e del loro comportamento in

relazione agli utilizzi in campo biotecnologico

COURSE AIMS

Results of learning outcomes

Knowledge of and expertise in:
- main methods for the preparation of nanomaterials of interest in the
field of biotechnology
- fundamental aspects of physical and physical-chemical features of nanomaterials at the basis of their possible exploitation in nanobiotechnology
- fundamental aspects of the combined use of nanoparticles and biomacromolecules
- experimental methods for the characterization of nanobiotechnologycal systems, and selection of the most proper ones in dependence on specific features of the systems
- electron microscopy, and capability to design the proper observation methods for the investigation of samples of biological/biotechnological interest.

Risultati dell'apprendimento attesi

Acquisizione di:
- Conoscenza dei principali metodi di preparazione di nanomateriali per applicazioni nel campo biotecnologico
- Padronanza degli aspetti fondamentali delle proprietà fisiche e chimicofisiche
che caratterizzano nanomateriali per applicazioni
nanobiotecnologiche.
- Padronanza degli aspetti fondamentali che caratterizzano l'abbinamento/interazione di biomolecole a nanomateriali per scopi tecnologici
- Conoscenza dei principali metodi di caratterizzazione di sistemi nanobiotecnologici, e capacità di scegliere i piu' adatti a seconda del tipo di sistema
- Conoscenza dei metodi di microscopia elettronica e capacità di individuare le modalità di osservazione più adatte a sistemi di interesse biotecnologico

COURSE DELIVERY

Traditional

LEARNING ASSESSMENT METHODS

Learning assessment methods

Written examination, usually based on 5 open questions

Modalità di verifica dell'apprendimento
Esame scritto, che di norma prevede 5 domande aperte

SYLLABUS

Syllabus

This course is devoted to the knowledge and understanding of physical-chemical features of naomaterials at the basis of their functional behaviours which can be exploited for biotechnological applications.
The topics will then deal with:
"soft" nanomaterials
- self-assembling of amphiphilic molecules resulting in the formation of micelles
- relationships between compositional and structural features of amphiphilic molecules and structure and functional behaviour of micelles

- methods for the characterization of micelles-based nanomaterials
- cases-study related to actual or potential application of self-assembled soft materials in biotechnology (e.g, drug delivery, gene therapy)

"hard" nanomaterials
- oxide nanoparticles (typically made of silica), hybridized with fluorophores, intented for applications in "in vitro" and "in vivo" optical imaging: preparation, characterization, surface functionalization for targeting, possible uses
- metal nanoparticles(typically made of gold): origin and dependences of peculiar optical behaviours (plasmon resonance, effect on the emission features of nearby fluorophores), possible uses in cellular and molecular biology
TImaging of nanoparticles: electron microscopy
Scanning electron microscopy: principles; signals to be exploited for the formation of images; type of information present in the images depending on teh signal collected; sample preparation; uses in biology/biotechnology
Transmission electron microscopy: principles; origin and importance of the high resolution, sample preparation; uses in biology/biotechnology
Chemical analysis by energy dispersion spectroscopy of X-rays emitted by samples impinged by a beam of accelerated electrons: principles; uses in biology/biotechnology

Programma

Questo insegnamento è dedicato alla conoscenza e comprensione di caratteristiche chimico-fisiche di nanomateriali che sono alla base di comportamenti funzionali degli stessi di interesse per applicazioni in campo biotecnologico.
Gli argomenti trattati riguardano quindi:
nanomateriali "soft"
- fenomeni di self-assembling di molecole anfifiliche a formare sistemi micellari
- interrelazioni tra caratteristiche di molecole anfifiliche e struttura e funzionalità di aggregati micellari
- metodi di caratterizzazione di sistemi micellari
- esempi di applicazioni esistenti (drug delivery da micelle di copolimeri a blocchi)e di indirizzi di ricerca e sviluppo relativi ad utilizzi biotecnologici di sistemi micellari (vettori per terapia genica)
nanomateriali "hard"
- nanoparticelle ossidiche, tipicamente silicee, ibridizzate con fluorofori per imaging ottico in vitro ed in vivo: caratteristiche, preparazione, metodi di caratterizzazione, funzionalizzazione di superficie per targeting
- nanoparticelle metalliche (tipicamente di Au), natura e dipendenze del comportamento ottico (risonanza plasmonica; effetti nei confronti di fluorofori), utilizzo di tale comportamento per applicazioni biomolecolari
Tecniche di imaging di nanoparticelle: microscopia elettronica
Microscopia elettronica a scansione: principi, caratteristiche, segnali utilizzabili per la formazioni di immagini e relativo contenuto informativo; preparazione dei campioni. Esempi di utilizzo in ambito biologico/biotecnologico
Microscopia elettronica in trasmissione: principi, caratteristiche; origine ed importanza della possibilità di ottenere elevate risoluzioni; preparazione dei campioni. Esempi di utilizzo in ambito biologico/biotecnologico
Analisi chimica tramite spettrometria a dispersione di energia di raggi X caratteristici emessi dai campioni durante le osservazioni di microscopia elettronica. Esempi di utilizzo in ambito biologico/biotecnologico

SUGGESTED TEXTBOOKS AND READINGS

- I.A. Israelechvili, Intermolecular and surface forces, Wiley&Sons, Chichester-UK, 1999, second edition

- J.J. Bozzola, L.D. Russel, Electron Microscopy. Principles and Techniques for Biologists. Secon Edition; Jones and Bartlett Publishers, Boston, 1999

- William & Carter, Transmission electron Microscopy, Interscientia, San Diego, 2002, seconda edizione

- scientific papers, uploaded on the webpage of the course

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9has

Physiology - Biochemistry

Fisiologia - Biochimica

Academic year:	2017/2018
Course ID:	BIO0108
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	
Credits/recognition:	10
Course SSD (disciplinary sector):	
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Biochemistry
- Phisiology

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=0kpa

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Biochemistry

Biochimica

Academic year:	2017/2018
Course ID:	BIO0108B
Teacher:	Carola Ponzetto
Teacher contacts:	0116334566, *carola.ponzetto@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/10 - biochimica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

COURSE OBJECTIVES

English

Biochemistry
Educational Aims

The aim of this course is to give an overview of the most recent advances in cancer 's metabolism, an area of research that has gained considerable interest since metabolic imaging can significantly impact patient management by improving tumor staging, restaging, radiation treatment planning, and monitoring of tumor response to therapy.

Italiano

Biochimica
Obiettivi formativi

Lo scopo di questo corso è quello di fornire un quadro dei più recenti progressi nel campo del metabolismo del cancro, un area di ricerca che ha assunto particolare interesse per la possibilità, trasferendo queste conoscenze al perfezionamento dell'imaging metabolico, di contribuire in maniera significativa alla diagnostica e al monotoraggio della risposta alla terapia.

COURSE AIMS

English

Biochemistry
Expected results

It is expected that the student will become acquainted with 1) the molecular mechanism underlying the metabolic alterations linked in cancer to the activation of oncogenes, to the loss of tumor suppressors, or the lesions in metabolic genes, 2) the technical opportunities for non-invasive imaging of these metabolic alterations, 3) the potential clinical applications of these techniques

Italiano

Biochimica
Risultati attesi

E' atteso che lo studente apprenda:

- i meccanismi molecolari alla base delle deviazioni metaboliche che si accompagnano nel cancro all' attivazione di oncogeni, alla perdita di funzione di oncosoppressori, o alle lesioni di geni metabolici,
- le possibilità tecniche per effettuare l'imaging di questi metaboliti anomali, 3) le possibili applicazioni cliniche di queste tecniche.

COURSE DELIVERY

English

Biochemistry

The exam will consist in the oral presentation (max 30 min), using power point slides, of a recent scientific article chosen from a list proposed by the teacher. The students are invited to start their presentation with an adequate introduction. After the oral presentation there will be a session of questions based on three review articles indicated by the teacher.

Italiano

Biochimica

L'esame consisterà nella presentazione approfondita di un articolo recente, scelto tra una lista di possibili articoli suggeriti dalla docente, inquadrando l'argomento mediante un'introduzione adeguata. Tempo a disposizione max 30min. Segue quindi una sessione di domande su tre reviews su Cancer and Metabolism fornite dalla docente

SYLLABUS

English

Tumor metabolism has gained considerable interest in the field of imaging since in recent years biochemical studies have revealed that the activation of specific oncogenes (or the loss of tumor soppressors) lead to precise metabolic alterations.

In this course metabolism will be revisited in light of the adaptations imposed by the activation of oncogenes, the loss of tumor suppressors, or the mutations of metabolic genes.
The imaging techniques available to measure the metabolism of glucose, lipids and aminoacids will be discussed. Examples of the usefulness of metabolic imaging in diagnostics and in monitoring the response to therapy will be given.

Italiano

Il metabolismo tumorale ha assunto nuovo interesse nel campo dell'imaging in quanto negli ultimi dieci anni studi biochimici hanno rivelato che all'attivazione di determinati oncogeni (o alla perdita di oncosoppressori) corrispondono precise alterazioni metaboliche.
In questo corso il metabolismo verrà rivisitato alla luce degli adattamenti imposti dall'attivazione di oncogeni, dalla perdita di oncosoppressori, o dalla mutazione di enzimi metabolici .
Verranno quindi discusse le tecniche di imaging per il determinare metabolismo del glucoso,dei lipidi e degli aminoacidi.
Verranno forniti esempi dell'utilità dell' imaging metabolico in diagnostica e nel monitoraggio della risposta alla terapia.

SUGGESTED TEXTBOOKS AND READINGS

English

Original scientific articles will be illustrated during classes. Power point presentations of the lectures will be made available to the students. A list of recent articles will be provided, from which each student will select one for the oral presentation. A list of reviews on Cancer and Metabolism will be provided.

Italiano

Biochimica

Testi consigliati

Verranno illustrati a lezione articoli originali. I power point delle lezioni saranno resi disponibili agli studenti. Una lista di lavori recenti verrà fornita dalla docente, da cui ciascun studente sceglierà un articolo da illustrare durante la presentazione orale. Verrà inoltre fornita una lista di Reviews sull'argomento.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=kg2h

Phisiology

Fisiologia

Academic year:	2017/2018
Course ID:	BIO0108A
Teacher:	Prof. Filippo TEMPIA
Teacher contacts:	0116708169, *filippo.tempia@unito.it*
Year:	1st year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	BIO/09 - fisiologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

PREREQUISITES
Conoscenze di fisica, biochimica, biologia molecolare, biologia cellulare, istologia. Verranno forniti dei cenni di anatomia degli apparati che saranno trattati nel corso. Knowledge of physics, biochemistry, molecular biology, cellular biology, histology, anatomy. Notions of anatomy will be provided when necessary.

COURSE OBJECTIVES

English

The student must know the mechanisms responsible for cellular and molecular events at the basis of physiological signals, integrating information deriving from preceding classes (cellular biology, molecular biology, biochemistry).

The student must understand the organizational principles at the basis of physiological functions and their integration.

The student must acquire the scientific approach necessary for the study of the function of the organs of the human body, through examples of physiological systems.

Italiano

Lo studente deve conoscere i meccanismi responsabili dei fenomeni cellulari e molecolari alla base dei segnali fisiologici, integrando le conoscenze trasmesse da corsi precedenti (biologia cellulare, biologia molecolare, biochimica).

Lo studente deve comprendere i principi organizzativi generali alla base delle funzioni fisiologiche e la loro integrazione.

Lo studente deve apprendere l'approccio scientifico necessario per lo studio delle modalità di funzionamento dei diversi organi del corpo umano, mediante alcuni esempi di sistemi fisiologici.

COURSE AIMS

English

At the end of the learning process, the student must show knowledge of the cellular and molecular mechanisms of biological signals. The student must show an understanding of the principles of organization of physiological functions and the mechanisms of their integration. The student must demonstrate the capacity to utilize the scientific approach to describe physiological functions.

Italiano

Al termine dell'apprendimento lo studente dovrà dimostrare di conoscere i meccanismi cellulari e molecolari dei segnali biologici. Dovrà inoltre dimostrare di aver compreso i principi organizzativi alla base delle funzioni fisiologiche e i meccanismi della loro integrazione. Lo studente dovrà essere in grado di utilizzare l'approccio scientifico nel descrivere i meccanismi delle funzioni fisiologiche.

COURSE DELIVERY

English

L'insegnamento è costituito da 40 ore di lezione frontale.

Italiano

The course is constituted by 40 hours of frontal lesson.

LEARNING ASSESSMENT METHODS

English

The evaluation is based on two test:

1. a written test with true/false answers; the grade is based on the number of exact (+1), null (0) and wrong (-1) answers, so that, statistically, zero level of knowledge (random answers) results in grade zero. The pass grade is half of the maximal score (for example, with 32 questions the maximal grade is 32/32 and the pass grade is 16/32).

2. an oral examination with admission upon passing the written test on the same exam day; in the oral examination the student must show to know in depth the subjects taught in the class and to be able to present them with logic and according to the scientific method.

The final grade is determined from the results of the written test and the oral examination.

Italiano

La valutazione dell'esame si basa sue due prove:

1. un test scritto con risposte vero/falso; la valutazione si basa sul numero di risposte esatte (+1 punto), nulle (0 punti) ed errate (-1 punto), in modo che statisticamente una conoscenza zero (risposte date a caso) dia punteggio zero. La sufficienza è la metà del punteggio massimo (per esempio, con 32 domande il punteggio massimo è 32/32 e la sufficienza è 16/32).

2. un esame orale a cui si accede con il superamento del test scritto nello stesso appello di esame; nella prova orale lo studente dovrà dimostrare di conoscere approfonditamente gli argomenti trattati a lezione e di saperli esporre con logica e rigore scientifico.

Il voto complessivo deriva dai risultati del test scritto e della prova orale.

SYLLABUS

English

- Introduction to the study of the nervous system
    - Principles of organization of the nervous system
- Biophysics and cellular physiology
    - Biophysics of excitable membranes
    - Synaptic transmission
    - Synaptic plasticity
- Plastic changes of the nervous system
    - Formation of neural circuits
    - Activity-dependent modification of brain circuits
    - Repair and regeneration in the nervous system
- Sensory physiology
    - General physiology of sensory receptors
    - Somatosensory system
    - Pain and analgesia
    - Hearing and balance
    - Vision
    - Taste and olfaction
- Motor control
    - Spinal motor circuits
    - Brainstem and control of posture
    - Cortical control of volontary movement
    - Basal ganglia
    - Cerebellum
    - Ocular movements
- Higher nervous functions
    - Learning and memory
    - Sleep-wake cycle
    - Emotion, motivation and reward
    - Cognitive functions
    - Language

Italiano

- Introduzione allo studio del sistema nervoso
    - Principi di organizzazione del sistema nervoso
- Biofisica e fisiologia cellulare
    - Biofisica delle membrane eccitabili.
    - Trasmissione sinaptica.
    - Plasticità sinaptica
- Modificazioni plastiche del sistema nervoso
    - Formazione dei circuiti nervosi
    - modificazioni attività-dipendenti del sistema nervoso
    - Riparazione e rigenerazione nel sistema nervoso
    - Fisiologia sensoriale
    - Fisiologia generale dei recettori sensoriali.
    - Sensibilità somatica.
    - Dolore e analgesia.
    - Udito ed equilibrio.

    - Visione.
    - Gusto e olfatto.
- Controllo motorio
    - Circuiti motori spinali
    - Tronco encefalico e controllo della postura
    - Controllo corticale dei movimenti volontari
    - Gangli della base
    - Cervelletto
    - Movimenti oculari
- Funzioni nervose superiori
    - Apprendimento e memoria.
    - Ciclo sonno-veglia.
    - Motivazione e ricompensa.
    - Emozioni.
    - Funzioni cognitive.
    - Linguaggio.

SUGGESTED TEXTBOOKS AND READINGS

Purves – "Neuroscienze" – Zanichelli (3a edizione-traduzione della 4a edizione in lingua inglese)
Kandel, Schwartz, Jessel, Siegelbaum, Hudspeth "Principles of neural science" – McGraw Hill (5th edition)
D'Angelo, Peres – "Fisiologia. Molecole, cellule e sistemi" – Edi-Ermes
Conti "Fisiologia Medica" (I vol.) – Edi-Ermes, 2a edizione

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Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=huip

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Scientific Communication

Scientific Communicatios

Academic year:	2017/2018
Course ID:	BIO0120
Teacher:	Prof. Alberto Bardelli Prof. Emilio HIRSCH Prof. Valeria POLI
Teacher contacts:	0119933235, *alberto.bardelli@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	2nd year
Type:	Elective
Credits/recognition:	4
Course SSD (disciplinary sector):	BIO/11 - biologia molecolare BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES
This class requires a laboratory experience of at least one year, because students need to have already experienced experimental design and execution, as well as data processing and presentation. The class is therefore suited to students in their 2nd year of the Master Course, already advanced in their experimental thesis.

PROPEDEUTIC FOR
Not propedeutic for any other course

COURSE OBJECTIVES

This course aims at providing students with theoretical as well as practical knowledge about the scientific method, and about the different modalities of an efficacious presentation of scientific data and the different forms of communicating it. Moreover, communication forms such as formal correspondence and electronic mail will be considered.

COURSE AIMS

At the end of the course students should have learned the rules that govern the different communication forms (i.e. oral, written and graphic), both to communicate their results and to write a research project. Via a practical test, students will have to demonstrate their competence in oral communication (10 minutes power point presentation), graphic (preparation of a poster with a Meeting format describing their research) and written (preparation of a complex, multi-paneled figure and its legend and of an abstract with a paper's format).

COURSE DELIVERY

The course will consist for 75% of platform lectures, and for 25% of practical exercises of oral presentation in fron of the class using a ppt format, followed by general discussion highlighting the weak and strong points

- I introduce myself: history and motivations for my studies and future choices.
- Experimental thesis work.

The participation to these sessions is compulsory.

LEARNING ASSESSMENT METHODS

After the completion of the platform lectures, there will be a practical test as follows:

- powerpoint presentation in front of the class
- production of the written material (poster, abstract, figure and legend). This test represents the final exam and participation is mandatory.

The evaluation will take into account the quality of the different essays, and in the case of the oral presentation both slides quality/coherence of the presentation and communication ability will be considered. Scoring will be in 30th, up to 30/30 with laudem.

SYLLABUS

Analysis of scientific methods

Scientific annotation as a means of self-communication

Principle of scientifc communication: the public, the purpose, the mean, the context

Oral scientific communication: general rules,techniocal hints, personal attitude

Visual scientific communication: poster drawing and presentation

Written scientific communication: paper writing, grant application

SUGGESTED TEXTBOOKS AND READINGS

The is no textbook for this course. Supporting material in the format of electronic pdf text files and online material will be provided.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=q9mp

Spectroscopy of biomolecules

Spectroscopy of biomolecules

Academic year:	2017/2018
Course ID:	BIO0153
Teacher:	Simonetta Geninatti Crich Prof. Gianmario Martra
Teacher contacts:	*simonetta.geninatti@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	6
Course SSD (disciplinary sector):	CHIM/02 - chimica fisica CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES
Basic knowledge in Inorganic Chemistry, Physical Chemistry, Biochemistry

PROPEDEUTIC FOR
All courses and practical activities dealing also with methods based on molecular spectroscopies

COURSE OBJECTIVES

English:

The objectives proposed to students in this course are based on the following achievements:

1. knowledge of the chemical, physical and physical-chemical principles at the basis of the generation of signals exploited in molecular spectroscopies of biomolecules, namely NMR spectroscopy and electron spectroscopies (both in absorption and emission)

2. good capability in critical understanding scientific texts

3. good capability in designing investigation of different samples by molecular spectroscopies, on the basis on their constitutive features, possible constrains related to limited amounts, types of outputs requested (identification; quantification)

4. good capability in the complementary use of the molecular spectroscopic methods indicated above

COURSE AIMS

- Knowledge of main sample handling methods for NMR and electronic spectroscopic (both in absorption and emission) measurements

- Capability to design proper spectroscopic measurements for the investigation of biomolecular samples, taking

into account the peculiar features of these samples (e.g, complexity of the matrix), and the specific target(s) to be pursued (identification/quantification)

- Capability to analyse data resulting from the methods indicated above.

COURSE DELIVERY

The course will be delivered through lessons in the lecture room (90%) and in labs (10%), for focus on some methodological aspects.
A half of the coiurse will be devoted to NMR (3 CFU, 24 h) and a half to electronic (absorption and emission) spectroscopy (3 CFU, 24 h)

LEARNING ASSESSMENT METHODS

The exam is devoted to the assessment of the knowledge, and related understanding, of the program attained by the students. In addition, also knowledge and understanding of basic knowledge in Chemistry and Biochemistry which should be necessary consider will be evaluated, as well as the use of a proper scientific/technical language.

The examination is carried out in oral form. The final mark is expressed in thirtieths.

SYLLABUS

Absorption electronic spectroscopy:

- origin of the energy transfer from the electromagnetic radiation to molecular electronic states

- types of electronic levels and electronic transitions

- solvatochromism

- UV circular dichroism

- study of the protein structure by absorption electronic spectroscopy (principles, experimental methods)

- study of the structure of nucleic acids by absorption electronic spectroscopy (principles, experimental methods)

Photoluminescence electronic spectroscopy:

- radiative and radiation less decays from excited electronic states

- fluorescence and phosphorescence

- radiative and fluorescence lifetimes

- collisional quenching

- energy transfer through the space

study of the protein structure by photoluminescence spectroscopy (principles, experimental methods)

- study of the structure of nucleic acids by photoluminescence spectroscopy (principles, experimental methods)

Nuclear Magnetic Resonance (NMR) Spectroscopy applications in the determination of structure, dynamics, and interactions of biological macromolecules:

- Introduction to the NMR spectral parameters used in structural biology, namely the chemical shift, the J-coupling,

nuclear Overhauser effects, and residual dipolar couplings.

- Resonance assignment, and NMR spectral parameters are their convertion into angle and distances between atoms

in a macromolecules.

-Relaxation phenomena and mapping the molecular interactions, information on the binding interface as well as the determination of kinetic and thermodynamic constants..

-NMR studies on Metalloproteins (proteins containing at least one metal ion) and paramagnetism based drug discovery.

- Nucleic acids studied by NMR and their interaction with metallo drugs.

- In cell/In tissue NMR spectroscopy.

SUGGESTED TEXTBOOKS AND READINGS

Reference material is available at the course website.

Suggested textbooks (all available from the teachers):

- H. Friebolin "Basic one- and two-dimensional NMR spectroscopy", VCH, 1993

- Ivano Bertini, Kathleen S. McGreevy, Giacomo Parigi "NMR of biomolecules" Wiley 2012.

- DW. Claridge "High-resolution NMR techniques in Organic Chemistry", Pergamon 1999 (Elsevier Science)

N.J. Turro, Modern Molecular Photochemistry, University Science Books, 1991

C.N.R. Rao, Ultra-Violet and Visible Spectroscopy, Butterworths, third edition, 1966

J.R. Lakowitz, Principles of fluorescence spectroscopy, Plenum, 2000 I.D. Campbell

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=2rtd

Stem cell biology

Stem cell biology

Academic year:	2017/2018
Course ID:	BIO0175
Teacher:	Prof. Fiorella ALTRUDA Dott. Vincenzo Calautti
Teacher contacts:	0116706414, *fiorella.altruda@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	5
Course SSD (disciplinary sector):	BIO/13 - biologia applicata
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written and oral

PREREQUISITES

English: Understanding the contents of the course requires solid background in General Biology, Molecular and Cellular Biology, Molecular Genetics, Basic Computing. Italiano: La comprensione dei contenuti del corso richiede di aver acquisito solide basi di Biologia Generale, Genetica Generale, Biologia Molecolare, Genetica Molecolare, Biologia Cellulare e Informatica di Base.

COURSE OBJECTIVES

- English

The course aims at providing the essential knowledge to understand stem cell biology and stem cell therapeutic applications. The biology of normal (embryonic, tissue specific) and pathological (tumor initiating cells) stem cell types and their signaling mechanisms will be analyzed in depth. Specific emphasis will be given to the most recent advancement in stem cell-based therapies.

- Italiano

Lo scopo del corso e' quello di trasmettere ai discenti i fondamenti concettuali e gli aggiornamenti necessari per comprendere gli sviluppi piu' recenti della biologia delle cellule staminali e delle loro possibili applicazioni terapeutiche. In particolare, verra' trattata approfonditamente la biologia di vari tipi di cellule staminali normali (embrionali, tessuto-specifiche) e patologiche (cellule staminali tumorali), e sui loro meccanismi di segnalazione. Particolare enfasi verra' posta su come tradurre in applicazioni terapeutiche le attali conoscenze sulla biologia cellulare e molecolare delle cellule staminali.

COURSE AIMS

- English

The student is expected to learn the main biological properties of embryonic, iPS and tissue-specific stem cells, the molecular bases underlying stem cell functions, and the actual or prospective stem cell therapeutic applications.

- Italiano

Ci si attende che lo studente apprenda le proprietà biologiche di base delle cellule staminali embrionali, adulte e

pluripotenti indotte, le basi molecolari della staminalità, e le applicazioni terapeutiche in corso e potenziali dei vari tipi di cellule staminali.

COURSE DELIVERY

- English

24 hours Lectures

16 hours Seminars

- Italiano

Lezioni frontali 24 ore

Seminari 16 ore

LEARNING ASSESSMENT METHODS

- English

The students will undergo both a written test and an oral presentation. The evaluation of each test is expressed as a grade of out of 30. The arithmetic mean between the two tests represents the final score of the module. The written test consists of four open questions, in which the student is expected to report on four major areas of stem cell biology (e. g. pluripotency, stem cells and aging, cancer stem cells, somatic stem cells). The oral test consists of a 20' presentation followed by a question/answer sectionof 5-10', focused on one or more scientific papers chosen by the studens and subjected to the teacher's approval. Criteria for evauation of the oral presentations include: novelty, biological significance, translational/therapeutic potential of scientific findings, critical evaluation of data and methods.

- Italiano

Gli studenti sosterranno sia una prova scritta che una prova orale. La valutazione di ogni prova sara' espressa in trentesimi. La media aritmetica tra i risultati delle due prove costituira' la valutazione finale del modulo. La prova scritta consiste di quattro domande aperte in cui lo studente deve trattare sinteticamente quattro temi principali della biologia delle cellule staminali (ad esempio, la pluripotenza, il ruolo delle cellule staminali nell'invecchiamento, cellule staminali e tumori, e descrivere un tipo di cellule staminali somatiche). La prova orale consiste in una presentazione orale di 20' seguita da una sezione domanda/risposta di 5-10' in cui lo studente espone e discute uno o piu' articoli scientifici da lui scelti con l'approvazione dell'insegnante. I criteri per la valutazione della prova orale includono l'innovativita' e significato biologico dei temi presentati, il loro potenziale traslazionale e/o terapeutico, la valutazione critica dei dati e delle metodologie.

SYLLABUS

- English

"Stemness"

Germ line stem cells, Embryonic stem cells, Pluripotency, Multilineage Differentiation.

Tissue-specific stem cells: Experimental models of epithelial self-renewal; the epidermis and the skin adnexa; intestinal stem cells;

Role of the "niche" in stem cell maintenance and differentiation. Role of microvescicles in stem cell regulation.

Stem cells and Aging.

The "cancer stem cell" hypothesis

Stem cell identification: phenotypic markers versus functional assays

Reprogramming of somatic cells into pluripotent stem cells (iPS cells)

Molecular signaling underlying stem cell self-renewal, differentiation and senescence.

Current stem cell therapeutic applications

Stem cells and anti-cancer therapies

Use of drugs and small molecules for stem cell therapeutic manipulations

Mathematical models of stem cell-based tissue homeostasis and regeneration.

- Italiano

Definizione di staminalità.

Cellule staminali della linea germinale, cellule staminali embrionali: pluripotenza, differenziamento multilinea.

Identificazione delle cellule staminali: marcatori fenotipici e saggi funzionali.

Cellule staminali tessuto-specifiche; Modelli di autorinnovamento degli epiteli: l'epidermide e gli annessi cutanei; cellule staminali e autorinnovamento dell'epitelio intestinale.

Ruolo della "nicchia" nella biologia delle cellule staminali tessuto-specifiche. Ruolo delle microvescicole nella regolazione delle cellule staminali.

Invecchiamento e cellule staminali.

Teoria delle cellule staminali tumorali

Riprogrammazione di cellule somatiche a cellule pluripotenti e analisi delle reti di segnalazione che sottostanno allo stato di pluripotenza.

Segnali molecolari che regolano l'autorinnovamento, il differenziamento e la senescenza delle cellule staminali.

Attuali applicazioni terapeutiche di cellule staminali.

Cellule staminali e terapia antineoplastica.

Uso di farmaci e piccole molecole nella manipolazione terapeutica delle cellule staminali.

Modelli matematici di omeostasi e rigenerazione tissutale basati sull'attività delle cellule staminali.

SUGGESTED TEXTBOOKS AND READINGS

- English

Alberts et al., Molecular Biology of the Cell (6th edition), McGraw-Hill.

Original scientific papers provided by the teacher.

- Italiano

Alberts et al., Biologia Molecolare della Cellula, sesta edizione (Zanichelli).

Articoli originali forniti a lezione.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=4e26

Supramolecular and Bioinorganic Chemistry

Supramolecular and Bioinorganic Chemistry

Academic year:	2017/2018
Course ID:	BIO0153
Teacher:	Simonetta Geninatti Crich
Teacher contacts:	*simonetta.geninatti@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	3
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written

PREREQUISITES
Inorganic chemistry Physical chemistry, Organic Chemistry, Biochemistry

COURSE OBJECTIVES

The course aims at providing the students with the fundamentals of molecular recognition, of the interactions responsible for the formation of supramolecular systems and on the role of metals in biological systems and medicine. The student will be introduced to the principal classes of supramolecular systems (organic / inorganic of biological interest) together with the main techniques currently used for their characterization.

COURSE AIMS

- Knowledge of the nature of non-covalent interactions at the basis of the formation of supramolecular compounds which are held together by intermolecular bonds.

- Knowledge of the basic coordination chemistry and of the interdisciplinary approach to study the peculiar role of metals in biology and their interaction with organic and biological molecules.

-Basic knowledge of different spectroscopic techniques used to study metals in biological systems and intermolecular interactions.

- Capability to analyse data resulting from the methods indicated above

COURSE DELIVERY

20 hours lesson + 4 hours seminars

LEARNING ASSESSMENT METHODS

The examination is carried out in written form¸ The final mark is expressed in thirtieths.

SYLLABUS

1) Principles of the molecular recognition (Hydrogen-bond and the weak intermolecular interactions, the coordinative bond; chelating effect)

2) The determination of the thermodynamic stability constant of host/guest supramolecular adducts

3) Organic and Inorganic supramolecular systems; Self-assembling systems: Cyclodesxtrins, Micelles and Liposomes; and their biomedical applications; molecular machines.

4) Basic coordination chemistry for biotechnologists.

5) Overview on spectroscopic methods to study metals in biological systems.

6) Biological ligands for metal ions.

7) Transition metals in biology; the role of Zn, Cu, Fe, Mn, Ni, Co

8) Metals in brain their role in neurodegeneration.

9) Metals in medicine and metals as drugs.

SUGGESTED TEXTBOOKS AND READINGS

1) Jonathan W. Steed, David R. Turner, Karl J. Wallace, ¸Core Concepts in Supramolecular Chemistry and Nanochemistry; Wiley, 2007.

2) JW Steed, JL Atwood Supramolecular Chemistry, Wiley, 2009.

3) RR Crichton Biological Inorganic Chemistry, Elsevier, 2013.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9m6l

Supramolecular chemistry and Spectroscopic methods

Supramolecular chemistry and Spectroscopic methods

Academic year:	2017/2018
Course ID:	BIO0153
Teacher:	
Teacher contacts:	
Year:	1st year
Type:	Distinctive
Credits/recognition:	8
Course SSD (disciplinary sector):	CHIM/02 - chimica fisica CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Spectroscopy of biomolecules
- Supramolecular and Bioinorganic Chemistry

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=21nc

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Spectroscopy of biomolecules

Spectroscopy of biomolecules

Academic year:	2017/2018
Course ID:	BIO0153
Teachers:	Simonetta Geninatti Crich Prof. Gianmario Martra
Teacher contacts:	*simonetta.geninatti@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	6
Course SSD (disciplinary sector):	CHIM/02 - chimica fisica CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES

Basic knowledge in Inorganic Chemistry, Physical Chemistry, Biochemistry

PROPEDEUTIC FOR
All courses and practical activities dealing also with methods based on molecular spectroscopies

COURSE OBJECTIVES

English:

The objectives proposed to students in this course are based on the following achievements:

1. knowledge of the chemical, physical and physical-chemical principles at the basis of the generation of signals exploited in molecular spectroscopies of biomolecules, namely NMR spectroscopy and electron spectroscopies (both in absorption and emission)

2. good capability in critical understanding scientific texts

3. good capability in designing investigation of different samples by molecular spectroscopies, on the basis on their constitutive features, possible constrains related to limited amounts, types of outputs requested (identification; quantification)

4. good capability in the complementary use of the molecular spectroscopic methods indicated above

COURSE AIMS

- Knowledge of main sample handling methods for NMR and electronic spectroscopic (both in absorption and emission) measurements

- Capability to design proper spectroscopic measurements for the investigation of biomolecular samples, taking into account the peculiar features of these samples (e.g, complexity of the matrix), and the specific target(s) to be pursued (identification/quantification)

- Capability to analyse data resulting from the methods indicated above.

COURSE DELIVERY

The course will be delivered through lessons in the lecture room (90%) and in labs (10%), for focus on some methodological aspects.
A half of the coiurse will be devoted to NMR (3 CFU, 24 h) and a half to electronic (absorption and emission) spectroscopy (3 CFU, 24 h)

LEARNING ASSESSMENT METHODS

The exam is devoted to the assessment of the knowledge, and related understanding, of the program attained by the students. In addition, also knowledge and understanding of basic knowledge in Chemistry and Biochemistry which should be necessary consider will be evaluated, as well as the use of a proper scientific/technical language.

The examination is carried out in oral form. The final mark is expressed in thirtieths.

SYLLABUS

Absorption electronic spectroscopy:

- origin of the energy transfer from the electromagnetic radiation to molecular electronic states

- types of electronic levels and electronic transitions

- solvatochromism

- UV circular dichroism

- study of the protein structure by absorption electronic spectroscopy (principles, experimental methods)

- study of the structure of nucleic acids by absorption electronic spectroscopy (principles, experimental methods)

Photoluminescence electronic spectroscopy:

- radiative and radiation less decays from excited electronic states

- fluorescence and phosphorescence

- radiative and fluorescence lifetimes

- collisional quenching

- energy transfer through the space

study of the protein structure by photoluminescence spectroscopy (principles, experimental methods)

- study of the structure of nucleic acids by photoluminescence spectroscopy (principles, experimental methods)

Nuclear Magnetic Resonance (NMR) Spectroscopy applications in the determination of structure, dynamics, and interactions of biological macromolecules:

- Introduction to the NMR spectral parameters used in structural biology, namely the chemical shift, the J-coupling, nuclear Overhauser effects, and residual dipolar couplings.

- Resonance assignment, and NMR spectral parameters are their convertion into angle and distances between atoms

in a macromolecules.

-Relaxation phenomena and mapping the molecular interactions, information on the binding interface as well as the determination of kinetic and thermodynamic constants..

-NMR studies on Metalloproteins (proteins containing at least one metal ion) and paramagnetism based drug discovery.

- Nucleic acids studied by NMR and their interaction with metallo drugs.

- In cell/In tissue NMR spectroscopy.

SUGGESTED TEXTBOOKS AND READINGS

Reference material is available at the course website.

Suggested textbooks (all available from the teachers):

- H. Friebolin "Basic one- and two-dimensional NMR spectroscopy", VCH, 1993

- Ivano Bertini, Kathleen S. McGreevy, Giacomo Parigi "NMR of biomolecules" Wiley 2012.

- DW. Claridge "High-resolution NMR techniques in Organic Chemistry", Pergamon 1999 (Elsevier Science)

N.J. Turro, Modern Molecular Photochemistry, University Science Books, 1991

C.N.R. Rao, Ultra-Violet and Visible Spectroscopy, Butterworths, third edition, 1966

J.R. Lakowitz, Principles of fluorescence spectroscopy, Plenum, 2000 I.D. Campbell

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=2rtd

Supramolecular and Bioinorganic Chemistry

Supramolecular and Bioinorganic Chemistry

Academic year:	2017/2018
Course ID:	BIO0153
Teacher:	Simonetta Geninatti Crich
Teacher contacts:	*simonetta.geninatti@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	3
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Written

PREREQUISITES
Inorganic chemistry Physical chemistry, Organic Chemistry, Biochemistry

COURSE OBJECTIVES

The course aims at providing the students with the fundamentals of molecular recognition, of the interactions responsible for the formation of supramolecular systems and on the role of metals in biological systems and medicine. The student will be introduced to the principal classes of supramolecular systems (organic / inorganic of biological interest) together with the main techniques currently used for their characterization.

COURSE AIMS

- Knowledge of the nature of non-covalent interactions at the basis of the formation of supramolecular compounds which are held together by intermolecular bonds.

- Knowledge of the basic coordination chemistry and of the interdisciplinary approach to study the peculiar role of metals in biology and their interaction with organic and biological molecules.

-Basic knowledge of different spectroscopic techniques used to study metals in biological systems and intermolecular interactions.

- Capability to analyse data resulting from the methods indicated above

COURSE DELIVERY

20 hours lesson + 4 hours seminars

LEARNING ASSESSMENT METHODS

The examination is carried out in written form¸ The final mark is expressed in thirtieths.

SYLLABUS

1) Principles of the molecular recognition (Hydrogen-bond and the weak intermolecular interactions, the coordinative bond; chelating effect)

2) The determination of the thermodynamic stability constant of host/guest supramolecular adducts

3) Organic and Inorganic supramolecular systems; Self-assembling systems: Cyclodesxtrins, Micelles and Liposomes; and their biomedical applications; molecular machines.

4) Basic coordination chemistry for biotechnologists.

5) Overview on spectroscopic methods to study metals in biological systems.

6) Biological ligands for metal ions.

7) Transition metals in biology; the role of Zn, Cu, Fe, Mn, Ni, Co

8) Metals in brain their role in neurodegeneration.

9) Metals in medicine and metals as drugs.

SUGGESTED TEXTBOOKS AND READINGS

1) Jonathan W. Steed, David R. Turner, Karl J. Wallace, ¸Core Concepts in Supramolecular Chemistry and Nanochemistry; Wiley, 2007.

2) JW Steed, JL Atwood Supramolecular Chemistry, Wiley, 2009.

3) RR Crichton Biological Inorganic Chemistry, Elsevier, 2013.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=9m6l

The Genetic Basis of Cancer

The Genetic Basis of Cancer

Academic year:	2017/2018
Course ID:	BIO0167
Teacher:	Prof. Alberto Bardelli
Teacher contacts:	0119933235, *alberto.bardelli@unito.it*
Degree course:	[0101M21] Molecular Biotechnology
Year:	1st year
Type:	Distinctive
Credits/recognition:	3
Course SSD (disciplinary sector):	BIO/17 - istologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	Oral

PREREQUISITES
To understand the contents of the class, students should have a solid background on General Biology, Genetics, Cell Biology, Molecular Biology, Molecular Genetics.

COURSE OBJECTIVES

The class aims at teaching students on the molecular basis of human cancer onset and progression. In particular, the course is focused on the most common genetic alterations (somatic mutations, genetic amplifications, deletions and translocations) present in solid tumors. Moreover, the course elaborates in depth about proto-oncogenes, oncogenes and tumor suppressor genes. Other discussed subjects are also the tissue specificity of the mutational profile of cancer genes and the role of genome instability in tumor progression. Notions about causes and mechanisms regulating cell transdifferentiation in physiology and pathology as initial steps of cancer onset are reviewed. Finally, the role of genomic alterations in personalized cancer target therapy are examined.

COURSE AIMS

At the end of the course students must demonstrate knowledge on the topics of the lessons and the most recent literature regarding the role of genetic alterations in onset, progression, diagnosis and therapy of human cancers. In addition, student must be able to critically evaluate experimental approaches (in vitro and in vivo) that are the basis of current knowledge in this field of research.

COURSE DELIVERY

Frontal lessons, 2 hours per week

LEARNING ASSESSMENT METHODS

Oral examination. The oral tests will be evaluated based on critical thinking skills, the quality of the presentation and knowledge of the subjects of the course. The critical discussion of a scientific publication is an integral part of the exam. The vote will be expressed as a fraction of 30 (eventually cum laude) and will represent the average of the marks of the other Functional Genomics courses.

SUPPORT ACTIVITIES

Laboratory activities carried out by the students for their thesis are considered as practical exercises.

SYLLABUS

Cancer: a genetic disease The causes of cancer Genetic alterations and tumor progression Cancer genes: Oncogenes, Tumor Suppressor genes, Gatekeepers and Caretakers Cell and animal models to study tumor progression Genetic profiling of human tumors Genetic basis of targeted cancer therapy Genetic alterations: diagnosis and personalized treatment

SUGGESTED TEXTBOOKS AND READINGS

The course deals with scientific topics in constant development and accordingly it is not possible to indicate a reference text. Attendance is highly recommended.

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=wvtp

Therapeutic Biotechnology

Terapie Biotecnologiche

Academic year:	2017/2018
Course ID:	BIO0144
Teacher:	
Teacher contacts:	
Year:	2nd year
Type:	
Credits/recognition:	7
Course SSD (disciplinary sector):	MED/14 - nefrologia MED/26 - neurologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course modules:

- Molecular Therapy in Nephrology
- Molecular Therapy in Neurology

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=fa2e

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Molecular Therapy in Nephrology

Terapie molecolari in Nefrologia

Academic year:	2017/2018
Course ID:	BIO0144
Teacher:	Prof. Benedetta BUSSOLATI
Teacher contacts:	0116706453, *benedetta.bussolati@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/14 - nefrologia
Delivery:	Formal authority
Language:	Italian
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=acm9

Molecular Therapy in Neurology

Terapia Molecolare in Neurologia

Academic year:	2017/2018
Course ID:	BIO0144
Teacher:	Prof. Alessandro Mauro
Teacher contacts:	0116636327-0323514370, *alessandro.mauro@unito.it*
Year:	2nd year
Type:	Distinctive
Credits/recognition:	
Course SSD (disciplinary sector):	MED/26 - neurologia
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=y5km

Ultrasound Imaging

Imaging Ottico ed Ultrasuoni

Academic year:	2017/2018
Course ID:	BIO0111
Teacher:	Prof. Giancarlo CRAVOTTO
Teacher contacts:	011 670 7183, *giancarlo.cravotto@unito.it*
Year:	2nd year
Type:	Related or integrative
Credits/recognition:	
Course SSD (disciplinary sector):	CHIM/06 - chimica organica
Delivery:	Formal authority
Language:	English
Attendance:	Obligatory
Type of examination:	

Course webpage: http://www.molecularbiotechnology.unito.it/do/corsi.pl/Show?_id=q4hc