UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

SCHOOL "POLITECNICA E LE SCIENZE DI BASE"

DEPARTMENT OF CHEMICAL SCIENCE

Student's Guide

1st Cycle Degree/Master

Biomolecular and Industrial Biotechnology

Degree programme class: *L2*

CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI

ANNO ACCADEMICO 2022/2023

Biotecnologie Industriali Federico II

BiotecnologieindustrialiFII

Biotecnologie Biomolecolari e Industriali UNINA

Settembre 2022

A quick guide to the programme

The programme at a glance

Biotechnologies use biological systems to produce goods and services useful for man in respect of the environment. The Industrial Biotechnologist is a professional who has the task of designing, building and managing biological systems and processes for the eco-sustainable production of:
- high value-added biomolecules (chemicals, enzymes, drugs, vaccines, and so on)
- Biosystems for the de-pollution of the environment (bioremediation)
- bioplastics - also biodegradable - from renewable sources (biopolymers)
- biofuels (ethanol, butanol, hydrogen, diesel, and so on)
- biosensors and biochips for molecular diagnostics (nanobiotechnology)

The Bachelor in Biomolecular and Industrial Biotechnology (class of Biotechnology L-2) is a programmed number (max 120 students). The programme offer includes a strong component of experimental activities (e.g. practical laboratory exercises) that are made possible given the limited number of students.

The course aims to train graduates who have knowledge: i) of the different fields of biotechnology; ii) enabling them to operate in industrial/social contexts characterised by the production/use of many categories of products falling within the scope of industrial biotechnology. The emerging role of biotechnology in many production sectors (pharmaceutical, human health, agro-industrial, chemical, bioplastic and biofuel industries) and service sectors (such as bioremediation, quality control of biotechnology chains, environmental protection) requires multidisciplinary preparation, integrating disciplines such as chemistry, biochemistry, molecular biology, genetics, fermentation biotechnology, process technologies, thermodynamics and transport phenomena, enzymology.
The majority of graduates continue their studies in Master's Degree. Further information can be found on www.biotecnologieindustriali.unina.it.

Job opportunities

Graduates will be able to:
• find a job as technicians with mainly executive functions in research and development laboratories in public and private bodies and in the chemical, pharmaceutical, food and biotechnology industries;
• perform technical functions in the chemical industry for the production of intermediates and products for fine chemistry, in the industry for environmental remediation for the management of bioremediation processes, in the fermentative industry for the production of primary and secondary metabolites.
• work for the development and use of molecular diagnostic kits, for the validation and analysis of biotechnological products, for providing services related to the main biotechnology analysis methodologies and process technologies, for the detection of genetically modified organisms in the agro-food supply chain and in the environment
• enroll in the Master of Science in Molecular and Industrial Biotechnology.

Admission to the programme and prerequisites

Access to the Degree Programme is scheduled (max 120 students). Admission requires participation at the admission test and place yourself in useful position in the ranking. The admission test is provided by the CISIA Inter-university Consortium and its structure is that of the standard national CISIA TOLC-I test delivered in TOLC@CASA mode.

The participation in the selection for the a.a. 2022/23 is divided into two parts, summarized in the competition notice published from the month of June on the University portal (www.unina.it) in the section Degree Courses with programmed number. The two moments are:

1) participation in the TOLC-I online test (at any University - it is not necessary to participate exclusively in the TOLC-I provided at the University Federico II);

2) online submission of the application for participation in the admission competition.

Participation in the online test is DISTINCT from the application for participation in the admission competition. The two procedures are separate.

The CISIA Consortium is responsible for the deadline of the tests. Usually, the deadline is about 7 days before the Test. Updates are available on the CISIA website.

Piano di Studi

I Anno								
Denominazione Insegnamento	**SSD**	**Modulo**	**CFU**	**Ore**	**Tipologia Attività**	**TAF**	**Ambito disciplinare**	**obbligatorio /a scelta**
Matematica ed elementi di statistica	MAT/03		9	72	Lezione frontale	A	Discipline matematiche, fisiche, informatiche e statistiche	Obbligatorio
Chimica generale	CHIM/03		9	76	Lezione frontale, esercitazioni e laboratorio	A	Discipline chimiche	Obbligatorio
Introduzione alle biotecnologie e biologia	BIO/13		9	72	Lezione frontale	A	Discipline biologiche	Obbligatorio
Fisica e laboratorio di informatica	FIS/01		9	72	Lezione frontale	A	Discipline matematiche, fisiche, informatiche e statistiche	Obbligatorio
Chimica organica	CHIM/06		9	76	Lezione frontale, esercitazioni e laboratorio	A	Discipline chimiche	Obbligatorio
Genetica	BIO/18		6	48	Lezione frontale	A	Discipline biologiche	Obbligatorio
Inglese				48		E		Obbligatorio

II Anno								
Denominazione Insegnamento	**SSD**	**Modulo**	**CFU**	**Ore**	**Tipologia Attività**	**TAF**	**Ambito disciplinare**	**obbligatorio /a scelta**
Biochimica	BIO/10	Biochimica delle macromolecole e metabolismo cellulare	6	48	Lezione frontale	A	Discipline biologiche	Obbligatorio
	BIO/10	Biochimica applicata	6	52	Lezione frontale esercitazioni e laboratorio	A	Discipline biologiche	Obbligatorio
Microbiologia generale e applicata	BIO/19		9	72	Lezione frontale	B	Discipline biotecnologiche con finalità specifiche: biologiche e industriali	Obbligatorio
Biologia molecolare	BIO/11		6	52	Lezione frontale esercitazioni e laboratorio	C		Obbligatorio
Biotecnologie molecolari	BIO/10	Biochimica avanzata	6	52	Lezione frontale esercitazioni e laboratorio	B	Discipline biotecnologiche comuni	Obbligatorio
	BIO/18	Genetica molecolare	6	48	Lezione frontale	C		Obbligatorio
Biotecnologie microbiche	CHIM/11	Principi di chimica delle fermentazioni	6	52	Lezione frontale esercitazioni e laboratorio	B	Discipline biotecnologiche comuni	Obbligatorio
	CHIM/11	Biotecnologie delle fermentazioni	6	52	Lezione frontale esercitazioni e laboratorio	B	Discipline biotecnologiche comuni	Obbligatorio
Principi di ingegneria dei bioprocessi	ING-IND/24		6	48	Lezione frontale	C		Obbligatorio

III Anno								
Denominazione Insegnamento	**SSD**	**Modulo**	**CFU**	**Ore**	**Tipologia Attività**	**TAF**	**Ambito disciplinare**	**obbligatorio /a scelta**
Chimica bioanalitica	CHIM/01		6	48	Lezione frontale	B	Discipline biotecnologiche con finalità specifiche: chimiche e farmaceutiche	Obbligatorio
Enzimologia industriale	BIO/10		6	48	Lezione frontale	B	Discipline biotecnologiche comuni	Obbligatorio
Percezione ed etica delle biotecnologie industriali	M-FIL/03		6	48	Lezione frontale	B	Discipline per la regolamentazione, economia e bioetica	Obbligatorio
Introduzione agli impianti biotecnologici	ING-IND/25		6	48	Lezione frontale	B	Discipline biotecnologiche con finalità specifiche: chimiche e farmaceutiche	Obbligatorio
Biologia molecolare avanzata	BIO/11		9	72	Lezione frontale esercitazioni e laboratorio	B	Discipline biotecnologiche comuni	Obbligatorio
Attività formative a scelta autonoma dello studente			(+)			D		Obbligatorio (tre a scelta)
Tirocinio			9			F		Obbligatorio
Orientamento al mondo del lavoro e norme di sicurezza in laboratorio			1			F		Obbligatorio
Prova finale			5			E		Obbligatorio

(+) Insegnamenti a scelta autonoma dello studente proposti dalla Commissione Didattica (18 CFU complessivi)

Denominazione Insegnamento	**SSD**	**Modulo**	**CFU**	**Ore**	**Tipologia Attività**	**TAF**	**obbligatorio /a scelta**
Biodiritto	IUS/01		6	48	Lezione frontale	D	a scelta
Sintesi e progettazione degli oligonucleotidi	CHIM/06		6	48	Lezione frontale	D	a scelta
Chimica e Biochimica degli alimenti	BIO/10		6	48	Lezione frontale	D	a scelta

Legenda
Tipologia di Attività Formativa (TAF):

A = Base
B = Caratterizzanti
C = Affini o integrativi
D = Attività a scelta
E = Prova finale e conoscenze linguistiche
F = Ulteriori attività formative

Additional study plan information
Students must submit a Personalized Study Plan (PDS) both for the choice of courses of their own choice and whether they opt for courses to be followed within the framework of ERASMUS mobility. The PdS from ERASMUS students has to be presented to the Student Administration office, according to their rules.

Customizing the study plan
The student must submit the Study Plan by October 15 (possibility of rectification for the second semester with presentation in the window 15 February - March 15) for the choice of courses of their own choice. The Teaching Coordination Commission annually proposes, as part of the Study Programme, a list of courses that allow the student to deepen particular aspects of the disciplines that make up the cultural heritage essential for each student.

Traineeship opportunities
The student can also carry out internship activities at non-university facilities, recognized and accredited at the University and operating in the scientific field of interest (the list of accredited facilities is available on the University website). You can contact the Commission "Thesis and Internships" for details and consult the page
http://www.biotecnologieindustriali.unina.it/it/page/laurea/esami-di-laurea.html

Graduation thesis and exam
The Final Degree Test consists in the presentation and discussion of a written paper (Thesis) that focuses on a subject of a specific cultural area that also includes technical-practical activities related to the Degree Programme. Brief instructions for the drafting of the report can be downloaded from the site.
The Student has about 10 minutes for the oral presentation of the thesis.

International exchange programmes (Erasmus programme)
The ERASMUS+ programme allows university students to spend a period of study at a European University with an EU contribution. During their stay abroad, students have the opportunity to take courses, take exams and take advantage of the University facilities as a student regularly enrolled in it. The activity carried out at the European Universities must be agreed with the teaching structure to which they belong.
consult the page
http://www.biotecnologieindustriali.unina.it/it/page/erasmus-ed-internazionalizzazione/erasmus.html

Orientation and Tutoring

Orientation to incoming students

The Degree Programme organises incoming orientation initiatives in close coordination with the other study programmes of the Department/School/University.
Details are available at the page
http://www.biotecnologieindustriali.unina.it/it/page/orientamento/orientamento-in-ingresso.html#Orientamento:in:ingresso

The Biology department provides orientation activities within the Science Degree Plan, Biology/Biotechnology with actions aimed at high school students and also their teachers (http://www.pls.unina.it/home/biologia-e-biotecnologie/)

Tutoring and counseling

The Course of Study organizes a series of activities aimed at ongoing orientation. They include:
- MENTORING;
• PhD students and LM students in Molecular and Industrial Biotechnology carry out mentoring activities for students of the first year of the degree
• students in each year of the course are divided into groups and can contact the teacher assigned.
- OBSERVATORY progression I year Degree. The Teaching Coordination Commission analyses the careers of students in the first year of the Degree every six months: April and November of each year. The analysis is aimed at supporting students in the progression of their university career. In keeping with anonymity, the results are discussed in CCD meetings and shared with student representatives in the Working Table.

Details on the page
http://www.biotecnologieindustriali.unina.it/it/page/orientamento/orientamento-in-itinere.html

Career orientation and job placement

The Degree Programme organises outgoing orientation and placement initiatives in close coordination with the other courses of study in the Department/School/University. Every year the Scuola Politecnica e delle Scienze di Base organizes the Career Day with meetings with companies. The Degree Course organizes Orientation meetings to the world of work as an integral part of the training activities.
Details on the page
http://www.biotecnologieindustriali.unina.it/it/page/orientamento/orientamento-in-uscita.html

Calendar of educational activities'and timeline

Application timeline

Initial enrolment and successive annual enrolment is presented between September 1st and October 31st. The initial enrolment is possible until March 31st. Details are reported on the website of the University:
https://www.unina.it/didattica/sportello-studenti/guide-dello-studente

Further deadlines (presentation of study plan, ERASMUS application, etc.) are reported on the website of the MSc.
http://www.biotecnologieindustriali.unina.it/it/

Academic Calendar: courses and exams

I Semester – From the end of September up to the beginning of Christmas holiday
II Semester – From the beginning of March up to the beginning of June
Exams – January to March. June, July, September and October

The timetable of the lectures is available at the webpage
http://www.biotecnologieindustriali.unina.it/it/page/laurea/calendario-esami-laurea.html

Course Timetable

The timetable of the lectures is available at the webpage
http://www.biotecnologieindustriali.unina.it/it/page/laurea/orari-delle-lezioni-laurea.html

Graduation dates

The timetable of the graduation exams is available at the webpage
http://www.biotecnologieindustriali.unina.it/it/page/didattica-ed-orientamento/esami-di-laurea-e-laurea-magistrale.html

Contact persons

Chairman of the MSc: Prof.ssa Daria Maria Monti – Dipartimento di Scienze Chimiche - tel. 081.679150 - e-mail: dariamaria.monti@unina.it.

Responsible for the **Orientation**: Prof.ssa Angela Arciello, Dipartimento di Scienze Chimiche - Tel. 081-679147. e-mail: angela.arciello@unina.it

Responsible for the **SOCRATES/ERASMUS** programme: Prof.ssa M. Luisa Tutino – Dipartimento di Scienze Chimiche - tel. 081.674317 - e-mail: tutino@unina.it.

Responsible for **trainings**: Prof.ssa Rachele Isticato – Dipartimento di Biologia (tel. 081-679035 - email rachele.isticato@unina.it) - e Dott. Daniele Tammaro – Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale (e-mail: daniele.tammaro@unina.it).

Segreteria didattica:
Dott. Anna Mancino anna.mancino@unina.it, Dipartimento di Scienze Chimiche
Dott. Giuseppe Rollino giuseppe.rollino@unina.it, Segreteria Studenti area Scienze della Scuola Politecnica e delle Scienze di Base
Sent cc email to ccd.biotecnologieindustriali@unina.it

Comitato di Indirizzo del MSc

Dr. **Joanna Dupont-Inglis** (Head of EU Affairs, European Bioplastics)
Dott. **Leonardo Vingiani** (Direttore di Assobiotec, IT)
Dott. **Nicola Torre** (Centrient Pharmaceuticals, Delft, NL)

Working table
The Chairman of the MSc.
Two students for each year of the MSc.
Details at page
http://www.biotecnologieindustriali.unina.it/it/page/la-struttura/tavolo-di-lavoro.html

Sites and links

Sites
Complesso Universitario di Monte Sant'Angelo
https://www.google.com/maps/place/Universit%C3%A0+Degli+Studi+di+Napoli+Federico+II+Complesso+Universitario+di+Monte+Sant'Angelo/@40.8322726,14.1824662,15z/data=!4m19!1m13!4m12!1m4!2m2!1d14.1947658!2d40.8250146!4e1!1m6!1m2!1s0x133b0ed5dc19a33b:0xb3482663d2c21f6e!2smonte+sant'angelo+napoli!2m2!1d14.1849805!2d40.8388234!3m4!1s0x133b0ed5dc19a33b:0xb3482663d2c21f6e!8m2!3d40.8388234!4d14.1849805

MSc:
http://www.biotecnologieindustriali.unina.it/it/

Department
http://www.scienzechimiche.unina.it/home

School website
http://www.scuolapsb.unina.it/

University website
http://www.unina.it/home

Social networks

Instagram
Biotecnologie IndustrialiFII
https://www.instagram.com/biotecnologieindustrialifii/?hl=it

Facebook
https://www.facebook.com/biotecnologieindustriali/

Telegram
https://t.me/biotecnologieindustriali

Twitter
BiotecnologieindustrialiFII
https://twitter.com/Biotecnologiei1

Linkedin
Biotecnologie Industriali - Università degli Studi di Napoli "Federico II"
https://www.linkedin.com/groups/6620663/

YouTube
Biotecnologie Biomolecolari e Industriali UNINA
https://www.youtube.com/channel/UCDUlubUpRIgZqeJ2xjVPp7Q

Course description

The content and objectives of the courses, the name of the professor, the methods of carrying out the lectures and checking results can be consulted at the link
http://www.biotecnologieindustriali.unina.it/it/page/didattica-ed-orientamento/laurea.html

COURSE DESCRIPTION
ELEMENTS OF MATHEMATICS AND STATISTICS

SSD: GEOMETRIA (MAT/03)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: CUOMO SALVATORE
PHONE: 081-675624
EMAIL: salvatore.cuomo@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

NONE

PREREQUISITES

Basic knowledge of algebraic calculus and notions of Euclidean geometry.

LEARNING GOALS

The main aim of the teaching is to lead the student to know and understand the language and basic concepts of mathematics with reference to the differential and integral calculus of functions of one variable; to be able to identify the most appropriate methods to analyze and solve a problem concerning the topics of the course and to correctly interpret the results; to know and understand elements of probability calculation, elements of descriptive and inferential statistics.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

At the end of the course, the student must demonstrate: to know and understand the language and basic concepts of mathematics with reference to the differential and integral calculus of functions of one variable; to be able to identify the most appropriate methods to analyze and solve a problem concerning the topics of the course and to correctly interpret the results; to know and understand elements of probability calculation, elements of descriptive and inferential statistics.

The student must demonstrate knowledge and understanding of the issues related to basic mathematics and its applications with respect to data analysis. He must demonstrate to be able to elaborate arguments concerning the relationships between given relations and functions starting from the notions learned regarding basic concepts of Mathematical Sciences. The training course aims to provide students with the knowledge and basic methodological tools necessary to model phenomena and analyze data.

Applying knowledge and understanding

At the end of the course, the student must demonstrate that they: develop simple mathematical models for data processing; correctly interpret the results of an experiment; develop computational models also through the use of the computer.

- *Autonomy of judgment: ability to independently evaluate the effectiveness of a mathematical model and to develop a model.*
- *Communication skills: knowing how to correctly argue formalized results through the mathematical sciences*
- *Learning skills: to independently read scientific texts and research works that contain simple mathematical models.*

COURSE CONTENT/SYLLABUS

Rudiments of Set Theory: preliminary notions, operations with sets (union, intersection, difference, complementation, cartesian product), functions, binary relations, (equivalence relations, order relations), the maximum, minimum, sup. and inf. of an ordered set. Real Numbers: an axiomatic approach, some properties of the real numbers, real functions deifnite in the set of real numbers. Rudiments of Analitc Geometry in the Plane: segments and vectors, cartesian and parametric representation of a line,parallelism and orthogonality. Elementary Functions: the norm function, elevation to the n-th power and n-th square root functions, exponential and logarithm functions, elevation to the a-power (with a real number) function and its inverse, trigonometric functions and their inverse. Limits and Continuity: limits and their properties,monotonic functions, continuos functions,derivative. Rudiments of Integral Calculus: indefinite integral of a function, integration methods, the air of a rectangoloid and definite integral.Rudiments of probability theory: results of an event and the space of results and events, axioms for the probability theory, conditional probability, the event factorization and the Bayes's theorem, independent events. Random variables: discrete and continuos random variables, probability distribution, expectation, mean value and their properties. Rudiments of statistics. Selection and organization of data (rudiments of descriptive stataistic): aritmetic mean, median and mode, variance and standard

derivation, quantiles and interquantile range, box—plot, the chi-quadrato test. Rudiments of Computer Science: The Algorithm concept, an introduction to computer programming, data analysis by means a spreadsheet software, word processing and presentation software. Rudiments of database.

READINGS/BIBLIOGRAPHY

•"Elementi di matematica", Marcellini-Sbordone LIGUORI Editore, 2005.

•"Elementi di matematica I ", Alvino-Trombetti, Liguori Editore 2016. "

•"Probabilità e Statistica", Sheldon Ross, Casa Editrice APOGEO, 2015.

•"Esercizi di Matematica e Statistica parte I ", Ardelio Galletti e Salvatore Cuomo, nane Editore, 2013.

•"Esercizi di Matematica e Statistica parte II ", Ardelio Galletti e Salvatore Cuomo, nane Editore, 2014.

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use: a) lectures for about 60% of the total hours, b) exercises to practically deepen theoretical aspects for 30% c) laboratory to deepen the applied knowledge for 10% of the CFU. Furthermore, the instruments adopted will be: recorded lessons, programming languages, online material.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
GENERAL CHEMISTRY

SSD: CHIMICA GENERALE E INORGANICA (CHIM/03)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: NASTRI FLAVIA
PHONE: 081-674419
EMAIL: flavia.nastri@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

None

LEARNING GOALS

The course provides the basic knowledge for understanding the principles of chemistry and chemical phenomena.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students will gain knowledge and understanding of the major concepts, of the theoretical and experimental foundations of chemistry, the fundamental chemical principles concerning the

structure of the atom, the chemical bond, the molecules and their geometry, the states of aggregation of matter. Students will have demonstrate the ability to employ critical thinking and efficient problem-solving concerning chemical reactions, homogeneous and heterogeneous chemical equilibria, and the related thermodynamic and kinetic aspects.

Applying knowledge and understanding

The student must demonstrate the ability in solving basic problems concerning the manipulation of chemical substances, in predicting their ability to transform, with relevance to their reactivity and behavior in aqueous solutions. The student must demonstrate to have acquired the basic concepts of general chemistry through numerical exercises and experimental activities, and to have also developed skills in fundamental laboratory operations.

Further learning outcomes:

Making judgement: student will gain the ability to employ critical thinking in the description of a scientific phenomenon, and problem solving skills with respect to stoichiometric calculations. Furthermore, student must be able to identify substances and the relative proportions for the preparation of systems with defined characteristics (concentration, pH, osmotic properties). The student must also be able to collect and interpret laboratory operational data, elaborate concepts and draw conclusions aimed at solving chemical problems.

Communication skills: students will gain written and oral communication skills, especially the ability to communicate information related to the composition of matter and its transformation.

Learning ability: the student must be able to expand their knowledge by reading scientific texts or articles, thanks to the tools, curiosity and critical judgment gained from acquired skills and competencies.

COURSE CONTENT/SYLLABUS

Structure of matter and its properties. Structure of the atom. Periodic Table and Periodic Properties. Stoichiometry. Chemical bonds. Liquids, Solids, Gases Phase diagrams. Solutions and their properties. Thermochemistry and Thermodynamics. Chemical Kinetics. Chemical Equilibrium. Electrochemistry. Laboratory Practice.

READINGS/BIBLIOGRAPHY

Slides from the teacher website

Suggested textbooks:

Petrucci, Herring, Madura, Bissonnette, “Chimica Generale”, Undicesima Edizione (2018), Editrice Piccin;

Kotz e Treichel, “Chimica”, Settima Edizione (2021), Casa Editrice EdiSES;

Atkins, Jones “Principi di Chimica”, Terza Edizione (2012), Casa Editrice Zanichelli;

Tro “Chimica, un approccio molecolare”, Seconda Edizione (2017) Casa Editrice EdiSES.

TEACHING METHODS OF THE COURSE (OR MODULE)

Lectures, numerical exercises and laboratory experiments.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
INTRODUCTION TO BIOLOGY AND BIOTECHNOLOGY

SSD: BIOLOGIA APPLICATA (BIO/13)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: FALCO GEPPINO
PHONE: 081-679092
EMAIL: geppino.falco@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

None

LEARNING GOALS

The course will provide knowledge of living systems, with particular attention to the structure and function of cellular constituents and to the main methods that allow the genome manipulation. The course will also provide knowledge on which molecules characterize biological processes. Among the educational objectives, the teaching pays particular attention to the molecular basis of cell biology in relation to applications in the field of diagnostics, treatments and environmental analyzes. The training course will provide the suitable tools to develop in the student the critical ability of the topics dealt with the implications of innovation and technology transfer.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate understanding and knowledge of the problems relating to the functions of biomolecules, and the structural and functional organization of the cell and intracellular compartments. He must also demonstrate to know how to relate the cell cycle and cell division functionally to environmental factors. The educational path of the course aims to provide students with knowledge of the main molecular phenomena that regulate the biology of prokaryotic and eukaryotic organisms.

Applying knowledge and understanding

The student must demonstrate to be able to extend the molecular knowledge of the main biological processes to applications involving the production and visualization of biological molecules. In particular, the student must be able to design the molecular and functional stabilization of gene transcripts and proteins in cellular bioproduction systems.

COURSE CONTENT/SYLLABUS

Biotechnologies: the birth and development of new science. Illustration of the significance, potentialities and applications of biotechnology. The professional figure of the Industrial Biotechnologist (**1CFU**). Living organisms. Cellular theory. The prokaryotic and eukaryotic cells. The viruses. Main macromolecules of biological interest: proteins, carbohydrates, lipids, and nucleic acids (**2CFU**). DNA replication and RNA transcription mechanism. The genetic code. Chromatin organization. The meaning of constitutive chromatin, facultative heterochromatin and euchromatin. Protein synthesis. Fundamental concepts of the three-dimensional protein organization. Biological membranes: structure and function. Protein placement in cellular sub-compartments (**3CFU**). Cellular compartments and organelles. Endoplasmic reticulum and the Golgi apparatus: role and function. The endosomes and Lysosomes: their role in the processes of endocytosis and phagocytosis. The cytoskeleton: dynamics, molecular organization, and functions. The extracellular matrix. Cell-cell adhesion molecules and cell-matrix. Cell motility. Cell proliferation. The Cell Cycle and Mitosis. Meiosis. Gametogenesis. Fertilization. The cellular response to extracellular signals. The first stages of embryonic development and cell differentiation. Apoptosis and Necrosis (**3CFU**).

READINGS/BIBLIOGRAPHY

PowerPoint presentations on the course topics will be available on the professor's website. Lecture notes and scientific articles. *Alberts –Molecular Biology of the Cell – Ed. Zanichelli*

TEACHING METHODS OF THE COURSE (OR MODULE)

Oral communication lessons and seminars

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
PHYSICS AND COMPUTER LABORATORY

SSD: FISICA SPERIMENTALE (FIS/01)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: VELOTTA RAFFAELE
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 9

REQUIRED PRELIMINARY COURSES

None.

PREREQUISITES

Basics of analytical geometry (e.g., cartesian coordinates, distance between two points, equation of a straight line) and trigonometry (definition of sine and cosine functions). These topics can be learned by attending the mathematics course offered prior the physics course. However, the level of knowledge of the above topics gained in high school is usually adequate to effectively attend the physics course.

LEARNING GOALS

The course aims at providing the student with the basic knowledge of the physics laws also using PC tools and utilities. Special emphasis will be given to the topics of interest in life sciences.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The students will learn the methodology and the fundamentals of physics so as to be able to analyse and understand the physical phenomena, with special emphasis to those relevant in life sciences (e.g., sedimentation, membrane potential, capillarity, ion dynamics in presence of electric and magnetic field, etc.). Such skills will allow the students to recognize causality between the phenomena occurring in nature and the principles behind them.

Applying knowledge and understanding

The students will be able to solve basic physics exercises also by using numerical approach utilizing commercial software. Moreover, the tools acquired from the course will enable students to address some of the typical problems arising in life sciences (e.g., interpretation of spectra measured by several techniques like electrophoresis or mass spectrometry) with scientific rigor and critical thinking.

COURSE CONTENT/SYLLABUS

Units of measurement. Scalars and vectors. Motion law. Velocity and acceleration. (0.8 CFU).
Principles of dynamics. Force and mass. Torque. Couple of forces. Levers. (0.6 CFU).
Work and kinetic energy. Potential energy. Energy conservation. Conservative forces: gravitation. Non-conservative forces: friction. (0.6 CFU).
Pressure. Pascal’s and Archimedes principles. Stevino’s law. Flow and Leonardo's law. Bernoulli's theorem and its applications. Cohesion forces. Surface tension, capillary. Surface-active liquids. Viscosity. Poiseuille’s law. Turbulence and Reynolds number. (1.4 CFU).
Temperature. Heat. Ideal gases. State transformations. First and second principles. Applications (0.6 CFU)
Electric charge, force, field, and potential. Examples. Potential energy. Continuous current. Ohm’s and Kirchoff’s laws. Applications. Joule effect. (0.6 CFU).
Magnetic force, field, dipole. Biot-Savart’s law. Ampére’s theorem. Currents Interactions. (0.4 CFU).
Electro-Magnetic induction. Displacement current. Notes on Maxwell’s equations. (0.5 CFU).
Refractive index, reflection and refraction. Electromagnetic waves. Total internal reflection and its applications. Geometric optics. Mirrors and thin lenses. Conjugate points. Image construction by rays. (0.5 CFU).
Applied computer science. Basic concepts of statistics and error theory. Experimental and statistical errors. Maximum likelihood method. Least squares and linear best-fit (1.5 CFU).
Electronic datasheet elaboration. (1.5 CFU)
Likelihood method. Least squares and linear best-fit. (1.5 CFU).
Electronic datasheet elaboration. (1.5 CFU)

READINGS/BIBLIOGRAPHY

1) Slides prepared by the lecturers.
2) Any undergraduate physics textbook for life sciences.

TEACHING METHODS OF THE COURSE (OR MODULE)

The lecturer will hold class lectures for theory and exercises (approximately 60% and 40% of the hours, respectively). Part of the exercise hours will be held by using computer.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
ORGANIC CHEMISTRY

SSD: CHIMICA ORGANICA (CHIM/06)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: CIMMINO ALESSIO
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EMAIL: alessio.cimmino@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 9

REQUIRED PRELIMINARY COURSES

GENERAL AND INORGANIC CHEMISTRY

PREREQUISITES

NO

LEARNING GOALS

The course aims to provide adequate knowledge of the main organic compounds of biological interest and prediction of their reactivity. Basic methods for the preparation of organic compounds and for their analysis. These tools, accompanied by numerical and laboratory exercises, will allow students to grasp the structure / property implications and make useful predictions about the behavior of the different classes of compounds.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student should demonstrate knowledge of the main classes of organic compounds, highlighting the relationships between structure, physical properties and chemical behavior, with particular focus on their reactivity. The training course - aimed at understanding the molecular basis of processes and interactions between biomolecules, and between biomolecules and the environment - is complemented by laboratory exercises, aimed at providing familiarity with the manipulation, analysis and purification of organic compounds.

Applying knowledge and understanding

The student should demonstrate knowledge of the structural characteristics of the functional groups present in organic compounds and their reactivity, describing the main reaction mechanisms. He should be able to recognize the effects that modulate the chemical properties of organic compounds, predict their behavior in certain environmental conditions and describe the main conversions of functional groups, rationalizing possible synthesis strategies of more complex substrates starting from simple molecules.

COURSE CONTENT/SYLLABUS

Chemical bonds and carbon derivatives: chemical linkages and octet rule, Lewis structures, resonance, atomic orbitals, molecular orbitals, hybridization of carbon, geometry of the molecules, polar covalent bonds and polarity of the molecules. 1 CFU

Functional groups and main classes of organic compounds. Acids and Bases in organic chemistry: Brønsted-Lowry and Lewis acids; strength of acids, structure-acidity relationships, inductive effect; resonance; nucleophilicity and electrophilicity. 1 CFU

Isomerism and Stereochemistry: constitution, configuration and conformation; constitutional isomers and stereo-isomers, enantiomers and chiral molecules, optical activity, molecules with more stereocentres: diastereoisomers; meso forms. 1 CFU

Alkanes, Cycloalkanes, Alkenes and Alkynes: structure, constitutional isomerism, nomenclature, physical properties, conformational analysis, main reactions; regio- and stereochemistry in electrophilic addition reactions to alkenes and alkynes. 1 CFU

Benzene and Aromatic Compounds: the structure of benzene, benzene derivatives, the Huckel rule, aromatic heterocyclic compounds, electrophilic aromatic substitution reactions, activating/disactivating and orientering effects of the substituents. 1 CFU

Halogenoalkanes; Alcohols, Ethers, Thiols; Amines. 0.5 CFU

Aldehydes and Ketones; 0.5 CFU

Carboxylic acids and their Derivatives: structure, nomenclature, physical properties, main reactions and their mechanisms. 0.5 CFU

Enolate ions: aldol and Claisen reactions. 0.5 CFU

Study of the main classes of molecules of biological interest: Carbohydrates, Lipids, Aminoacids and Peptides, Nucleosides and Nucleic Acids: structural aspects, classification, physical properties, stability and reactivity. 1 CFU

Practical laboratory activities: Crossed aldol condensation reaction: synthesis and purification of dibenzalacetone. 1 CFU

READINGS/BIBLIOGRAPHY

For the general part: W.H. Brown e T. Poon “Introduzione alla Chimica Organica” EDISES, 2020 (VI Ed.), or J. Mc Murry “Fondamenti di Chimica Organica” ZANICHELLI, 2011, or P.Y. Bruice “Chimica Organica”, EDISES, 2017.
For the exercises: F.S. Lee, W.H. Brown e T. Poon “Guida alla soluzione dei problemi da Introduzione alla Chimica Organica” EDISES, 2015; M.V. D’Auria, O. Taglialatela e A. Zampella “Guida ragionata allo svolgimento di Esercizi di Chimica Organica” LOGHIA, 2020.

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use: a) lectures for about 55% of the total hours (5 CFU); b) numerical exercises to practically deepen theoretical aspects (3 CFU); laboratory exercises to deepen applied knowledge (1 CFU)

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

The written test is based on solving numerical exercises and is binding for the purposes of accessing the oral test. The written test and the oral test account for 50%. The learning outcomes to be tested are the student's critical ability to correlate the structural aspects of organic compounds with their physical and chemical properties, with particular focus on their stability and chemical reactivity.

COURSE DESCRIPTION
GENETICS

SSD: GENETICA (BIO/18)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: POLLICE ALESSANDRA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

Knowledge of cell division mechanisms (mitosis and meiosis)

LEARNING GOALS

The aim of the course is to provide students with the knowledge and basic methodological tools necessary to analyze the transmission of genetic traits. The methodological tools will be acquired through the description and analysis of genetic experiments and the knowledge will be acquired through the interpretation of the experimental results. These tools will allow students, through the application of logical-deductive principles, to understand the causes of the main problems of formal and molecular genetics and to understand their evolutionary implications

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding of the problems relating to the mechanisms that regulate the transmission of genetic traits. The student must demonstrate how to elaborate discussions concerning the organization, structure and evolution of genes and genomes.

Applying knowledge and understanding

The student must demonstrate to be able to apply the logical-deductive principles of Genetics for the solution of problems about the transmission of traits in all organisms. The course is aimed at transmitting the operational skills necessary to concretely apply the knowledge of formal and molecular genetics and favoring the ability to fully use the methodological tools acquired

COURSE CONTENT/SYLLABUS

***Mendelian genetics**: the basic principles of inheritance; :genetic crosses; application of the Mendel's principles; pedigrees analysis. (1,25 CFU)*

***Extensions of Mendelism**: incomplete dominance and codominance; multiple alleles; gene interactions and complementation. (0,5 CFU)*

***Chromosome theory of heredity**: genes and chromosomes; chromosomes during mitosis and meiosis; linkage, crossing over and genetic maps. (1,25 CFU)*

***Inheritance of complex traits**: quantitative traits; genetic and environmental variance. (0,25 CFU)*

***Variation in chromosome number and structure**: chromosomal deletions, duplications, inversions and translocations; aneuploidy and polyploidy. (0,25 CFU)*

***Bacterial genetics**: transformation, conjugation, transduction and genetic maps in bacteria. Plasmids and episomes. (0,25 CFU)*

***Definition of the gene**: structure and function. Benzer experiments. Genetic maps in bacteriophages. (0,25 CFU)*

***Genetic code**: properties, organization and deciphering. Crick and Brenner experiments; Intra- and inter-genic suppression. (0,5 CFU)*

***Regulation of gene expression in prokaryotes**: positive and negative control; inducible and repressible control. Operons. Attenuation. (0,5 CFU)*

***Hints on regulation of gene expression in eukaryotes**: transcriptional and post-transcriptional regulation also through epigenetic; dosage compensation; X inactivation. (0,25 CFU)*

***Population genetics**: Hardy-Weinberg principle and its applications. Polymorphisms and evolution: effects of mutation, gene flow, genetic drift and natural selection. The neutral theory of evolution. (0,5 CFU)*

***Description and applications of the teacher's research activity** (0,25 cfu)*

READINGS/BIBLIOGRAPHY

It is recommended to use a recently published university manual of Genetics. Additional teaching material is available on the teacher website and on the Microsoft Teams channel of the Course

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use

a) Frontal lessons for about 70% of the total hours

b) Group exercises to deepen and apply theoretical aspects for about 30% of the total hours

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [ ] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
BIOCHEMISTRY OF MACROMOLECULES AND CELLULAR METABOLISM

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: ARCIELLO ANGELA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 18583 - BIOCHIMICA
MODULE: 34076 - BIOCHIMICA DELLE MACROMOLECOLE E METABOLISMO CELLULARE
SSD OF THE MODULE:
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

Chemistry and **Organic Chemistry** are strongly recommended.

PREREQUISITES

Knowledge of Chemistry and Organic Chemistry bases

LEARNING GOALS

The course aims to provide students with the basic notions on the structure of proteins, on the role of enzymes, on the structure and function of the main classes of molecules of biological interest and on the main metabolic pathways of biomolecules. Furthermore, the course will introduce the topic of the functional role of biomolecules and of the biochemical transformation processes in which they are involved for the production of chemical energy.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student has to demonstrate knowledge and understanding of the structural levels of proteins, of the role of enzymes, of the structure and function of the main classes of molecules of biological interest and of the main metabolic pathways of biomolecules. The student has also to demonstrate knowledge and comprehension of the role that biomolecules play in the cell and of the processes in which they are involved for biochemical transformations and for the production of chemical energy. The student has also to demonstrate knowledge and comprehension of the aspects inherent to the relationship between structure and function of biomolecules and of the concepts and meaning of enzymatic catalysis.

Applying knowledge and understanding

The student has to be able to independently evaluate the efficiency of an enzymatic reaction on the basis of kinetic parameters and be able to discuss the functional relationships between biomolecules in a living cell. The student has to develop the ability to collect and interpret experimental data, to carry out bibliographic research and to use databases and other sources of information to solve specific problems in the biotechnology field.

The student has to be able to explain in written and verbal form the basic notions on the role of proteins and of metabolic processes. The student has also to be able to present a paper and to summarize in a complete but concise way the reported results by correctly using scientific language. The student has also to be able to correctly interpret the available scientific literature and to communicate learned concepts, in Italian and English, even with the use of multimedia systems.

The student has to be able to update or expand his/her knowledge on the structure of proteins and on metabolic pathways by consulting independently texts, scientific articles, and also through specialized seminars, conferences, etc.

COURSE CONTENT/SYLLABUS

Protein structure. L- amino acids. The peptide bond. The structural organization of proteins: primary, secondary, tertiary and quaternary structures: how these structures are stabilized. Amino acid lateral chains potentiality to establish interactions. The relationship between structure and function. The role of the enzymes. The concept of enzymatic catalysis. Activation energy and role of the enzymes in biocatalysis. The enzyme-substrate complex.

Enzyme kinetics. the titration curve, the equation of Michaelis and Menten. Experimental determination of Km and Vmax. Enzyme inhibition. Allosteric enzymes. Concepts of cooperativity and role of the regulation sites.

Cell metabolism. General concepts of energetics. Carbohydrates metabolism. Glycolysis. Piruvate fermentation reactions. The pathway of phosphogluconate. Gluconeogenesis. Synthesis and degradation of glycogen and their coordinated regulation. Betaoxidation of fatty acids. Fatty acids biosynthesis. Protein catabolism, deaminations, transamination

reactions, the urea cycle. The cycle of tricarboxylic acids. Oxidative phosphorylation and ATP synthesis. Examples of metabolism regulation.

READINGS/BIBLIOGRAPHY

Recommended textbooks (to be chosen by the student):

Nelson e Cox - I principi di Biochimica di Lehninger VIII Ed., 2022 (Zanichelli Editore)

Campbell e Farrell –Biochimica IV Ed., 2012 (EdiSES)

Mathews et al. Biochimica, 2013. (Pearson Editore)

D. Voet, J.G. Voet e C.W. Pratt - Fondamenti di Biochimica II Ed., 2004 (Zanichelli Editore)

TEACHING METHODS OF THE COURSE (OR MODULE)

Lectures will be carried out by using multimedia supports, movies and specialized software.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

The oral exam will consist in the formulation of three questions for each module in order to ensure that the final score will be weighted on both courses, being each of 6 credits.

COURSE DESCRIPTION
APPLIED BIOCHEMISTRY

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: GAGLIONE ROSA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 18583 - BIOCHIMICA
MODULE: 01763 - BIOCHIMICA APPLICATA
SSD OF THE MODULE:
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

Strongly recommended Chemistry and Organic Chemistry.

PREREQUISITES

Basic knowledge of Chemistry and Organic Chemistry.

LEARNING GOALS

The aim of the course is to introduce the student to the basic methodological knowledge and to the necessary tools to perform identification, purification and quantization of proteins, and for the design of experiments aimed at their characterization.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge of the issues related to protein purification.

The student must demonstrate knowledge to elaborate discussions of the methods employed, starting from the notions learned on the structure and function of proteins. These tools will allow the student to use the basic equipment of a biochemistry laboratory.

At the end of the course, the student must be able to broaden their knowledge by independently drawing on texts, scientific articles, and must be able to follow scientific seminars.

Applying knowledge and understanding

The student must demonstrate to be able to design experiments to perform purification and characterization of proteins and to solve problems deriving from the heterogeneity of the biological molecules. These skills will allow to the student to learn how to solve problems even in different fields, adapting to unexpected results.
The student must be able to establish the appropriate experimental design and subsequently to interpret the data collected from the measurements in the laboratory.
The student must be able to face unexpected events by proposing alternative solutions.
The necessary tools will be provided to allow the student to analyze and judge the results in total autonomy.

COURSE CONTENT/SYLLABUS

0.5 CFU. The pHmeter: use of the instrument; differences between the method Henderson-Hasselbach and the pHmeter.
0.25 CFU. Concepts of yield, purity and specific activity.
0.5 CFU. Biological assays; the ELISA assay and calibration curve.
0.5 CFU. Protein detection: spectrophotometer, Lambert and Beer law, absorption spectra, colorimetric methods.
0.5 CFU. Protein fractionation: homogenizers and mechanical systems, use of detergents, fractionation based on the isoelectric point and solubility (salts, organic solvents, organic polymers and heat denaturation).
0.5 CFU. Protein purification by chromatography: gel-filtration; ion exchange; affinity; hydrophobic; HPLC.
0.25 CFU. Dialysis and ultrafiltration.
0.25 CFU. The Western blotting technique.
0.25 CFU. Determination of the molecular weight of a protein by gel filtration and by SDS-PAGE.
0.5 CFU. Determination of the primary structure of a peptide with the Edman reaction. Determination of the composition in amino acids.
2 CFU. Laboratory practice will include: use of the pHmeter; perform a chromatography; use a spectrophotometer; determine the protein concentration; visualize proteins on polyacrylamide gels under denaturing conditions; western blotting.

READINGS/BIBLIOGRAPHY

Didactic material provided by the teacher.
Textbooks:
- Metodologie biochimiche. M. C. Bonaccorsi di Patti, R. Contestabile, M. L. Di Salvo. Edizione 2019 (Zanichelli Editore)
- Fondamenti di biochimica. L. Pollegioni. Edizione 2021 (Edises Editore)
- I principi di biochimica di Lehninger. David L. Nelson, Michael M. Cox. Edizione 2022 (Zanichelli Editore)

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use:
a) frontal lessons for about 70% of the total hours;
b) laboratory practice to deepen theoretical aspects for about 30% of the total hours.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☑ Other : There will be laboratory practice and a handout to be filled out which will be discussed during the exam.

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

The oral exam will consist in the formulation of three questions for each module; the final vote is weighted on both of them (being each module of 6 credits).

COURSE DESCRIPTION
MOLECULAR BIOLOGY

SSD: BIOLOGIA MOLECOLARE (BIO/11)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: PISCITELLI ALESSANDRA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

Basic knowledge of Chemistry and Organic Chemistry.

LEARNING GOALS

The purpose of this course is to give the bases to correctly understand the structural organization of the gene and the molecular mechanisms which rule its function. Beside the description of basic processes such as DNA replication and repair, transcription, and translation, a part of the course will be devoted to examples of basic molecular biology techniques.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

After completing this course, students have adequate knowledge of the fundamental principles and basic mechanisms of molecular biology. In particular, they are able to understand and discuss issues of gene expression, DNA replication and repair, and the structure of the genome. Students have also knowledge of basic molecular biology technologies.

At the end of the course students develop independent thinking and critical assessment. The necessary tools will be provided to allow students to independently analyse and judge literature data. They must be able to connect and integrate the various topics of the course by developing their critical capacity.

•**Cognitive skills** - acquisition of fundamental elements at molecular level concerning the complexity of the information flux from genes to proteins; - acquire the required information (theoretical and experimental) to carry out the process of gene cloning.

Applying knowledge and understanding

•Practical and subject specific skills

- ability to apply the knowledge in the field of molecular biology;
- ability to propose an analytical problem-solving approach.

Further expected learning outcomes:

•*Autonomy of judgment*

- development of an aptitude to deal with the continuous advancements of molecular biology, a discipline in continuous expansion;
- ability to integrate the acquired knowledge in the field of molecular biology, biochemistry and microbiology.

•*Communication skills*

- ability to identify and express relevant information
- demonstrate effective communication skills by practicing, reading, writing and speaking clearly
- demonstrate the ability to resume and present the scientific information.

•*Learning abilities*

- ability to read, understand and criticize a scientific text of molecular biology

COURSE CONTENT/SYLLABUS

1. The structure of DNA. DNA topology.
2. The structure of the RNAs.
3. Genome structure, nucleosomes and chromatine.

(1.5 CFU)

4. DNA replication.
5. The mutability and repair of DNA.

(1.5 CFU)

6. Mechanism of transcription.
7. RNA maturation: capping, adenylation and splicing.

(1 CFU)

8. Translation. The genetic code.

(1 CFU)

10. Manipulating DNA: some fundamental Molecular Biology techniques.

(1 CFU)

READINGS/BIBLIOGRAPHY

Books (student's choice; most recent edition is suggested):

Watson et al., **Biologia Molecolare del gene** –Zanichelli

Zlatanova and van Holde **Biologia Molecolare** –Zanichelli

Capranico et al. **Biologia Molecolare**- Edises

Maccarone **Metodologi biochimiche e biomolecolari** –Zanichelli

Brown **Biotecnologie molecolari** –Zanichelli

These books are available for consulting

Slides of lessons: registered students can download lesson presentations, and other teaching materials

TEACHING METHODS OF THE COURSE (OR MODULE)

The course is based on theoretical lessons (about 85% of total hours) with projections of slides, videos or connection to web sites of database with attempts to interact with the class and to stimulate questions and curiosity toward the dealt topics.

Moreover, experimental lab activitites will be managed (about 15% of total hours). Within the lab activitites some of the fundamental techniques of Molecular Biology, already introduced during the lectures, will be applied and discussed.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

At least three different topics are discussed with the student.

The criteria that will be used to verify the acquired knowledge and skills are:
1) the comprehension of the analyzed topics and the depth of the acquired knowledge;
2) the ability of explain in a well organized and effective way the required subject using a proper scientific lexicon.

COURSE DESCRIPTION
GENERAL AND APPLIED MICROBIOLOGY

SSD: MICROBIOLOGIA GENERALE (BIO/19)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: ISTICATO RACHELE
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 9

REQUIRED PRELIMINARY COURSES

none

PREREQUISITES

highly recommended Chemistry, Organic Chemistry and Genetics

LEARNING GOALS

The training objective of the course is to provide basic knowledge of microorganisms and their biotechnological applications.
In particular, it will be highlighted how the basic study of morphology, physiology, genetics, and microbial metabolism is necessary for the development of products n the industrial and environmental field. The ultimate goal of the course will be to allow learners to acquire useful knowledge for understanding the applications of Microbiology in various fields.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

At the end of the course, the student must demonstrate that he has acquired knowledge of the taxonomy, physiology, genetics, and metabolism of the main microbial groups of biotechnological interest. In addition, he must demonstrate that he understands the importance of microbial biodiversity and its application in the biotechnology field.
Thanks to discussions in the classroom, both in self-management, both co-management with the teacher, the student twill aquire technical language and adequate specialist terminology.
The student must be able to study independently and deepen their own skills by consulting bibliographic material, databases, and other
information on the net. All learning outcomes will be achieved through participation in lectures and exercises, individual study on recommended texts, and the aid of tutoring.

Applying knowledge and understanding

The student must demonstrate knowledge of the main microbiological techniques and be able to use the instrumentation of the microbiology laboratory. This will allow the student to independently discriminate which techniques to apply to grow microorganisms isolated from the environment in the laboratory, and analyze their growth and characterization.
The student must improve their ability to judge and analyze problems concerning the environment and the industry by applying the skills acquired during the course, as well as collecting and interpreting laboratory data.

COURSE CONTENT/SYLLABUS

Development of Microbial Biotechnologies. Microorganisms in biological research, their naturalistic and agro-industrial roles.
Morphology and Structure of the Prokaryotic Cell. Main differences between prokaryotic and eukaryotic cells. The bacterial spore.
Microbial growth. Biofilm.
Viruses.
Microbiological techniques: Microbial Growth. Requirements for Growth. Factors affecting growth. growth rates. Culture media. Optical, electronic, and atomic force microscope. Measurement of growth. Phases of Growth and Growth curve.
Principles of Molecular Biology and Microbial Genetics. Regulation of gene expression. Quorum sensing. Bacterial genetics techniques in vivo (genetic transformation, conjugation and transduction) and in vitro.
Microbial Growth Control: Sterilization. Antimicrobial Substances: Chemotherapeutics and Antibiotics. Antivirals and antifungals. Drug resistance. New antimicrobial drugs.
Metabolic Diversity and Microbial Ecology: Fermentation. Aerobic and Anaerobic Breathing. Chemolithotrophy. Nitrogen fixation. Bacterial photosynthesis. Phylogenetic diversity in microorganisms.

Industrial use of microorganisms.
Environmental and Medical Microbiology.

READINGS/BIBLIOGRAPHY

Brock Microbiology of Microorganisms 16th Edition. Madigan. 2022
D. R. Wessner C. Dupont T. C. Charles. MICROBIOLOGY. 2015
The teaching material and specific communications of the teacher are available, together with other support activities, on the website: https://www.docenti.unina.it/RACHELE.ISTICATO

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use:
1) frontal lessons for about 70% of the total hours,
b) LEARNING by doing: exercises to learn the basic technologies of Microbiology in a practical way (12 h)
c) seminars on applications of microorganisms in the industrial field
d) OUTDOOR LEARNING and PROBLEM-SOLVING approaches to facilitate learning processes and for the acquisition of strategic skills

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [x] Open answers
- [x] Numerical exercises

b) Evaluation pattern

The final exam will verify and evaluate the achievement of the educational objectives listed above.
The assiduous attendance and participation in the classroom will be positively evaluated.
Passing the written exam will allow access to the oral exam.
The student must show that he has acquired the concepts and notions reported in the program and the ability to apply methods and tools for the analysis of microbial communities, for the study of the application of the microorganisms in the natural environment.
The student's ability to integrate the various contents of the course and the property of scientific language will also be evaluated.

COURSE DESCRIPTION
ADVANCED BIOCHEMISTRY

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: CARPENTIERI ANDREA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 12212 - BIOTECNOLOGIE MOLECOLARI
MODULE: 17517 - BIOCHIMICA AVANZATA
SSD OF THE MODULE:
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

In order to be able to deal with the topics proposed during the course, students are strongly recommended to have a basic knowledge of Protein and Nucleic Acid Chemistry learned during the Biochemistry course and some concepts of Organic Chemistry.

LEARNING GOALS

The main objective of the course is to introduce the students to the fundamental concept of the relationship between structure and function of different biomolecules. Numerous examples will be illustrated both at the protein level and at the laevel of other molecules of biochemical interest (lipids, mono- and polysaccharides). These concepts will then be related and contextualised to some fundamental events in the biochemistry of organisms (e.g. protein misfolding, the role of

post-translational modifications, etc.). Lastly, some of the research topics that have been of most interest to the world of research in recent years will be illustrated: Proteomics

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

In consideration of the examples discussed, the students must be able to articulately report on how proteins perform their functions in vivo with reference to the molecular mechanisms underlying important cellular processes. He/she must demonstrate an understanding of the relationship between the structure and function of proteins, and how this relationship has determined their evolutionary selection. They must know the chemical characteristics and biochemical implications of major post-translational modifications.

Applying knowledge and understanding

Students must demonstrate knowledge of the main experimental methods for studying protein-protein interactions (immunoprecipitations, functional proteomics), and on the basis of these, propose experimental approaches to understand and describe cellular processes as networks of interactions between biological macromolecules.

- Autonomy of judgement: The approach of the lectures is interactive, with continuous solicitation of students' participation with comments, logical connections and with reference to topics covered in other courses. The students are therefore always stimulated to be critical and not purely mnemonic with regard to the topics covered during the lectures, so as to acquire an autonomy of judgement on the main concepts exposed during the course.
- Communication skills: Once the knowledge of the topics dealt with in the course has been acquired and made their own, the student must be able to elaborate the contents in simple but scientifically rigorous language, so as to be able to express themselves clearly also to professionals from other sectors or to an extended audience of non-experts.
- Learning ability: Starting from the classroom discussions, from the didactic material available on the lecturer's website, the student has at his or her disposal all the tools to proceed autonomously to subsequent in-depth studies, drawing mainly from the recent scientific literature available on the web (scientific articles, reviews, etc.).

Translated with www.DeepL.com/Translator (free version)

COURSE CONTENT/SYLLABUS

Proteins: recapitulation of the characteristics of amino acids and the four structural levels. Characteristic structural elements in fibrous and globular proteins. Description of certain domains, with particular emphasis on those recurring in DNA-binding proteins.

Evolution of proteins: Homology and sequence identity. Parologues and orthologues. Divergent evolution and convergent evolution. Proteins and enzymes with more than one function (Moonlight): a consequence of the evolution of complex organisms

Protein folding in vitro and in vivo: What is folding: from the Anfisen experiment to 'tunnel' models for the thermodynamic description of the process. The molten globule. Outlines of the main techniques used to study folding in vitro. The main classes of proteins that assist folding in vivo; mechanisms acting as quality control of folding in cells. Misfolding and aggregation diseases (Prions, amyloid proteins).
Post-translational modifications and their functional significance: Proteolysis. Phosphorylation. Epigenetic modifications of histones: acetylation and methylation. Lipid binding. N- and O-glycosylations. Particular type of post-translational modification: Self-splicing. Inteins and Esteins.
Examples of Structure-Function Relationships of Proteins: Antibodies: concepts of innate immunity and acquired immunity. Antibodies valuable tools in biochemical and biotechnological applications.
Proteases: structure, mechanism of action, functions in vivo and in vitro. Biotechnological applications of proteases. Structural proteins: collagen and keratins
Protein half-life: Ubiquitin and proteaosome
Cell death: apoptosis, autophagy and necrosis, generalities.
Introduction to Proteomics: The new view of the biological world in the post-genomic era. The main objectives and tools of Proteomics. Functional proteomics in the study of protein-protein interactions.
Experimental approaches for the study of protein-protein interactions in the understanding of molecular processes. Strategies for studying protein-protein interactions in vivo: double hybrid technique, purification of multi-protein complexes by affinity chromatography and immunoprecipitation.

READINGS/BIBLIOGRAPHY

Lectures in pdf format uploaded on the lecturer's website and available to all course participants.
Recommended textbooks: Williamson: 1) How Proteins Work - Zanichelli, Ed. 2013; 2) Whitford: Proteins - Structure and Function - Wiley, Ed. 2005; 3) Alberts, Johnson, Lewis, Morgan, Raf, Roberts and Walter: Molecular Biology of the Cell - 6th Edition - Garland Science.

TEACHING METHODS OF THE COURSE (OR MODULE)

Lectures

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers

☐ Numerical exercises

b) Evaluation pattern

The level of learning will be assessed through the analysis of knowledge related to the topics addressed in the course but also on the basis of the ability to process content in a critical and personal manner, stimulating the making of logical connections both with the various topics addressed in the course and with topics covered in previous courses.

COURSE DESCRIPTION
Molecular Genetics

SSD: GENETICA (BIO/18)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: ANGRISANO TIZIANA
PHONE: 081-679721
EMAIL: tangrisa@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 12212 - BIOTECNOLOGIE MOLECOLARI
MODULE: U0596 - GENETICA MOLECOLARE
SSD OF THE MODULE:
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

Not provided

PREREQUISITES

Basic knowledge of both formal and Molecular Genetics is required.

LEARNING GOALS

The objective of the course is to provide students with the basic knowledge and methodological tools necessary to analyze complex biological phenomena through molecular genetics tools. In particular, through direct or reverse genetics, the student will be able to understand and describe the functioning of a cell and an experimental model system while learning and using the main techniques of Molecular Biotechnology.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate ability and understanding of gene function and expression issues. They must demonstrate the ability to develop statements concerning the relationships between molecular genetics mechanisms, the application of cloning strategies, and the use of biological systems, from single cells to complex systems, from the notions learned. The training aims to provide students with the basic knowledge and methodological tools to analyze and understand molecular biological phenomena associated with genetic engineering mechanisms, such as homologous or heterologous expression and gene silencing.

Applying knowledge and understanding

The student should be able to independently evaluate which methodology, among those learned, will be most suitable for arriving at the identification of genes responsible for a phenotype, functioning and expression of a gene. The student should be able to update and expand their knowledge by reading and understanding more specialized texts and scientific articles and by attending scientific seminars in the field. In addition, they should be able to correctly explain the notions understood and present or summarize bibliographic data in a complete, concise, and accurate manner using technical, scientific language. The student stimulated to become familiar with the terms proper to the discipline will be able to convey even to non-experts in the field the principles, contents and application possibilities with correctness and simplicity.

COURSE CONTENT/SYLLABUS

I Part-Theoretical (3CFU): Principles of classical genetics and molecular analysis for identifying genes and analyzing biological phenomena. Direct and reverse genetic analysis. Genetic selection and genetic screening. From gene to phenotype and from phenotype to gene: Beadle and Tatum experiments in Neurospora. Regulation of gene expression in eukaryotes. Epigenetic regulation and the influence of the environment. Hints at the structure of genomes. microRNAs, lncRNAs and pseudogenes, biological role. Use of siRNAs and shRNAs in genetic engineering. Mutation and repair of DNA. Mechanisms of spontaneous and induced mutations. Intragenic and intergenic suppression. Complementation and alpha complementation. Mechanisms and biological significance of DNA recombination. Generalized, specialized, illegitimate recombination. Transposons and their role in the establishment of genomes. Notes.
II Part-applications (3CFU): Techniques of genetic manipulations: In prokaryotes. Propagation plasmids and expression plasmids in E.coli, molecular cloning, fusion proteins, transformation, screening of recombinants, molecular probes, principles and applications of PCR, hints at 'use of lambda as a cloning vector, construction and analysis of genotypes. In Simple Eukaryotes Saccharomyces cerevisiae: life cycle, mating type and mating-type switch, artificial and natural plasmids. Manipulation techniques in yeast: transformation, knock out, knock-in, tetrad screening. Protein production in yeast. In Complex eukaryotes. Eukaryotic cells in culture. Primary, immortalized tumor, stem cells. Stable and transient transfection. Expression plasmids. Reporter plasmids. Analysis of phenotypes in cells. Application of the Crispr/CAS9 method in biotechnology. Vaccines and production strategies. Variability of immunoglobulins. Vaccines.

READINGS/BIBLIOGRAPHY

Notions of Basic Genetics: Genetica-dall'analisi formale alla genomica- Hartwell- Hood-Goldberg-Reynolds- Silver- Veres e Mc Graw-Hill; Genetica moderna Griffiths, A.J.F. –Miller, J.H.-Gelbart, W.M.-Lewontin, R. C.- Ed. Zanichelli; Genetica P. J. Russel Ed. Edises Genetica- Analisi di Geni e Genomi Hartl-Jones Ed. Edises; Principi di Genetica Snustad-Simmons Ed. Edises; Analisi dei geni e dei genomi Richard J Reece Ed. Edises.

Technical notions: Biotecnologie Molecolari –Brown –Zanichelli; DNA ricombinante - Watson, Caudy, Myers, Witkowski.

Teams Channel:

https://teams.microsoft.com/l/team/19%3ab366f9fff3d147e0892390a03c21fe04%40thread.tacv2/conversations?groupId=d7faba96-3635-4f17-bb15-ef3701c9fba1&tenantId=2fcfe26a-bb62-46b0-b1e3-28f9da0c45fd

TEACHING METHODS OF THE COURSE (OR MODULE)

The professor will use: a) lectures for about 70% of the total hours (6 CFUs), b) seminars for application and in-depth study of specific topics for 30%.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

The oral test consists of 3 questions. The final grade will be the weighted average on the CFUs of each teaching (module).

COURSE DESCRIPTION
PRINCIPLES OF CHEMISTRY OF FERMENTATION

SSD: CHIMICA E BIOTECNOLOGIA DELLE FERMENTAZIONI (CHIM/11)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: PARRILLI ERMENEGILDA
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EMAIL: ermenegilda.parrilli@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 31837 - BIOTECNOLOGIE MICROBICHE
MODULE: 34079 - PRINCIPI DI CHIMICA DELLE FERMENTAZIONI
SSD OF THE MODULE:
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

no any

PREREQUISITES

no any

LEARNING GOALS

The course aims to provide the knowledge necessary to understand the different aspects of the biotechnological production of substances of industrial interest. In detail, it aims to provide the fundamental elements of microbial growth kinetics in the different fermentation modes (batch, fed-batch, and continuous), of the principles of industrial microbiology, and of fermentation chemistry. Furthermore, the course aims to deepen the microbial metabolism aimed at the development of industrial production processes.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding of the problems relating to the development of a fermentation process that uses microorganisms of industrial interest. He must demonstrate that he knows how to elaborate even complex discussions concerning the fermentation methods to be adopted (batch, fed-batch, and continuous) based on the metabolic characteristics of the microorganism and the needs of the process starting from the notions learned on microbial metabolism.

Applying knowledge and understanding

The student must demonstrate that he is able to design and set up the fermentation process, solve problems concerning the choice of the microorganism to use, the culture medium to adopt, and the fermentation method to be adopted. The student must demonstrate to be able to extend the methodologies acquired to the main fermentation processes of industrial interest.

COURSE CONTENT/SYLLABUS

Contents: Microorganisms of industrial interest. The main products. Growth Kinetic models. General information on microbial metabolism. Description of an industrial fermentation process. Fermentation TechnologiesINTRODUCTION History of industrial biotechnology: biotechnologies from the beginning to the present. The biotechnology process: industrial fermentation and bioconversion. Microorganisms of industrial interest. The main products. KEY MODELS Batch, fed-batch, and continuous. Microbial growth. Monod's model. Main methods to measure biomass. Volumetric and Specific Productivity. BASIC METABOLICS FOR PRODUCT PRODUCTION. General information on microbial metabolism; Energy metabolism: respiration and fermentation; Anaerobic respiration; Carbohydrate use: via EMP, ED; A cycle of TCA; Glyoxylic cycle. Main microbial fermentations: alcoholic, lactic, and ABE. BIOPROCESS OPERATING Modality ES Batch, continuous, fed-batch fermentation, advantages, and limitations.

READINGS/BIBLIOGRAPHY

Textbooks: •Microbial biotechnologies, edited by Donadio and Marino, CEA - Casa Editrice Ambrosiana 2008
S. O. Enfors and L. Haggstrom: Bioprocess technology: fundamentals and applications, Hogskoletryckeriet, Stockolm, 1998.
Stanbury P.F., Whitaker A. and Hall S.J .: Principles of Fermentation Technology Pergamon 1995.
Gottshalk G .: Bacterial Metabolism, Springer Verlag (for the part concerning microbial metabolism) 2000
Lecture notes are provided by the teacher and available online at the

teacher's website

TEACHING METHODS OF THE COURSE (OR MODULE)

The course includes lectures, numerical exercises, and practical laboratory experiments

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [x] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [x] Open answers
- [x] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
FERMENTATIONS BIOTECHNOLOGY

SSD: CHIMICA E BIOTECNOLOGIA DELLE FERMENTAZIONI (CHIM/11)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: FARACO VINCENZA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: 31837 - BIOTECNOLOGIE MICROBICHE
MODULE: 34115 - BIOTECNOLOGIE DELLE FERMENTAZIONI
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

-

PREREQUISITES

-

LEARNING GOALS

The aim of the course is the acquisition of both theoretical and practical knowledges concerning the preparation of a fermentation process that uses microorganisms of industrial interest and the choice of the components necessary for this purpose. The course aims to both illustrate the principles of fermentation chemistry in order to understand the bases of production processes and describe examples of biotechnological applications of microorganisms. This will include the acquisition of knowledge of the characteristics and manipulation of microorganisms of industrial importance and the techniques for their improvement, the metabolic pathways of interest for

industrial fermentations and the kinetics of the main operating modes of bioprocess management, unitary operations for the preparation of a fermentation process and some industrial fermentations.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding of the issues relating to the operational aspects of setting up a fermentation process that uses microorganisms of industrial interest and the choice of components necessary for this purpose. It must also demonstrate knowledge of the possible applications that can be achieved by fermentation and the respective technologies to be used.

Applying knowledge and understanding

The student must demonstrate to be able to design and set up the fermentation process from an operational point of view, solve problems concerning the choice of the microorganism to be used, the culture medium, the type of fermenter, and the technologies of sterilization, aeration and product recovery, to be adopted. The student must demonstrate to be able to extend the acquired methodologies to the main fermentation processes of industrial interest.

COURSE CONTENT/SYLLABUS

INTRODUCTION History of industrial biotechnology: biotechnologies from the beginning to the present. The biotechnology process: industrial fermentation and bioconversion. The main components: Microorganisms of industrial interest, biocatalysts, bioreactors and facilities, raw materials; and the main operational units: preparation of culture medium, aeration and agitation, sterilization, Downstream processing for conducting a fermentative process APPLICATIONS Production of biomass: baker's yeast. Production of food and beverage by fermentation. Production of antibiotics (penicillin). Lignocellulose and waste conversion for production of biofuels and biopolymers. Biorefineries and circular economy. Industrial application of bacteria and yeasts for the production of recombinant proteins of industrial and biotechnological interess: cloning vectors, markers, expression vectors Production of aminoacids: lisine Practical part: Preparation of colture medium. Inoculum and growth of microorganisms. Study of microbial growth in dependence on different culture medium composition by batch fermentation. Recovery and determination of biomass. Determination of main fermentative parameters. Analysis of results. Exercises for calculation of the main fermentative parameters.Exercises for calculation of the main fermentative parameters of sterilization

READINGS/BIBLIOGRAPHY

Books: S. O. Enfors and L. Haggstrom: Bioprocess technology: fundamentals and applications, Hogskoletryckeriet, Stockolm, 1998. •Stanbury P.F., Whitaker A. and Hall S.J.: Principles of Fermentation Technology Pergamon 1995. •Gottshalk G.: Bacterial Metabolism, Springer Verlag (per la parte riguardante il metabolismo microbico)2000 •Power point presentations prepared by professor Faraco

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will deliver lessons up to 95% of the expected hours, 95% that will be integrated with summarizing lectures and possible seminars on specific topics on the application of biological chemistry to industrial chemistry.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [x] Open answers
- [x] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
PRINCIPLES OF ENGINEERING BIOPROCESSES

SSD: PRINCIPI DI INGEGNERIA CHIMICA (ING-IND/24)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: PIROZZI DOMENICO
PHONE: 081-7682274
EMAIL: domenico.pirozzi@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: II
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

none

PREREQUISITES

Basic concept of mathematics, phisycs and chemistry

LEARNING GOALS

The student must acquire the ability to use the basic methodological tools for the analysis of a bioprocess, understanding the structure, formulating and using the material and energy balances, identifying the critical variables.
Furthermore, he must demonstrate to understand the terminology used, and how to use the tools provided to correctly set up the bioprocess optimization.
He should also know how to use the knowledge acquired to solve the exercises discussed in the course.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate the acquisition of basic methodological tools for the analysis of a bioprocess. He must be able to set the procedures for the optimization of the process.

Applying knowledge and understanding

The student must be able to describe the scheme of a bioprocess to non-experts, highlighting its critical aspects.
Futhermore, the student must be able to expand their knowledge autonomously, addressing topics similar to those covered in the course.

COURSE CONTENT/SYLLABUS

Contents:
Matter balances. The concept of balance. The Law of conservation of mass. Closed systems. Open systems, concept of flow-rate. Mass balances without reaction. Base of calculus and scale factor. Problems with recycle and/or bypass. Balances with reaction. Atomic balances. Multiple reactions. Reactions with biomass production.
Energy balances. First law of thermodynamics for continuous systems. Energy balances without reaction. Specific heat, latent heat. Mixing and balances with phase transition. Energy balances with reaction. Standard heat of reaction. Standard heat of formation. Standard heat of combustion. Hess's law. Equation of Hess's law. Energy balances in biomass growth reactors: aerobic and anaerobic case.
Methods of separation. The phase equilibrium of mixtures. Ideal solutions. Raoult's law and Dalton's law. Industrial distillation. Non-ideal solutions. Solutions with non-volatile solutes. Boiling point elevation and freezing point depression. Henry's Law. Colligative properties. Osmotic pressure. Van't Hoff's law. Determination of molecular weights through osmotic pressure measurements. Viscosity. Archimedes' law, frictional force. Calculation of sedimentation rate. Centrifugation.

READINGS/BIBLIOGRAPHY

P. M. Doran, "Bioprocess Engineering Principles", Academic Press (1995);
P. Atkins, J. de Paula, "Physical Chemistry for the Life Sciences", Oxford University Press (2006);
M. M. Denn, "Process Fluid Mechanics", Prentice-Hall (1980).

TEACHING METHODS OF THE COURSE (OR MODULE)

Frontal lectures.
Numerical training.
Practical training

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [ ] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

COURSE DESCRIPTION
BIOANALYTICAL CHEMISTRY

SSD: CHIMICA ANALITICA (CHIM/01)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: AMORESANO ANGELA
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EMAIL: angela.amoresano@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

No preparatory teaching is required

PREREQUISITES

Basic knowledge in general chemistry and organic chemistry

LEARNING GOALS

The course aims to provide students with the knowledge and basic methodological tools necessary for qualitative and quantitative analytical evaluation of products of biotechnological interest

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student should demonstrate knowledge and understanding of the problems relating to the analysis techniques applied to chemical processes in the environmental, health, agri-food fields.
The student must demonstrate that he is able to choose the best analytical methodologies to solve problems

relating to industry, environmental pollution and / or to extend the methodologies learned to areas other than the environmental one.

Applying knowledge and understanding

The training course is aimed at transmitting the operational skills necessary to concretely apply the knowledge and foster the ability to fully use the methodological tools provided during the course.
Autonomy of judgment: The student must be able to independently evaluate the specific analytical processes to indicate the main methodologies relevant to the qualitative and quantitive characterization and evaluation of products of biotechnological interest and to propose new solutions for the chemical-physical characterization of different classes of molecules examined.
The necessary tools will be provided to allow students to independently analyze different types of matrices and to judge the results obtained.
Communication skills: •The student must be able to explain to non-expert people the basic notions concerning the characterization of types of molecules using correctly the technical language with clarity and rigor
Learning skills: •The student will be directed to update or expand their knowledge by independently drawing on texts, scientific articles, specific to the sectors, and must be able to gradually acquire the ability to follow specialized seminars, conferences, masters, etc. in the reference sectors.

COURSE CONTENT/SYLLABUS

The course describes the main instrumental analytical methodologies for the qualitative and quantitative evaluation of products of biotechnological interest.
Outline of analytical chemistry;
Validation parameters of analytical methods;
Methods for determining the protein concentration;
Buffer solutions;
Atomic and molecular spectroscopy: nuclear magnetic resonance bases and applications;
Circular dichroism and Fluorescence. Bases and applications;
Liquid chromatography and gas chromatography: principles and applications;
Mass spectrometry techniques, principles;
ICPMS;
GCMS;
LCESIMS;
MALDIMS;
MRMMS;
tandem mass spectrometry;
MRMMS;
Differential proteomics;
Quantitative proteomics;
Applications of biomolecular mass spectrometry.

READINGS/BIBLIOGRAPHY

Chimica Strumentale Eds Zanichelli Robinson and Robinson 2007

Chimica Analitica Strumentale Eds Edises Hololer Skoog Crough 2009

TEACHING METHODS OF THE COURSE (OR MODULE)

The final interview will aim to verify the ability to develop an analytical strategy for the qualitative and quantitative evaluation of products of biotechnological interest

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☐ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☐ Numerical exercises

b) Evaluation pattern

The interview ends with an evaluation expressed out of thirty. The minimum grade is 18/30, the maximum is 30 with honors

COURSE DESCRIPTION
INTRODUCTION TO PLANT BIOTECHNOLOGY

SSD: IMPIANTI CHIMICI (ING-IND/25)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: MARZOCCHELLA ANTONIO
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

To know concept introduced during the courses of:
MATHEMATICS AND ELEMENTS OF STATISTICS, Chemestry, INTRODUCTION TO PHYSICS AND COMPUTER SCIENCE, Biochemestry, Principles of Fermentation Chemistry, Principles of bioprocess engineering

LEARNING GOALS

To know the procedures to characterize main units of a biotechnological flowsheet (biorecators inluded) from the point of view of physical, physical-chemistry and chemical issues.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding issues regarding relationships among: enzymatic or microbial kinetics; type of reactor (STR and CSTR); process productivity. The student must also demonstrate knowledge of the types of upstream and downstream units, and their design and operation. The student must demonstrate to be able to discuss about the productivity of a unit flowsheet starting from the basic issues known regarding the single units.

Applying knowledge and understanding

The student must demonstrate to be able to design bioconversion units by processing assigned enzymatic/microbial and productivity kinetics. The extension of the methodology to non-simple kinetics is included in the application. The student must also design equipment based on equilibrium conditions and transport speeds. The course is aimed at provide the operational skills required to apply the knowledge in the context of biotechnological production processes.

COURSE CONTENT/SYLLABUS

Notes on mixing: perfectly mixed apparatus; plug flow apparatus.
Review of the kinetics typical of biotechnological processes: enzymatic kinetics and microbial unstructured and non-segregated kinetics.
Stirred Tank Reactor: STR. Design equation. Graphic interpretation of the design equation. Productivity. STR productivity and operating conditions to optimize the productivity. STR application to the reviewed kinetics.
Continuous Stirred Tank Reactor: CSTR. Time-space and dilution rate, productivity. Graphical interpretation of the time-space of a CSTR, and comparison with the reaction time of a STR. CSTR application to the reviewed kinetics. The phenomenon of the wash-out. Biomass production in a CSTR: selection of the operating condition for the maximization.
Introduction to downstream processes: classification of the unit operations and selection on the bases of the physical and physical and physic-chemical features of the suspension/components to process. Discontinuous filtration: principle, filtering time, design equation. Continuous filtration: design equation. Drum-filter. Terminal velocity of particles and batch sedimentation time. Discontinuous centrifugation. Continuous centrifugation: relationship between volumetric flow rate and cut-off diameter. Small thickness centrifuges: sigma coefficient. Extraction: distribution coefficient, balance of matter, yield.

READINGS/BIBLIOGRAPHY

Ghosh R. (2006) PRINCIPLES OF BIOSEPARATIONS ENGINEERING, World Scientific Pub. Singapore
For consulting
Nielsen J., Villadsen J and Lidén G. (2003) BIOREACTION ENGINEERING PRINCIPLES. Plenum Press, New York. Bailey J.E., Ollis D.F. (1986)

BIOCHEMICAL ENGINEERING FUNDAMENTALS. McGraw-Hill, New York. McCabe W., Smith J. e Harriott P., (1998)
UNIT OPERATIONS OF CHEMICAL ENGINEERING, 6th Ed McGraw-Hill, New York Materiale distribuito dal docente

Slides provided during the course

TEACHING METHODS OF THE COURSE (OR MODULE)

Frontal lectures
Numerical training
Some issues are presented according to the "Thinking class" modality

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [ ] Oral
- [ ] Project discussion
- [x] Other : Tests during the course

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

The formulation of the problem is assessed together the correct numerical evaluation.

COURSE DESCRIPTION
INDUSTRIAL ENZYMOLOGY

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: MARINIELLO LOREDANA
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

No propaedeutic disciplines are required

PREREQUISITES

Basic knowledges in General Chemistry and Biochemistry are required.

LEARNING GOALS

Knowledges on enzymes as biotechnological tools in the industrial field.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students will be able to manipulate enzymes, i.e. they will be able to know main methods to determine enzymes's activity and funcionality.

Applying knowledge and understanding

Students must be able to apply the knowledge acquired in Enzymology in various industrial fields, for example food, pharmaceutical, environmental.

COURSE CONTENT/SYLLABUS

1. Structure, mechanism of action, classification and biological role of enzymes. Enzyme/substrate interaction. Multi-enzymatic complexes and isozymes. Multiple substrate reaction mechanisms (ordered, random, ping-pong, Theorell-Chance). Enzyme activity assay and determination of specific activity and turnover number. (1 CFU) 2. Enzyme kinetics in the presence of effectors: different types of inhibition (competitive, noncompetitive, uncompetitive) and activation. Determination of kinetic parameters (Km, Vm, Ki) by linear methods based on the equations of Lineawever-Burk, Eadie-Hofstee, Wolf-Hanes, Eisenthal, Dixon, Cornish-Bowden. (1 CFU) 3. Regulation of a) synthesis and enzymatic degradation, b) enzymatic activity in linear and branched metabolic pathways (sequential, multivalent, cumulative, synergistic and multiplicity of enzymes), c) by signal transduction. (1 CFU) 4. Enzyme purification: theoretical principles, experiences and deepening of the main separation techniques of macromolecules; yield calculation, purity criteria and purification tables. (1 CFU) 5. Immobilization of enzymes: theoretical principles, different procedures and applications, enzymatic reactors. (1 CFU) 6. Biotechnological use of enzymes: (a) cellular enzymes, purified enzymes, immobilized enzymes, (b) enzymes as additives or process adjuvants, (c) industrial use of enzymes. (1 CFU)

READINGS/BIBLIOGRAPHY

Slides of the Professor's lessons available on the Professor's official site, accessible to all the registerd students to the course

Books and books chapters

Elementi di Enzimologia, Salvatore Passarella, Aracne, 2011; L'inibizione enzimatica, Paolo Parenti, Aracne; Enzimi in azione. Fondamenti di cinetica e regolazione delle reazioni enzimatiche, Umberto Mura, Edises, 2012; I principi di biochimica di Lehninger, David L. Nelson, Michael M. Cox, 2014, Zanichelli; Enzymes in Food Technology, Edited byRobert J. Whitehurst andMaarten van Oort, 2010 Blackwell Publ. Ltd; Enzymes in Food and Beverage Processing, Edited by Muthusamy Chandrasekaran, 2016,Taylor &Francis Group, LLC) . Scientific articles suggested by the professor.

TEACHING METHODS OF THE COURSE (OR MODULE)

Frontal lessons. Some topics will be teached following the method of flipped lessons.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

☐ Written

☑ Oral

- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

Assessment will consider if the student is able of exposing the topics deeply, the complexity, of his/her lamguage and the capabililty of connecting different topics within the Enzymology course and among other related courses.

COURSE DETAILS

"PERCEPTION AND ETHICS OF INDUSTRIAL BIOTECHNOLOGY"

SSD M-FIL/03 *

** the SSD (scientific disciplinary sector) should be the one that is mentioned in the "Regolamento of the CdS" and not necessarily the one of the teacher. In case of an integrated course, the SSD (scientific disciplinary sector) should be written above only if all modules of the course belong to the same SSD, otherwise the SSD is to be written alongside the MODULE (see below).*

DEGREE PROGRAMME: BIOMOLECULAR AND INDUSTRIAL BIOTECHNOLOGY

ACADEMIC YEAR 2022-2023

GENERAL INFORMATION – TEACHER REFERENCES

TEACHER: LUCA LO SAPIO
PHONE: _
EMAIL: LUCA.LOSAPIO@UNINA.IT

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE):
MODULE (IF APPLICABLE):
SSD OF THE MODULE (IF APPLICABLE): M-FIL/03
CHANNEL (IF APPLICABLE):
YEAR OF THE DEGREE PROGRAMME (I, II, III): III
SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

There are no required preliminary courses

PREREQUISITES (IF APPLICABLE)

none

LEARNING GOALS

The aim of this teaching is to provide students with the fundamentals of ethics and bioethics. The teaching also aims to introduce students to the analysis of some crucial issues in the contemporary ethical and bioethical debate, to stimulate the development of critical skills and the ability to understand, as well as the appropriate use of the fundamental lexicon of ethics and bioethics

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students are expected to prove their understanding of the main ethical and bioethical issues raised by developments in the contemporary sciences, with particular emphasis on biotechnology. He or she is expected to show the ability to identify the major biomoral paradigms, to reconstruct argumentative frameworks, and to assess the social impact of new technologies. Finally, it should be able to successfully put under scrutiny biomoral questions through the use of counter-arguments, examples and thought experiments.

Applying knowledge and understanding

Students should be able to apply the acquired methodologies to the analysis of practical ethical and bioethical cases, first by highlighting the plurality of possible interpretative approaches, and second by being able to develop their own consequent ethical position, within a framework that is not merely reconstructive. He or she must also be able to employ the conceptual tools learned to the investigation of emerging positions in the various areas of public debate on ethical and bioethical issues.

COURSE CONTENT/SYLLABUS

Development of science and technology in the twentieth century is forcing humanity, for the first time in its history, to face unimaginable scenarios: on the one hand the risk of a Sixth mass extinction as a possible outcome of anthropic activities, on the other hand the possibility of radically changing oneself and the environment through the use of biotechnologies, robotics, genetic engineering, neuropharmacology and so on. The course intends to investigate these scenarios by discussing the following topics:

1. Bioethics: introduction to the discipline, analysis of the main ethical paradigms and categories used in contemporary ethical and bioethical debate; the ethics of quality of life and the ethics of sanctity of life; normative ethics, descriptive ethics, metaethics and applied ethics; deontologism, consequentialism and virtue ethics (1 ECTS)
2. Biotechnologies and human enhancement; genome editing and CRISPR-Cas9 (1,5 ECTS)
3. Synthetic biology: reconstruction of the main argumentative lines against and in support of synthetic life (1 ECTS)
4. Biotechnologies and environment: ecological crisis and sustainable development (1 ECTS)
5. Animal Bioethics and biotechnologies: animal rights, animal welfare; animal research and in vitro testing; synthetic meat as a possible alternative to killing animals for food (1 ECTS)
6. National and international documents regarding bioethics (0,5 ECTS)

READINGS/BIBLIOGRAPHY

L. Lo Sapio, *Cambia la tua vita o affronta l'estinzione. Introduzione a un'etica per la fine del mondo*, tabedizioni, Roma 2022 [chapters to be considered for the exam will be specified at the beginning of the course].

L. Lo Sapio, *Potenziamento e destino dell'uomo. Itinerari per una filosofia dell'enhancement*, Il Nuovo Melangolo, Genova 2015 [chapters to be considered for the exam will be specified at the beginning of the course]

C.J Preston, *L'era sintetica. Evoluzione artificiale, resurrezione di specie estinte, riprogettazione del mondo*, Einaudi, Torino 2019 [chapters to be considered for the exam will be specified at the beginning of the course].

TEACHING METHODS

The teacher will use face-to-face learning for 83.4 percent of the total number of hours, and will make use of audio-visual materials, presentations and teaching materials provided through institutional digital channels; 8.3 percent exercises to check students' learning levels on an ongoing basis; 8.3 percent of the total hours for in-depth seminars devoted to specific topics

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	
only written	
only oral	X
project discussion	
other	

COURSE DESCRIPTION
Advanced Molecular Biology

SSD: BIOLOGIA MOLECOLARE (BIO/11)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: PISCITELLI ALESSANDRA
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EMAIL: apiscite@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 9

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

The course will require basic knowledge of biochemistry and a good knowledge of molecular biology.

LEARNING GOALS

The course of Advanced Molecular Biology aims at providing a deep overview of the mechanisms that regulate the gene expression from transcription to the RNA- mediated control of translation. Students will also become familiar with advanced approaches in molecular biology methodologies to obtain quantitative data on nucleic acid processing.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

After completing this course, students have adequate knowledge of the fundamental principles of molecular biology. In particular, they will have acquired fundamental elements at molecular level concerning the complexity and the regulation of the information flux from genes to proteins.
At the end of the course, the student will have to know the theoretical and practical principles to start working successfully in a molecular biology laboratory or where molecular biological techniques are used. The student will also be able to understand the techniques used in detail and apply them appropriately.
At the end of the course students develop independent thinking and critical assessment. The necessary tools will be provided to allow students to independently analyse and judge literature data. They must be able to connect and integrate the various topics of the course by developing their critical capacity.

Applying knowledge and understanding

Further expected learning outcomes:

•Practical and subject specific skills

- ability to comprehend and interpret data related to biomolecular processes investigated with large-scale approaches;
- ability to transfer the acquired molecular biology knowledge to related problems in the frame of the multiple biotechnology applications.

•Autonomy of judgment

- development of an aptitude to deal with the continuous advancements of molecular biology, a discipline in continuous expansion;
- ability to integrate the acquired knowledge in the field of molecular biology, biochemistry and microbiology.

•Communication skills

- ability to identify and express relevant information by using the technical language correctly;
- ability to explain the concepts learned to non-experts;
- ability to resume and present the scientific information.

•Learning abilities

- ability to read, understand and criticize a scientific text of molecular biology.

COURSE CONTENT/SYLLABUS

1. Control of gene expression in prokaryotes
2. Mechanism of the regulation of gene expression in phages.
3. DNA-protein interaction motifs.

(3 CFU)

4. Control of gene expression in eukaryotes

(2 CFU)

5. Membrane Transport of Small Molecules and the Electrical Properties of Membranes

6. Signal transduction

(1 CFU)

7. Fundamentals and practices on recombinant DNA technology

(3 CFU)

READINGS/BIBLIOGRAPHY

Books (student's choice; most recent edition is suggested):

Watson et al., **Biologia Molecolare del gene** –Zanichelli

Zlatanova and van Holde, **Biologia Molecolare** –Zanichelli

Capranico et al., **Biologia Molecolare**- Edises

Nelson and Cox, **I principi di Biochimica di Lehninger** –Zanichelli

Voet, et al., **Fondamenti di Biochimica** –Zanichelli

Maccarone, **Metodologi biochimiche e biomolecolari** –Zanichelli

Brown, **Biotecnologie molecolari** –Zanichelli

These books are available for consulting.

Slides of lessons: registered students can download lesson presentations, and other teaching materials.

TEACHING METHODS OF THE COURSE (OR MODULE)

The course is based on theoretical lessons (about 70% of total hours) with projections of slides, videos or connection to web sites of database with attempts to interact with the class and to stimulate questions and curiosity toward the dealt topics.

Moreover, experimental lab activities will be managed (about 27% of total hours. Within the lab activities some of the fundamental techniques of Molecular Biology, already introduced during the lectures, will be applied and discussed.

Finally, students will work in groups on a specific topic of *in silico* gene cloning (about 3% of total hours).

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- ☐ Written
- ☑ Oral
- ☑ Project discussion
- ☐ Other

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers

☐ Numerical exercises

b) Evaluation pattern

At least three different topics are discussed with the student.

The criteria that will be used to verify the acquired knowledge and skills are:

1) the comprehension of the analyzed topics and the depth of the acquired knowledge;

2) the completeness and accuracy of the answers using an appropriate and specific language on the proposed topics;

3) the ability to critically discuss results in specific case studies.

COURSE DETAILS

"BIOLAW"

SSD IUS/01

DEGREE PROGRAMME: Biomolecular and industrial biotechnologies

ACADEMIC YEAR: 2022-2023

GENERAL INFORMATION – TEACHER REFERENCES

TEACHER: FRANCESCA DI LELLA
PHONE: 081/2534313 – CELL. 338-1258510
EMAIL: FRANCESCA.DILELLA@UNINA.IT

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE):
MODULE (IF APPLICABLE):
SSD OF THE MODULE (IF APPLICABLE):
CHANNEL (IF APPLICABLE):
YEAR OF THE DEGREE PROGRAMME: III
SEMESTER: I
CFU: 6

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

There are no required preliminary courses.

PREREQUISITES (IF APPLICABLE)

There are no prerequisites.

LEARNING GOALS

The aim of the teaching is to frame the relationship and the increasingly frequent intersections between law and science, providing basic knowledge on the legal aspects related to biotechnological applications. The study of the legislation and the analysis of case law are also conducted considering the bioethical implications inherent in the matter, in order to encourage a more complete and sensitized approach to the topics covered.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The training course aims, through the knowledge of the principles of law and the main regulations of the sector, to provide tools that help to orient oneself concretely in the performance of professional activities and scientific research, also applied, and to solve the problems inherent to them by keeping present the current reference legislation.

Applying knowledge and understanding

The student will have to acquire: 1) independent judgment, using the knowledge gained as a reference basis for a complete understanding of the various aspects of the activities in the biotechnology sector; 2) communication skills, explaining in a clear way and with adequate technical language the legal profiles of the issues addressed; 3) learning skills, such as the ability to orient oneself and update oneself, to know how to expand and progress in knowledge in a sector in continuous and rapid evolution.

COURSE CONTENT/SYLLABUS

Basics of law, legal rule, sanctions, sources. The main partitions between the various branches of law. Biolaw as a new field of study of peculiar issues related to biotechnology.

The relationship between law and biotechnology. The freedom of scientific and technical research. Technological innovation, experimentation, regulation. Specific protection needs emerging from manipulating living matter.

The rights of the person involved in biotechnology: common features and safeguards. The right to life. The right to health. The right to the protection of personal data, with particular reference to the use of health and genetic data in the field of scientific research.

Legal issues related to the establishment and operation of biobanks. The biological specimen regime. Responsibility profiles in laboratory activities.

Protecting the environment. The inspirational principles of matter. The environmental impact assessment. Environmental damage. Specific regulatory regulations for the protection of the environment and human health: the discipline of the Ogm and the Mogm.

Property on intangible assets: copyright and inventory rights. Requirements and Procedure to Obtain a Patent for Invention. Contractual figures for the economic exploitation of inventions. Discipline of Inventions of Employees and Researchers of Universities and Public Research Institutions. The legal protection of biotechnological inventions.

READINGS/BIBLIOGRAPHY

The teaching material is provided by the teacher and made accessible to students enrolled in the course on the web page www.docenti.unina.it/francesca.di_lella

TEACHING METHODS

The teacher will use: a) lectures for about 90% of the total hours, b) exercises to practically deepen theoretical aspects for the remainder of the course.

EXAMINATION/EVALUATION CRITERIA

*For **integrated courses**, this field should encompass all modules, with indication of the relative weight of each module on the final mark. For integrated courses, this field should be coordinated by the reference teacher for the course.*

a) Exam type:

*For **integrated courses**, there should be one exam.*

Exam type	
written and oral	
only written	
only oral	X
project discussion	
other	

In case of a written exam, questions refer to: (*)	**Multiple choice answers**	
	Open answers	
	Numerical exercises	

(*) multiple options are possible

b) Evaluation pattern:

COURSE DESCRIPTION
OLIGONUCLEOTIDES SYNTHESIS AND DESIGN

SSD: CHIMICA ORGANICA (CHIM/06)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: DI FABIO GIOVANNI
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EMAIL: giovanni.difabio@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

Not provided.

PREREQUISITES

Knowledge of basic elements of Chemistry and Organic Chemistry is recommended.

LEARNING GOALS

The objective of the teaching is to deepen some aspects relating to the structure, chemistry and different applications, not only in the pharmacological field, of synthetic oligonucleotides. The discussion on the structural properties and usefulness of these biomolecules will be an introductory part of the course. Different synthetic approaches (protecting groups, solid phase synthesis, combinatorial chemistry) for the synthesis of different modified nucleotides and oligonucleotides, will be analysed and discussed. In the light of the knowledge acquired during the course, some recent publications on the topics covered will be discussed. Some practical aspects

will be deepened with demonstrative experiences in the laboratory or in company.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student must demonstrate knowledge and understanding of the problems relating to the design, synthesis, purification and characterization of small sequences of natural and / or modified nucleic acids useful for appropriate pharmacological approaches. Starting from the notions learned, concerning the problems related to the design of molecules with pharmacological potential, as well as modern chemical synthesis strategies, the student must demonstrate that he is able to develop a path of design and synthesis of molecules, keeping in mind the different aspects of synthesis, purification and characterization of these molecules. The training course aims to provide the knowledge and the basic methodological tools useful to design the synthesis of suitable aptamers with potential pharmacological activities.

Applying knowledge and understanding

The student must be able to face and solve problems related to the design and to the synthesis of suitably modified nucleic acids. The in-depth analysis of some model projects will allow student to address the main problems in suitable and decisive manner. The student must be able to indicate the most advantageous methodologies taking into account the different aspects involved in the design and synthesis of modified oligonucleotides with potential pharmacological activities. The student must be able to discuss, explaining in a detailed and clear way, as well as with a language specific to the topics covered, an in-depth research path through the study of useful scientific reports. The student must be able to expand their knowledge by drawing on scientific texts and articles to train the ability to follow seminars, conferences and masters in areas associated with those of nucleic acids. In this regard, the course also provides a comparison / meeting with companies and research laboratories.

COURSE CONTENT/SYLLABUS

Drugs and their targets: classification; Intermolecular binding forces: weak interactions; Molecular recognition of drugs; Role of water; Molecular targets: enzymes and receptors; Nucleic acids as drug targets; Structure of nucleic acids: nucleosides and nucleotides; Conformational equilibria; Polymorphism of DNA; Unusual structures of nucleic acids; Stability of oligonucleotides (ON); Plane and circularly polarized light; Polarized light-matter interactions; Circular dichroism; ODNs characterization via CD; DNA intercalators; Topoisomerase inhibitors; Chelating and metallating agents; Pro-drug nucleosides; ON as next generation drugs; ON antisense; ON antigen; Aptamers; siRNA (short interfering RNA); DNA microarray. ON from SELEX; First and second generation of ON modified; ON conjugates; DNA mimics: PNA (Peptide Nucleic Acids); Chemical synthesis of ON; Solution and solid phase synthesis: advantages and limitations; The Intenucleoside Bond; Protecting groups strategy; Synthesis of nucleoside monomers useful for the synthesis of ON; Transient protection method; Phosphate protective groups; Phosphotriester method; Automated synthesis; Phosphoramidite method; H-phosphonate method; Solid phase synthesis of RNA; Chemical synthesis of ON: ODN 5'- and 3'-conjugates; Analysis and purification

of synthetic ONs; HPLC; Molecular exclusion chromatography; Affinity chromatography. Main sources of pharmacologically active molecules; Combinatorial approach and chemical diversity.

READINGS/BIBLIOGRAPHY

G. L. Patrick, Chimica Famaceutica, EdiSES and slides downloadable from the teacher's website.

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will only use frontal lessons. A visit to a company specialized in the automated synthesis of aptamers as well as their analysis, isolation and chemical-physical characterization is planned, compatibly with organizational availability.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [ ] Written
- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern

Oral test: the discussion will start from a discussion on a publication (chosen by student) discussed during the lessons. The test will continue recalling different concepts covered during the lectures and proposing a design path of suitable molecules with potential pharmacological activities.

COURSE DESCRIPTION
Food Chemistry and Biochemistry

SSD: BIOCHIMICA (BIO/10)

DEGREE PROGRAMME: CORSO DI LAUREA IN BIOTECNOLOGIE BIOMOLECOLARI E INDUSTRIALI (N75)
ACADEMIC YEAR 2022/2023

COURSE DESCRIPTION

TEACHER: GIOSAFATTO CONCETTA VALERIA LUCIA
PHONE:
EMAIL: giosafat@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
SSD OF THE MODULE: NOT APPLICABLE
CHANNEL: A-Z
YEAR OF THE DEGREE PROGRAMME: III
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None

PREREQUISITES

A manual of biochemistry of "biological interest" molecules.

LEARNING GOALS

The training course must allow the student to independently indicate the necessary methodological tools for 1) judging the quality of a food starting from the biochemical compounds present in it; 2) evaluate the nutritional and nutraceutical value of a food.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

At the end of the course the student will be able to 1) know in depth the main biochemical compounds of food interest; 2) understand its chemical and biochemical reactivity; 3) to know the effects that the conservation and transformation of food can have on biochemical compounds.

Applying knowledge and understanding

The training course of the course will allow students to 1) identify the processes to which the various biochemical compounds of food interest are subjected; 2) hypothesize variations in the nutritional and organoleptic properties of the main biochemical compounds in a food. The student must be able to 1) communicate the various biochemical compounds of food interest to non-experts in the field in an understandable but technically precise language, 2) describe the main metabolisms to which these compounds are subjected, 3) find information from online bibliography; 4) expand exposure capabilities.

COURSE CONTENT/SYLLABUS

Main food constituents. Amino acids and proteins. Functional properties of proteins in foods. Main transformations of proteins during food processing. Enzymes and their role for assessing food quality. Carbohydrates: monosaccharides, disaccharides and polysaccharides. Sweetening power of saccarose, fructose and stevia. Other synthetic sweeteners (saccharin and aspartame). Lipids: classification and distribution in foods. Oils and fats. Rancidity. Nucleic acids. Vitamins and their distribution in foods. Thermal stability of vitamins. Food additivs and integrators responsible for food color, aromas. Preservatives. Undesirable substances: endotoxins in animal and vegetal-based foods; bacterial toxins and mycotoxins; heavy metal contamination. Biochemical composition of milk and dairy products, meat, eggs, fruit, vegetables and cereals. Fermented foods and beverages (bakery products, beer, wine). Enzymatic and non-enzymatic food browning (Maillard's reaction, acrylamide production). Laboratory activities on (i) enzymes as indicators of food processing, (ii) determination of protein and lipid components in foods.

READINGS/BIBLIOGRAPHY

Principi di chimica degli alimenti, Cappelli, Vannucchi, Zanichelli;
Chimica degli alimenti, P. Cabras e A. Martelli, Piccin;
Biochimica della nutrizione, Carla Pignata, Società Editrice Esculapio.
Course slides, scientific papers and teaching materials provided by the lecturer

TEACHING METHODS OF THE COURSE (OR MODULE)

The lecturer will use: a) frontal lessons for about 70% of the total hours; b) Laboratory exercises (6 hours) to deepen the applied knowledge on: (i) enzymes as process indicators; (ii) determination of the protein component of some foods; III) presence of polyphenols in food matrices and evaluation of their antioxidant capacity; c) seminars on the flipped calssroom model (4 hours).

EXAMINATION/EVALUATION CRITERIA

a) Exam type

☐ Written

- [x] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [ ] Multiple choice answers
- [ ] Open answers
- [ ] Numerical exercises

b) Evaluation pattern