

COURSE CONTENTS of Biotechnology for the Bio-based and Health Industry (university of Insubria)



CFU inserite	n. insegnamenti	Biotechnology for Health Industry (Curriculum RED biotech)			Bio-based Industry (Curriculum WHITE biotech)		
			CFU	Sem.		CFU	Sem.
30	6	Pharmaceutical biotechnology	6	I	Pharmaceutical biotechnology	6	I
		Applied genomics	6	I	Applied genomics	6	I
		Plants as factories for biomolecules	6	I	Plants as factories for biomolecules	6	I
		Biostatistics and data science	6	I	Biostatistics and data science	6	I
		Scientific English	4	I	Scientific English	4	I
		Information literacy	2	I	Information literacy	2	I
36	6	Bioeconomy and innovation	6	II	Bioeconomy and Innovation	6	II
		Animal models for biotech research	6	II	Enzymology	6	II
		Synthesis and analysis of biotech drugs	6	II	Biorefineries	6	II
		Design of biopharmaceuticals	6	II	Green biomasses and bioremediation	6	II
1 su 2 a scelta		Nanobiotechnology and biomaterials	6	II	Transgenic animals for biotechnology	6	II
		Cell models and biomedical applications	6	II	Industrial biocatalysis	6	II
38	7	Protein engineering	6	III	Protein engineering	6	III
		Project management & soft skills	2	III	Project management & soft skills	2	III
1 su 3 a scelta		Molecular diagnostics	6	III	Molecular and applied microbiology	6	III
		Applied pathophysiology	6	III	Industrial processes and safety	6	III
		Nutraceuticals	6	III	Recombinant proteins	6	III
2 a scelta libera		A SCELTA 1	6	III	A SCELTA 1	6	III
		A SCELTA 2	6	III	A SCELTA 2	6	III
30	1	Tirocinio curriculare in preparazione della prova finale	30	IV	TESI	30	IV
4	1	Prova finale	4	IV	Prova finale	4	IV

CFU	SEM	Biotechnology for the Bio-based and Health Industry	
Pharmaceutical biotechnology	6	I	<ul style="list-style-type: none"> Pharmaceutical biotechnologies Metaboliti specializzati microbici e loro impiego con particolare riferimento all'industria farmaceutica Screening, genome mining, e produzione microbica di prodotti naturali Antibiotici, immunosoppressori, antitumorali e statine Meccanismi di azione e di resistenza Principali classi chimiche e vie biosintetiche di sostanze naturali
Applied genomics	6	I	<ul style="list-style-type: none"> Applied Genomics Il Progetto Genoma: obiettivi e realizzazione. Mappe generiche e fisiche del genoma umano. Definizione di marcatori genetici polimorfici nell'uomo Mappatura genetica dei geni-malattia nell'uomo: linkage analysis e LOD score. Metodi di identificazione di geni malattia mediante exome-sequencing con tecnologie NGS. Approcci al sequenziamento di genomi procariotici ed eucariotici. Sequenziamento ed annotazione del genoma umano. Il progetto EnCODE Approcci sperimentali per la produzione di organismi viventi (procarioti) dotati di genomi sintetici Il progetto HapMap. Approcci alle patologie umane complesse multifattoriale. Linkage disequilibrium nel genoma umano. Studi di associazione genome-wide (GWAS). Genomica personalizzata
Plants as factories for biomolecules	6	I	<ul style="list-style-type: none"> Plants as factories for biomolecules Biofortification strategies Production of plant secondary metabolites in vitro Plant Secondary Metabolism Engineering: Methods and Applications Plant as biofactories
Biostatistics and data science	6	I	<ul style="list-style-type: none"> Biostatistics and data science Populations and samples. Basics of probability. Random variables. Statistical test: power and protection of a test, Type I and Type II errors. What test to use. Use of statistical software. Examples in R
Scientific English	4	I	<ul style="list-style-type: none"> Scientific English Comunicazione accademica nel campo della ricerca biomedical Lessico, sintassi e grammatica dell'inglese scientifico Abilità di scrittura, lettura e comprensione di testi accademici Generi testuali accademici nel campo scientifico di riferimento
Information literacy	2	I	<ul style="list-style-type: none"> the main methods of querying information resources and retrieval of the documents needed to study and research through the most suitable tools; the selection and synthesis of research results: the criteria for evaluating the most appropriate information based on the type of resource and research purpose; the organization of the retrieved data. 3. the proper citation methods from formal, ethical and legal point of view, thus avoiding unaware actions of plagiarism.
Bioeconomy and innovation	6	II	<ul style="list-style-type: none"> Bioeconomy and Innovation Basic principles of economics Bioeconomy and bio-based value chains Sustainability assessment of bio-based innovations Appropriability strategies in biotech sectors The Bioeconomy revolution: market and technological opportunities Normativa relativa alla protezione della proprietà intellettuale Normativa di carattere ambientale e sanitario relativa ai processi biotecnologici Elementi economico finanziari dello sviluppo di progetti e di gestione di imprese Quadro economico dell'impresa biotecnologica in Italia e nel mondo e caratteristiche

		CFU	Sem.	Biotechnology for Health Industry (Curriculum RED biotech)
Animal models for biotech research		6	II	<ul style="list-style-type: none"> • Animal models for biotechnology • Historical aspects • Ethical and regulatory considerations • Definition and choice of animal models • Description of vertebrate and invertebrate models for biotechnological research • Insect biotechnology
Synthesis and analysis of biotech drugs		6	II	<ul style="list-style-type: none"> • Drug synthesis and analysis • Principi di ricerca e sviluppo di farmaci di sintesi e semisintesi • Screening di librerie chimiche • Strategie di chimica combinatoriale, one-pot synthesis, click chemistry, biocatalysis per la identificazione e modifica di farmaci • Metodi di analisi di farmaci • Aspetti regolatori
Design of biopharmaceuticals		6	II	<ul style="list-style-type: none"> • Design of biopharmaceuticals • Progettazione di farmaci biotecnologici: la medicina molecolare • Esempi di biofarmaci: anticorpi, antivirali, proteine terapeutiche • Enzyme replacement therapy • Computer Aided Drug Design • Esercitazione (miglioramento di un farmaco mediante analisi computazionale)
Nanobiotechnology and biomaterials	1 subject (among these)	6	II	<ul style="list-style-type: none"> • Nanobiotechnology and biomaterials • Nanomaterials and nanoparticles: chemical structure and composition. • Nanotoxicology • Bio-nano interactions • Techniques for nanomaterial characterization • The laboratory will focus on the synthesis of one of the nano-systems studied during the course and on its characterization by IR and/or NMR techniques.
Cell models and biomedical applications		6	II	<ul style="list-style-type: none"> • Cell models and biomedical applications • Basis of cell organization • Staminal cells • Cell transformation • Cell as model for in vitro and in vivo experiments • From bench to bedside: biomedical uses
Protein engineering		6	III	<ul style="list-style-type: none"> • Protein engineering • Rapporto struttura-funzione nelle proteine • Le proteine nella cellula • De novo design • Rational design • Directed evolution
Project management & soft skills		2	III	<ul style="list-style-type: none"> • Projects & Roles; Project Proposals; Gantt and PERT Diagrams; Cost Assessment; • Learning Styles; Soft Skills, Aptitudes, Team Work, Leadership • Communication & Presentation Skills

Molecular diagnostics	1 subject (among these)	6	III	<ul style="list-style-type: none"> • Molecular Diagnostics • caratteristiche del laboratorio diagnostico: certificazione e accreditamento, caratteristiche (sensibilità, specificità ecc.), refertazione • Principi dei metodi per la rilevazione di varianti e riarrangiamenti del DNA • Principi dei metodi per la quantificazione di marcatori • Principi dei metodi di rilevazione dello stato di metilazione del DNA • Applicazioni pratiche delle metodiche di diagnostica molecolare sopra descritte • Molecular Diagnostics • caratteristiche del laboratorio diagnostico, certificazione e accreditamento • il test diagnostico, caratteristiche (sensibilità, specificità ecc.), refertazione • Principi ed applicazioni dei metodi per la rilevazione di varianti e riarrangiamenti del DNA • Principi ed applicazioni dei metodi per la quantificazione di marcatori • Principi ed applicazioni dei metodi di rilevazione dello stato di metilazione del DNA
Applied pathophysiology		6	III	<ul style="list-style-type: none"> • Applied patophysiology • Applied Molecular Physiology Target Proteins -Membrane Protein (Ion channels, Transporters, Receptors and transduction pathway). Screening - Expression systems for protein function characterization Electrophysiological techniques (in research and high throughput screening) -fluorescent protein-based and Ionophore assays. • Applied molecular and cellular pathology -Target selective delivery, humanized and human monoclonal antibody procedure, single chain Fv antibody technology, antibody-cytokine fusion protein and nanocarriers for cancer-targeted drug delivery, and in vivo evaluation in mouse models. • mAb and single chain Fv antibody technology in cancer and anti-viral therapies. • Nanocarriers for cancer-targeted drug delivery • Procedure for nanoconjugated antibiotics and other drug (liposomes, nanocrystals, carbon nanotubes, polymeric nanoparticles NP, dendrimers, magnetic and other inorganic NP)
Nutraceuticals		6	III	<ul style="list-style-type: none"> • Nutraceuticals • Processi di estrazione/produzione di principi attivi nutraceutici • Nutraceutici: definizioni e utilizzo nella prevenzione e in diverse patologie • Probiotici e prebiotici • Funghi medicinali • Basi di cosmeceutica • Microorganismi come biofactories per la produzione di nutraceutici
Optional subject		6	III	
Optional subject	6	III		
Final Stage	30	IV		
Final Course exam	4	IV		

		CFU	Sem.	Bio-based Industry (Curriculum WHITE biotech)
Enzymology		6	II	<ul style="list-style-type: none"> Enzymology Basis of catalysis and Mechanisms of enzyme action Enzyme kinetic Factors that affect enzyme activity and stability Protein folding/Ligand binding LAB: practical enzymology
Biorefineries		6	II	<ul style="list-style-type: none"> Cosa è una bioraffineria e cenni di economia circolare e riciclo di biomasse Produzione di biometano e biidrogeno da consorzi microbici Produzione microbica di biofuels Bioplastiche da conversioni di biomasse Batteri elettrigeni e loro utilizzo in celle a idrogeno Visita ad impianti di produzione di biogas e/o di bioetanolo
Green biomasses and bioremediation		6	II	<ul style="list-style-type: none"> Green biomasses and bioremediation Phytoremediation Plants for water reclamation (phyto-purification) Biomasses from forest and agriculture Algae biofuels
Transgenic animals for biotechnology	1 subject (among these)	6	II	<ul style="list-style-type: none"> Basics of breeding and reproduction of vertebrate animals for use in various areas of agriculture and medicine. Techniques for generating genetically modified laboratory animals (mice, rat, and zebrafish) for use in the study and treatment of human diseases. Use of transgenic livestock (swine, cattle, ovine, caprine) to provide organs for xenotransplants, enhance production, protect the environment, increase animal welfare and disease resistance, and extract recombinant proteins from the milk. Application of biotechnologies to transform and increase the quality of animal food products. Manipulation of intestinal microbiota through the diet to promote animals health and improve their productivity.
Industrial biocatalysis		6	II	<ul style="list-style-type: none"> Concetti di base in biocatalisi Immobilizzazione di enzimi Reaction design Recupero dei prodotti Processi biocatalitici sostenibili Applicazioni biocatalitiche industriali e molecolari
Protein engineering		6	III	<ul style="list-style-type: none"> Basics of breeding and reproduction of vertebrate animals for use in various areas of agriculture and medicine. Techniques for generating genetically modified laboratory animals (mice, rat, and zebrafish) for use in the study and treatment of human diseases. Use of transgenic livestock (swine, cattle, ovine, caprine) to provide organs for xenotransplants, enhance production, protect the environment, increase animal welfare and disease resistance, and extract recombinant proteins from the milk. Application of biotechnologies to transform and increase the quality of animal food products. Manipulation of intestinal microbiota through the diet to promote animals health and improve their productivity.
Project management & soft skills		2	III	<ul style="list-style-type: none"> Projects & Roles; Project Proposals; Gantt and PERT Diagrams; Cost Assessment; Learning Styles; Soft Skills, Aptitudes, Team Work, Leadership Communication & Presentation Skills

Molecular and applied microbiology	1 subject (among these)	6	III	<ul style="list-style-type: none"> • Molecular and applied microbiology • Link between microbial physiology and applicative fields • Microbial metabolic pathways and bioremediation • Bacterial products and white biotechnology • Biotechnological potential of microorganisms • Microbiota
Industrial processes and safety		6	III	<ul style="list-style-type: none"> • Industrial Processes and Safety • SYSTEMS, PROCESSES and SAFETY FEATURES OF CHEMICAL AND PHARMACEUTICAL INDUSTRY (CHEMICAL RISK ASSESSMENT) • FOOD INDUSTRY PROCESSES AND SAFETY (BIOLOGICAL RISK ASSESSMENT) • PURIFICATION TECHNIQUES OF CONTAMINATED AIR AND SAFETY ISSUES
Recombinant proteins		6	III	<ul style="list-style-type: none"> • Recombinant Proteins • Strategie di clonaggio e sistemi cell-free • Produzione di proteine ricombinanti in E. coli; strategie per l'ottimizzazione dell'espressione • Produzione di proteine ricombinanti in altri sistemi procariotici • Sistemi di espressione eterologa eucariotici – lieviti • Sistemi di espressione eterologa eucariotici - cellule di insetto e di mammifero
Optional subject		6	III	
Optional subject		6	III	
Final Stage		30	IV	
Final Course exam		4	IV	

(NB: final detailed course contents (syllabus) will be available in july)