



UNIVERSITY OF L'AQUILA



Department of Health, Life and  
Environmental Sciences

**Profile of**  
***2<sup>nd</sup> Cycle Degree in***  
***MOLECULAR AND CELLULAR BIOTECHNOLOGIES***

**Laurea Magistrale in**  
**BIOTECNOLOGIE MOLECOLARI E CELLULARI**

**DEGREE PROFILE OF**  
**Laurea Magistrale in BIOTECNOLOGIE MOLECOLARI E CELLULARI**  
***Master degree in MOLECULAR AND CELLULAR BIOTECHNOLOGY***

TYPE OF DEGREE & LENGTH	Single degree (120 ECTS credits, 2 years)
INSTITUTION(S)	Università degli Studi dell'Aquila, <i>University of L'Aquila, Italy</i>
ACCREDITATION ORGANISATION(S)	Ministry of Education (Italy) Ordine Nazionale dei Biotecnologi – National Register of Biotechnologists ( <a href="http://www.biotecnologi.org">www.biotecnologi.org</a> ), Ordine Nazionale dei Biologi ( <a href="http://www.onb.it">www.onb.it</a> )
PERIOD OF REFERENCE	MIUR 2013, for 3 years
CYCLE /LEVEL	QF for EHEA: 2 <sup>nd</sup> cycle; EQF level: 7; Italian NQF: Laurea Magistrale

<b>A</b>	<b>PURPOSE</b>
	The Degree Programme in <i>Cellular and Molecular Biotechnology</i> aims to provide students with advanced knowledge of the molecular and cellular bases of biological systems, the structure and functions of biological macromolecules, the cellular processes in which they operate, the biotechnological and analytical tools and mathematical, physical and chemical methodologies required for biotechnological applications. Furthermore experimental, technological and computational aspects are considered providing knowledge on technological advances in genetic engineering and in bioinformatics, and skills for the use of computational biology for the management, interpretation and modeling of a constantly increasing amount of biological data.

<b>B</b>	<b>CHARACTERISTICS</b>	
1	DISCIPLINE(S) / SUBJECT AREA(S)	Molecular Biology, Biochemistry, Cell Biology, Applied Biology; Applied Physics; Genetics; Others (15: 15: 15: 15:15:15:10)
2	GENERAL / SPECIALIST FOCUS	Specialist focus on development and use of molecular procedures through interdisciplinary, global research-intensive methodologies in all the fields of the study of life.
3	ORIENTATION	Research orientation and component of application skills in the several industrial contexts. Specializations are provided envisaging specific employment/career opportunities: industrial design of innovative drugs and biotechnological products for cell and gene therapy
4	DISTINCTIVE FEATURES	This degree has a strong component of interdisciplinary learning with other Programmes and is developed in a stimulating research environment. Students have a 6/9-months compulsory placement in companies in Italy and/or abroad for on-field working experiences and research activities for the preparation of the Master's thesis.
<b>C</b>	<b>EMPLOYABILITY &amp; FURTHER EDUCATION</b>	
1	EMPLOYABILITY	Graduates are qualified to assume positions of high responsibility, with full respect for the related ethical, technical and legal considerations in activities associated with the development and use of molecular procedures in all the fields of the study of life, in national and private health service centers, hospitals and laboratories, pharmaceutical, food, chemical and biotechnology companies according to the profiles established by the National Biologist and Biotechnologist Registers .

2	FURTHER STUDIES	The Master degree in <i>Cellular and Molecular Biotechnology</i> normally gives direct access to a wide range of PhD and specialization programs (PhD in biosciences, Molecular and Cellular Biology, Molecular and Cellular Biotechnologies). Furthermore they can carry out research and teaching activities at university.
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<b>D EDUCATION STYLE</b>		
1	LEARNING & TEACHING APPROACHES	Lectures, laboratory classes, seminars, small group work, individual study based on text books and lecture notes, individual consultations with academic staff, preparing Diploma dissertation.
2	ASSESSMENT METHODS	Written exams, oral exams, laboratory reports, oral presentations, continuing assessments, final comprehensive exam, assessment of final dissertation.

<b>E PROGRAMME COMPETENCES</b>		
1	GENERIC	<p>The degree program meets the competences and quality assurance procedures required by the Italian Registers of Biologists (<a href="http://www.obn.it">www.obn.it</a>) and Biotechnologists (<a href="http://www.biotechnologi.org">www.biotechnologi.org</a>) and by the National Higher Education Quality Assurance Agency (AVA) requirements for degree courses at second level. This includes the Generic Competences expected for the second cycle graduated, as follows:</p> <ul style="list-style-type: none"> <li>— <b>Analysis and synthesis:</b> Capacity for analysis and synthesis using logical arguments and proven facts during scientific experiments and in the daily life.</li> <li>— <b>Adaptability:</b> Ability to be flexible and to adapt to new situations and to act professionally even under pressure;</li> <li>— <b>Team-work:</b> capability to work in team also in leading positions demonstrating concern and respect of diversities, commitment to tasks and responsibilities and rigor in performing the activities and for time management (including meeting deadlines).</li> <li>— <b>Communication skills:</b> Ability to communicate effectively and to present complex information in a concise manner orally and in writing and using appropriate technical and English language. Ability to develop and present projects of research and development, ability to illustrate research results</li> <li>— <b>Popularization skills:</b> Ability to communicate with non-experts, including some teaching skills.</li> <li>— <b>Learning ability:</b> ability, through independent study, to enter new fields by using biology and biotechnology knowledge.</li> <li>— <b>Problem solving:</b> capacity to handle stress and to deal effectively with practical problems.</li> <li>— <b>Quality assurance:</b> ability to assess the work and to maintain its quality.</li> </ul>
2	SUBJECT SPECIFIC	<p>The Second Cycle degree in <i>Cellular and Molecular Biotechnology</i> is designed specifically for graduates and professionals engaged in biomedical, industrial, pharmaceutical, agricultural, food, and environmental activities, and all those interested in basic biotechnology and biotechnological processes and products, and guarantees an excellent grounding in the techniques and methods of biotechnology. The Program meets all the Specific Competences as established and agreed in collaboration with the field national and international experts, local and national stakeholders, the National Register of Biologists, clustered within the key overarching competences summarized below. The students should acquire</p> <p><b>Detailed knowledge and understanding of</b></p> <ul style="list-style-type: none"> <li>-functioning and regulation of prokaryotic and eukaryotic cell;</li> <li>-methods aimed at the structural and functional characterization of biological macromolecules and cellular processes in which they are involved;</li> <li>-the pathological processes in humans, at the molecular, cellular and systemic levels;</li> </ul> <p><b>Ability to apply knowledge</b></p> <ul style="list-style-type: none"> <li>-methodological and technological skills related to cellular and molecular biotechnology, with particular reference to cell culture techniques;</li> <li>-bioinformatics skills for the organization and access to databases, with particular reference to genomics, proteomics and metabolomics;</li> </ul> <p><b>Analysis and synthesis capabilities</b></p> <ul style="list-style-type: none"> <li>-skills in molecular modeling for the design of molecules of biomedical interest;</li> <li>-skills for the design and manufacturing of biotechnology products, such as biopharmaceuticals, diagnostics, vaccines;</li> <li>- applicative and methodological competences, and use of specific instruments and technologies at different levels</li> </ul>

	<p>(biochemical, biomolecular, genetic, biotechnological, biostatistical, bioinformatic)</p> <p><b>Creativity</b></p> <ul style="list-style-type: none"> <li>-ability to design original experiments or procedures to investigate life processes down to the molecular level, or to design new and deep methods of investigation and application;</li> <li>- the ability to consult databases and to adopt innovative technologies and advanced instruments in order to update their own profile</li> </ul> <p><b>Evaluation methods</b></p> <ul style="list-style-type: none"> <li>- ability to elaborate and interpret experimental results and to disseminate the significance of their research, methods and applications;</li> <li>- ability to identify critical situations involving respect and knowledge of the regulations connected with bioethics, the validation/certification of biotechnological products and processes, and the protection of inventions and security in the biotechnological sector;</li> </ul> <p><b>Communication skills</b></p> <ul style="list-style-type: none"> <li>- ability to communicate effectively to experts and public the role of Biotechnology development in society development promotion and well being enhancement;</li> <li>- ability to prepare and present a research report using scientific method and language.</li> </ul>
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<b>F</b>	<b>COMPLETE LIST OF PROGRAMME LEARNING OUTCOMES</b>
	<p>On completion of the course students are equipped with a broad range of knowledge and skills that are highly required in many sectors of industry and biotechnology. Furthermore they are able to develop and apply new ideas for biotechnological processes and to undertake research projects.</p> <p><b>Graduates have:</b></p> <ul style="list-style-type: none"> <li>-advanced knowledge in the central areas of cell biology, molecular biology, genetics, biochemistry, microbiology, as well as in other more specialized areas like bioinformatics, genomics, stem cell biology.</li> <li>- sound knowledge in different specialist areas of biology such as molecular and cellular biology of plants.</li> <li>- awareness of the technological platforms employed in the field of genomics and proteomics, of the design and development of new biologically active molecules;</li> <li>- a good grasp of the key aspects of the operational processes adopted after the industrial design of biotechnological processes, with full respect for the maintenance of eco-sustainability</li> </ul> <p>possess advanced knowledge of patenting systems and technology transfer procedures;</p> <ul style="list-style-type: none"> <li>- a good knowledge of the regulations connected with bioethics, the validation/certification of biotechnological products and processes, and the protection of inventions and security in the biotechnological sector;</li> <li>- learning skills necessary to continue further studies with a sufficient level of independence;</li> <li>- ability to learn further laboratory techniques by using their own knowledge and/or scientific sources and to work towards objectives and as part of a group.</li> </ul> <p><b>Graduates are able to:</b></p> <ul style="list-style-type: none"> <li>- gather and interpret important scientific data from laboratory observation and measurements;</li> <li>- transfer and apply core scientific concepts to develop solutions in the biotechnology industry by planning and conducting experiments, and evaluating and quantifying results;</li> <li>- formulate analytical problems and propose ideas and solutions;</li> <li>- make judgments on the base of reflections on important scientific and ethical issues;</li> <li>- work with awareness of the legislative, regulatory, commercial, scientific and social environment;</li> <li>-use critical analysis and problem solving skills to develop, plan and implement innovative solutions within a diverse range of biotechnology industry sectors;</li> <li>- transmit and share information, ideas, problems and solutions on scientific issues at the highest levels, not only in Italian but also in another of the major European languages;</li> <li>- work in a multidisciplinary team with understanding and awareness of indigenous and other communities' religious beliefs and culture in biotechnology practice and identify their role and contribution to the group;</li> <li>-articulate a conscious understanding of their own values and demonstrate respect for the values of others and the ability to view an ethical dilemma from multiple view points;</li> <li>-synthesise information and communicate effectively, succinctly and sensitively with the scientific community, co-workers, government agencies, investors, the broad public and particular cultural and indigenous communities;</li> <li>-inform society of impending developments and engage in constructive debates;</li> <li>-plan and conduct research projects and effectively communicate research findings;</li> <li>-apply their understanding of the commercialisation processes to biotechnology products or services;</li> <li>-be fluent in English as well as Italian, both orally and in writing, with a sound knowledge of subject-specific terminology;</li> <li>- work autonomously and assume positions of responsibility in projects and facilities.</li> </ul>

**Comprehensive Scheme of the 2<sup>nd</sup> Cycle Degree in  
MOLECULAR AND CELLULAR BIOTECHNOLOGIES**

<b>YEAR</b>	<b>CODE</b>	<b>COURSE</b>	<b>Credits (ECTS)</b>	<b>Semester</b>
<b>I</b>	B0428	Gene therapy and molecular basis of the diseases	6	1
	B0411	Epidemiology	6	1
	B0497	Experimental models and cellular therapy	12	1
	B0414	Biomolecular Technologies	6	1
	B0496	Molecular Pharmacology and Toxicology	6	2
	DM0140	Genetic engineering, Genomics and Epigenomics	7	2
	B0495	Molecular Mechanisms and Biomarkers in the Cellular Response to Stress	6	2
	B0493	Proteomic, molecular targets and bioinformatic applications	7	2
	B0292	<i>Free choice Courses</i>	8	1/2
<b>II</b>	B0446	Molecular Imaging Methods	6	1
	B0292	Development and Production of Biotechnological Drugs	12	1
	B0499	Biochemistry of Nutrition	6	2
	B0292	<i>Free choice courses</i>	8	1 and/or 2
	B0488	<i>Internship</i>	2	1 and 2
	B0280	<i>Thesis</i>	30	2