Second level interuniversity Master in:

Bioeconomy in the Circular Economy. - BIOCIRCE

Bioeconomy and Circular Economy
Definition

BIOCIRCE

The **Master's programme** (II level) in **Bioeconomy in the Circular Economy (BIOCIRCE)** offers a comprehensive training programme for professionals who aim to work in those sectors of the economy that use biological resources and bio-technological processes to produce bio-based goods and services. The study programme enables the participants to deal with all aspects of the production and marketing of biobased products, with a specific focus on innovative new processes and products.

Students will study issues about the **entire** value chain of biobased products: the production of raw materials in agricultural ecosystems in diverse climatic regions, the properties and supply logistics of biological resources, the biotechnological and industrial processes used to convert these resources into (new) biobased products, and the marketing and consumption of such products. While studying the entire value chain for biobased products, the students deal with the environmental, social and economic dimensions of the bioeconomy from a micro- and a macro-level perspective, taking innovation, institutions and policies into account.

PARTNER ORGANIZATIONS

As an interdisciplinary programme jointly offered by 4 Universities (University of Milan Bicocca, University of Naples Federico II, University of Trieste and University of Turin), and by non-academic partners (Intesa San Paolo, Novamont SpA, GFBiochemicals SpA, Assobiotec and FPTP Lodi), This MS degree programme will provide skills and expertise necessary to deal with the full range of issues in this complex field.

For each partner: link to website

PARTICIPANTS

The programme welcomes students from a variety of backgrounds:

- Graduate scientists who want to pursue a career outside the lab in industry, policy or not-for-profit sectors
- Social scientists and business studies students who want to develop their interests in life science innovation
- People already working in biotechnology related fields who wish to engage in further training and skills
- The **MASTER programme** is designed for two groups of students that is professionals with either scientific or legal_economic background.

AIMS OF THE MASTER basic scientific knowledge and expertise are no longer sufficient for building a successful career in the growing bioeconomy. Therefore, the MS provides a rich combination of theoretical perspectives on life science innovation with a practical focus on the dynamics of the bioeconomy and its value chains.

One of the strengths of this programme is that graduates are exposed to different perspectives and points of view: Companies that focus on new biobased resources, processes and products;

- Established producers seeking to introduce renewable resources, biotechnological processes and their corresponding products onto the market;
- Actors attempting to gauge the need and acceptance of such products;
- Organizations that support the development of biobased value chains, e.g. through research and advisory services.

Among the main aims, the MASTER also includes:

- Developing of a sustainable innovation in a responsible manner
- Reduction of barriers to biotechnology innovation
- Promotion of the integration of biotechnology research across commercial applications
- Creation of an ongoing dialogue among governments, citizens and firms
- Bringing of new technologies to existing and emerging markets

To meet these modern challenges, the MASTER (1 year course) provides students with a dynamic set of competencies, skills, knowledge and frameworks (see below) about life science innovation, as highly desired by prospective employers in the public, private and not-for-profit sectors. Students will also have the opportunity to conduct placement-based dissertations with organisations, universities or companies that are involved in the bioeconomy.

The concept of Public Engagement as well as Responsible Research Innovations are at the background of each course.

Knowledge and conceptual frameworks:

- Current trends and recent achievements in life science innovation
- Innovation from 'proof to concept' to market readiness
- Risk, regulation and governance of the bioeconomy
- Knowledge management and intellectual property in life sciences
- New business models and value systems
- Financing of life science innovation and changing commercial R&D models and strategies

THE PROGRAM

Programme structure

This programme responds to the rapid growth in the global bioeconomy by providing the core knowledge and skills needed to compete in a rapidly evolving, highly skilled workforce.

The programme include **four compulsory modules** (5 Credits each) given by the four participating Universities. Modules cover relevant scientific topics as well as economic and legal issues

MILANO BICOCCA MODULE (5 credits):
Training objectives: Participants will be provided with updated knowledge about advanced technologies useful in Bioeconomy, in particular “omic” techniques, synthetic

biology and nanotechnology. The principal components of the whole production chain will be described and analyzed, thus identifying technological needs and benefits arising from the paradigm shift to circular economy. All information needed to understand mechanisms behind a long lasting successful technology transfer will be provided.
Course content: Scientific and technological advances in next generation sequencing, transcriptomics, proteomics and systems biology. Application of advanced biotechnology to the production of metabolites, chemicals and novel biocatalysts. Case studies on the valorization of lignocellulose and waste materials into novel high-added value chains will be described. Special attention will be paid to the market needs and EU strategies novel production chains respond to. Examples of technological and business acceleration will be provided through business models and innovative start ups within the Alimenta PTP's certified incubator. Project Management aspects will be addressed as well.

NAPOLI FEDERICO II MODULE (5 credits):
Training objectives: Aim of the module is to provide updates regarding advanced technologies of industrial applications of enzyme catalysts and microbial cells as "cell factories". The activities are focused on: i) the use of enzymes as additives and processes ancillaries for the production of products of industrial interest; ii) the use of advanced methods of microorganism engineering to improve production performances; iii) the strategies to optimize the exploitation of the productive potential of the microorganisms. The module will deal also with recognition and analysis of the opportunities available for a new venture, focusing in particular on the research entrepreneurial initiatives (academic and not) aimed at commercializing the research outcomes. The aim of the course is to equip learners with the theoretical and practical tools for the recognition and structuring of innovative business ideas.
Course content: The course is organized in two sections. The first section focuses on scientific and technological issues regarding the potential of biotechnological processes based on enzyme systems and wildtype or recombinant microorganisms. Methodologies to improve biocatalyst systems are presented and discussed. Industrial case studies are presented. During the course, the essentials of strategic and operational management of new research entrepreneurial initiatives will be presented. As well as the mechanisms for recognition of new business initiatives. Thanks to the tools provided, learners will be able to model a business idea and to evaluate it strategically and financially.

TORINO MODULE (5 credits):
Training objectives: The module aims to update participants on new regulations on access to genetic resources and the possible sharing of the benefits derived from them. It will also present some examples of valorization of the processing industry by-products. The educational objective of the teaching is to present actors of the capital market operating in innovative projects funding and to provide communication tools to succeed in new businesses; furthermore the module provides an illustration of the principles and operation of Economic – financial and sustainability report.
Course contents: The module aims to update participants on new national and international regulations governing access to genetic resources and the fair and equitable sharing of benefits derived from them in the event of commercial exploitation. In the second part of the scientific module the exploitation of by-products of the processing industry as a crucial step to the sustainability of supply chains will be addressed. Some industrial case studies will be presented. During the course different figures of investors will be presented illustrating investment model and procedures also involving evidences and cases. Beside it will be presented how to approach to an integrated model of communication for knowledge transfer and start up. Finally reporting models and major

economic and financial key performance indicators and sustainability indicators international guidelines will be presented.

BOLOGNA MODULE (5 credits):

Training objectives: The module aim is to provide students with basic knowledge of industrial biotechnological process design, including elements of bioreactors, downstream processing and principles of bioreactors scale-up. Cutting-edge biotechnological approaches used for the production of functional foods and food ingredients, such as probiotics, prebiotics, nutraceutics and enzymes will be provided. The students will also be exposed to the principles of biotechnology-based genetic improvement of crop species. Furthermore, the course will provide an overview on the marine and terrestrial microorganisms of interest for the biodegradation of organic pollutants and the production of bio-based products for environmental/industrial applications, and on the main processes for the bioremediation of contaminated sites and the treatment of industrial effluents. A further goal of the course is to describe the economic characteristics and related technical bases of primary production of raw materials for the bioeconomy. It includes the ability of understanding essential economic statistics and the mechanisms of reaction of the sector to markets and policies.

Course contents: Material balance, design and scale-up of bioreactors. Main unit operations involved in downstream processing. Use of process simulators for biotech process design. Metagenomics of the human gut microbiota to identify microbial candidates for the development of probiotics and prebiotics. Biotechnological production of nutraceuticals. Introduction to plant breeding with emphasis on biotechnological approaches (marker-assisted selection - MAS -, genetic engineering, genome editing). Microbiological and technological aspects related to the bioremediation of soils and sediments and the treatment of industrial wastewaters. Biosurfactants, enzymes and bioactive compounds produced by marine bacteria and their applications. Main characteristics of the supply of raw materials in the bioeconomy. Description of annual and perennial biomass crops: limits and opportunities for their development in fertile and marginal lands. Main characteristics of the demand of raw materials in the bioeconomy. Market structures. Forms of integration and organization: chains, contracts, districts, international markets. Bioeconomy policies. Specificity of the concept of efficiency and of the mechanisms of innovation.

The four modules will be then followed by a **six months industrial stage in a Company** (**30 credits**) which will be completed after the submission of a **thesis** (**10 credits**) on the research project carried on during the industrial stage. The thesis should be positively defended to get the final Title.

WHY TO PARTICIPATE TO BIOCIRCE

BIOCIRCE graduates will excel in strategic thinking about how to find solutions to practical problems relating to innovation and firm strategy, policy and regulation, collaborative R&D models, and governance and intellectual property.

Basic scientific knowledge is no longer sufficient for building a successful career in the growing bioeconomy. There is a high demand for trained professionals in this area, and this degree is an opportunity to impress prospective employers in the public, private and not-for-profit sectors with expertise in life science innovation.

The BIOCIRCE Programme enables graduates to undertake international careers paths in a wide range of organisations such as industrial multinational firms small- and medium-sized firms that pursue internationalization strategies; universities or other organizations

contributing to international research projects; national and international public administration and policy organizations or institutions for foreign trade.

The transferable skills you gain in areas such as communication and research will give you an edge in the employment market, whatever your eventual career.

Entry requirements:

An Italian master degree or its international equivalent.

BIOCIRCE aims to attract recent graduates from a variety of study disciplines and cultural backgrounds. It welcomes candidates with no business experience who look for a degree programme that act as bridge to the real world as well as candidates with business background who seeks in-depth knowledge of how theory applies to the real world.

Specific skills:

We expect good knowledge of English, proficiency in the use of MS office programs and the ability and readiness to work in intercultural teams.

Fees and costs:

For detailed information on fee status, policies and payment see:

http://masterbiocirce.com/

http://www.unimib.it/link/news.jsp?2674179126533988895 (sito dove è disponibile il bando **in italiano ed inglese**)