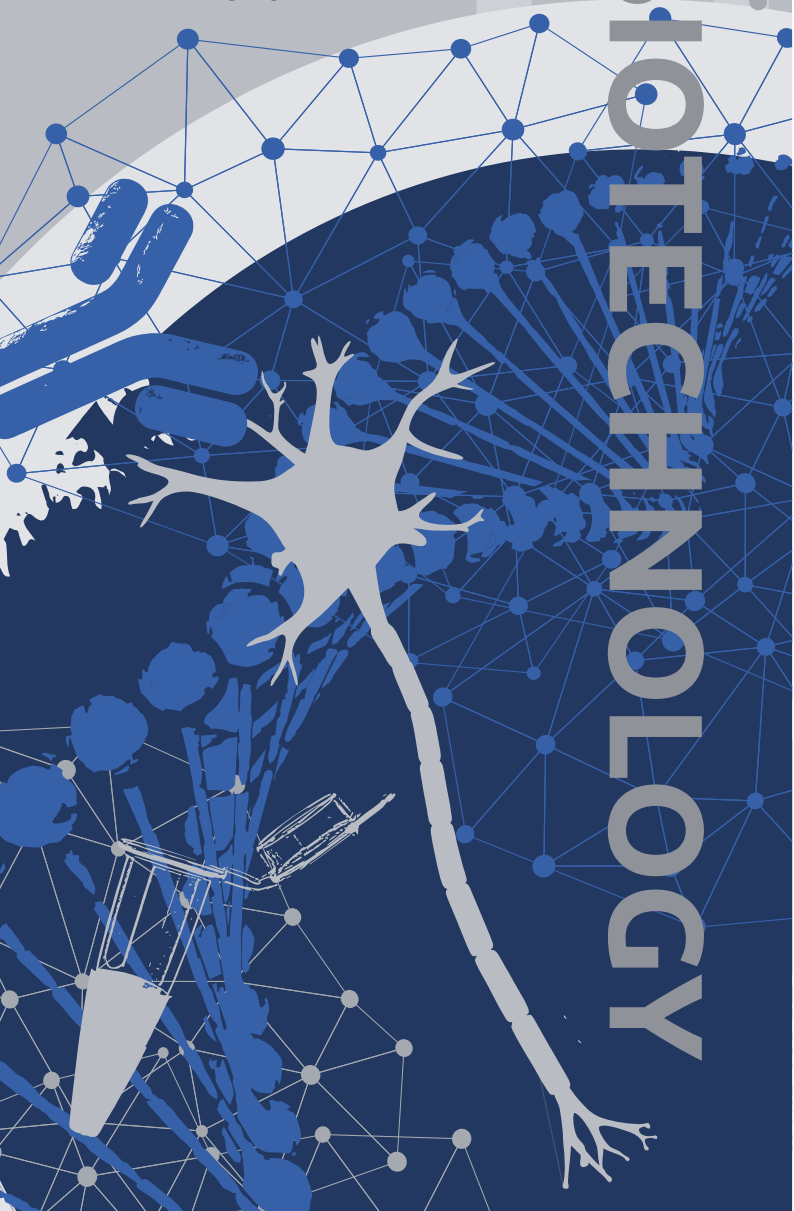
MOLECULAR BIOTECHNOLOGY

Guide
for applicants



Foreword

Changes in lifestyle and ever-growing population numbers, accompanied by an increased incidence of diseases of civilisation, a growing need for food and energy and environmental pollution on a massive scale: these are just some of the challenging issues the modern world now faces.

New ideas and qualified personnel are needed to address these issues.

Studying for a Magister degree (Polish equivalent of Master's degree) in Molecular Biotechnology at the Jagiellonian University gives students the opportunity to broaden their research skills in using biological processes and systems to create new products and technologies that can be used to resolve the problems identified above.

The broad range of issues on which scientists from the Jagiellonian University Faculty of Biochemistry, Biophysics and Biotechnology work, along with the laboratories and excellent equipment at their disposal, and the advanced techniques employed, all contribute to create an exceptionally rich and diverse teaching programme. This is in turn reflected in our highly-qualified graduates, who are much sought after by employers.

Hopefully, you will find this guide helpful and that it will encourage you to study Molecular Biotechnology with us.

Professor Jolanta Jura

Dean of the Faculty of Biochemistry, Biophysics and Biotechnology

Jagiellonian University and the Faculty of Biochemistry, Biophysics and Biotechnology

The Jagiellonian University was founded in 1364. It is one of the two largest and best universities in Poland. The JU belongs to the Coimbra Group of some of Europe's oldest universities. It is also a member of Una Europa – an alliance of leading research universities. Over 35 thousand students are enrolled at the Jagiellonian University, including 3 thousand foreign students.

The Jagiellonian University currently consists of 16 faculties. The Faculty of Biochemistry, Biophysics and Biotechnology was created in 2002. The FBBB is located in the south-west of Kraków, along with other faculties in the mathematical and natural sciences and research centers, which together form the JU's 3rd Campus.

The FBBB ranks as one of Poland's leading institutes of research and education. Scientists from the FBBB work on dozens of research projects, publish the results of their research in reputable journals, and cooperate with research centers around the world.

The Faculty's study programme has received several awards for high quality from Poland's national institutions for educational assessment.

MOLECULAR BIOTECHNOLOGY programme

PROGRAMME STRUCTURE

The Molecular Biology study programme was created with foreigners in mind. Studies for the Magister degree (Polish equivalent of Master's degree) last for two years (four semesters) and are conducted entirely in English. 121 ECTS points have to be obtained in order to complete the studies.
The title of Magister is awarded after passing all exams and completing a diploma dissertation.
The study programme is made up of compulsory courses and elective courses. The main emphasis is placed on students gaining practical skills.
Participation in laboratory classes, which account for 15–20 hours a week, is compulsory.
This is a fee-paying study programme.
Admissions numbers are 30 persons per year.

COMPULSORY COURSES

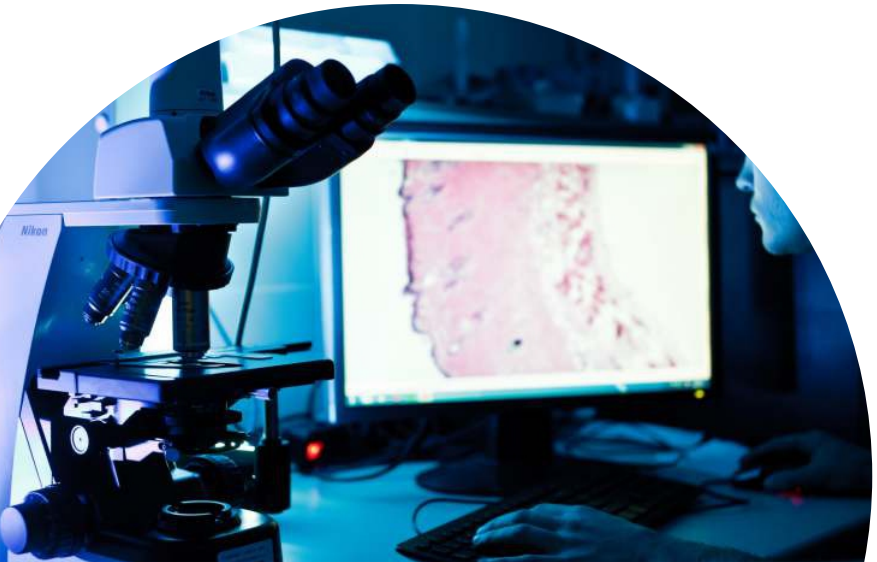
Compulsory courses are mainly concentrated in the first year of the study programme. They allow students to broaden their theoretical knowledge and practical skills in the following areas: molecular biotechnology, genetic engineering, biochemistry, cell biology, medical biotechnology, plant biotechnology, bioinformatics, the application of biotechnology in environmental protection and protection of industrial property and copyright.

ELECTIVE COURSES

The study programme offers a wide choice of elective courses, which the student can select according to their own areas of interest. Part of the elective courses which are of particular importance for biotechnology are practical in nature (laboratory classes). They are related to the use of various types of viral vectors, the production of monoclonal antibodies, methods of biofuel production, industrial microbiology, stem cells and cell engineering.

DIPLOMA DISSERTATION

To receive the title of Magister the candidate must complete a diploma dissertation and pass the final exam. The dissertation is written on the basis of a laboratory-based project. The thesis shall be made up of the elements typical of scientific articles, namely a presentation of the chosen scientific problem, a description of the experiments conducted, results of research and discussion.



SKILLS ACQUIRED BY STUDENTS OF MOLECULAR BIOTECHNOLOGY

Practical skills: observing the principles of working in the laboratory; standard operation of equipment; using methods of molecular biology, genetic engineering, advanced biochemical and biotechnological techniques (cell cultures, isolating and purifying proteins and nucleic acids, structural analysis of macromolecules), experience in planning and designing experiments, using bioinformatics tools.

Communication: creation of reports, taking part in seminars, and preparation of a presentation and diploma dissertation allow students to improve their skills in writing and public speaking, and develop their ability to express themselves clearly.

Data processing: students learn how to gather, compile and present biological data and information, and how to create reports and draft analyses.

ORGANISATION OF THE ACADEMIC YEAR

In Poland, the academic year starts in October and consists of two semesters – the winter semester and the summer semester. Each semester concludes with a period devoted to the sitting of exams (known as a "*sesja*" in Polish). Students who do not successfully pass the exam for a subject the first time, may take the exam a second time during the period for re-sits ("*sesja poprawkowa*") a few weeks later. In addition to this, there are two scheduled periods of vacation in the academic year (a short winter vacation in February and a long summer vacation – from July to September), as well as breaks lasting several days for the Christmas and Easter holidays.

Admission

DEGREE REQUIREMENTS

Bachelor's degree or equivalent. It is preferable to have previously completed a degree in the natural sciences: such as biology, biotechnology, biochemistry, molecular biology, chemistry, pharmacology, etc.

ENGLISH LANGUAGE REQUIREMENTS

Fluent written and spoken English. Knowledge of specialist, biological terminology.

RECRUITMENT PROCEDURE

Admissions for foreign students wishing to study at the Jagiellonian University usually open in March and close in August. Those interested in applying for the Molecular Biotechnology study programme should submit their application via the JU Online Application System. Admission to the study programme is based on interview. The interview is conducted in English and is normally conducted online (applicants do not have to travel to Poland for interview).

FEES

The total fee for two years of studies is 40,000 PLN (approx. 9,900 USD or 9,200 Euro)*.

* Data from 2023.

Living and studying in Kraków

With nearly 800 thousand inhabitants, Kraków is Poland's second largest city. Once the royal seat of the Kings and Queens of Poland, it is the former capital city of the country with academic traditions stretching back to the 14th century. It is a place where tradition and modernity, and the arts and sciences, come together in creative interaction.

A CITY OF CULTURE
Kraków is a city with a vibrant cultural scene. Dozens of festivals devoted to music, folk traditions, theatre, film and literature are organised every year. Exhibitions of paintings, crafts and applied arts are held in the city's numerous museums and galleries. Theatregoers can choose from a broad repertoire of comedy, drama, big shows and small-scale productions staged in both traditional and fringe theatres. In addition to the large multiplexes playing more mainstream films, there is also a network of small arthouse cinemas. Classical music, jazz, rock and pop concerts featuring Polish and international artists are held in clubs, the philharmonic concert hall and at other major venues in the city.

A CITY OF STUDENTS
There are 10 public institutions of higher education in Kraków, including the oldest in Poland, and one of the oldest in Europe, the Jagiellonian University. Around 130,000 students in total study at institutes of higher education in Kraków. Their presence gives the city a youthful feel, usually bustling with life into the small hours of the night.

A CITY FOR TOURISTS
The history of Kraków dates back to the 10th century AD. Fortunately, the city was not destroyed during World War II and still offers a full complement of historical monuments. The medieval old town of Kraków, together with the royal castle on the Wawel Hill and the district of Kazimierz, are included on the UNESCO World Heritage List. In addition to this, there are six national parks and the Tatra mountains which can be easily reached from Kraków. With its international airport and rail links, Kraków also serves as an excellent base for trips to other cities in Europe: such as Prague, Vienna, Budapest, Berlin, Kiev, Rome, Paris and Stockholm.

AN INCUBATOR FOR NEW TECHNOLOGIES
Over the past two decades, Kraków has attracted many companies in the high-tech sector, working on the development of the latest technologies in information systems, electronics, materials engineering and biotechnology.

DAILY LIFE
Kraków offers a high quality of life. There are plenty of parks, the public transport system is very well organised, and there is no shortage of places in halls of residence and flats for rent. The city is well-known for its diverse food scene – with takeaways, cafés, and "milk bars" serving homely Polish food, as well as pizzerias, and high-end restaurants, there is something for everyone. It is possible to speak English in most places in the city, especially in the city centre.

About BIOTECHNOLOGY

Biotechnology is defined as the use of biological systems, living organisms or parts of organisms to create or modify specific technological products or processes.

The earliest biotechnological projects in history of humanity can be considered to include the cultivation of plants, the breeding of animals, the brewing of beer, the production of wine, the pickling of fruits and vegetables, cheesemaking and the baking of bread. Though our ancestors may not have been familiar with such notions as genetic modifications, yeasts, bacteria, enzymes, alcoholic fermentation or lactic acid fermentation, they were successful – thanks to observations and experiments over many generations – in making use of biological processes and microorganisms for the production of food.

Modern biotechnology is a very diverse, multidisciplinary area of human activity. Biotechnological products are created by combining basic research in the biological sciences (biochemistry, molecular biology, genetics, microbiology, cell biology, immunology) and engineering. They are used widely in health care (medicine, pharmaceuticals, diagnostics, veterinary medicine), agriculture, environmental protection, production (including that of food, chemicals, cosmetics, paper and textiles) and in the development of alternative sources of energy.

Innovative biotechnology is based on:

- techniques of genetic engineering developed on the basis of mechanisms of duplication,
- modification, editing and regulation of gene expression occurring in nature, biochemical processes occurring in living organisms, and in microorganisms in particular,
- cell and tissue cultures,
- stem cells,
- bioinformatics.

Goals and challenges for BIOTECHNOLOGY

Modern biotechnology is closely linked with medicine, environmental protection and sustainable development. The most important goals of biotechnology include:

- feeding the planet's growing population,
- developing pharmaceuticals to treat diseases of civilisation, cancer and neurodegenerative diseases, which are having an increasing impact on our social lives and on the costs of health care,
- inventing new and clean (environmentally friendly) ways of obtaining energy, as alternatives to fossil fuels,
- creating effective methods of removing pollution from the soil, air and water (in particular ways of removing plastic from the environment), and of the treatment of solid waste.

The development of biotechnology is also giving rise to new ethical challenges that require a scrupulous risk-benefit assessment. Examples include: research with the use of human cells, the dangers of using genetic data for non-medical purposes, environmental threats related to GMO monocultures and the welfare of farm animals.

What BIOTECHNOLOGISTS do?

They develop systems – based on bacteria, yeast, plant and animal cells – used to produce biological compounds (mainly peptides and proteins) used as pharmaceuticals, specialised reagents, and dietary supplements.

They manufacture traditional vaccines against dangerous diseases and devise completely new forms of vaccines, which are safer, more effective, and also easier and faster to produce.

They create new therapeutics – such as biopharmaceuticals for use in precision medicine.

They develop innovative therapies for rare, serious and incurable diseases.

Thanks to genetic modifications, they create model plants and animals used in scientific studies.

They devise tests used to diagnose illnesses, detect the presence of pollution, and conduct scientific research.

They create varieties of plants and animals, which make it possible to reduce the unfavourable impact of agriculture and livestock farming on the environment (limiting consumption of water, fertilisers, herbicides, pesticides, antibiotics and hormones), increase yields, supplement foods with lacking nutrients and be used as biofuels.

They develop biodegradable materials, which can be used as packaging, for single-use products, etc.

They modify and use microorganisms and plants to clean the environment – by breaking down or eliminating toxic substances.

What it takes to be a BIOTECHNOLOGIST

Studies in biotechnology require:

knowledge in the sciences, especially chemistry and biology

problem-solving skills

the capacity to work with numbers and perform statistical analysis

skills in the use of information and communication technologies

an accurate and methodical approach

readiness to work on multidisciplinary teams

scientific curiosity

creativity

basic technical skills and manual abilities.

Work opportunities

Graduates in biotechnology will acquire interdisciplinary knowledge and a broad range of skills enabling them to find jobs in a wide variety of sectors upon completing their studies.

The career paths open to graduates depend to a large extent on the educational level reached and the associated professional title/scientific degree obtained, as well as on individual predispositions, skills and ambitions.

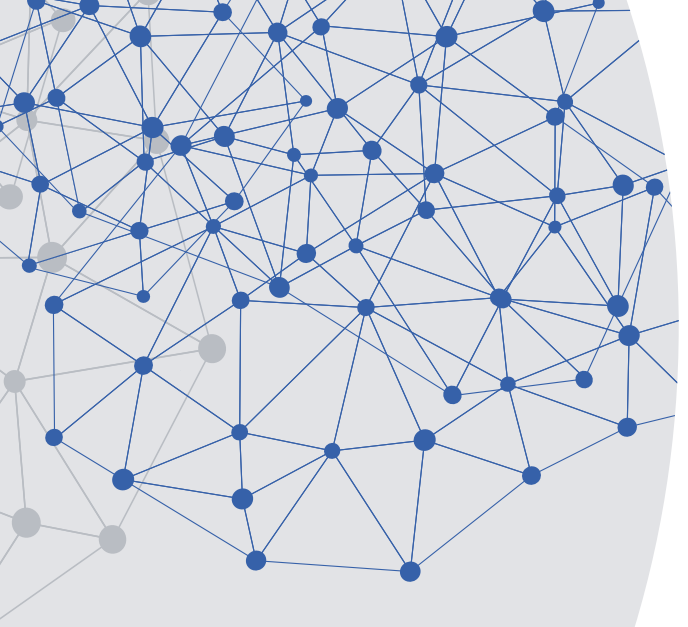
A Bachelor's degree qualifies graduates to work in technical laboratory positions, conducting standard analyses and experiments, and collecting data.

A Master's degree is required to work in more independent and creative positions with greater responsibility.

A PhD is necessary for those choosing to pursue a scientific career. It also clearly improves the chances of being accepted for managerial positions and senior management positions in private companies and government agencies.

Companies in the life sciences sector:

- **pharmaceuticals, diagnostics, biotechnology, cosmetics, chemical analytics; companies involved in the production and development of agricultural products, dietary supplements**
  R&D departments, quality control departments; development of new products, improvement of production technology
- **Companies producing specialised equipment and creating new technologies, companies from the chemical analytics sector, pharmaceutical companies,**
  marketing departments; sales departments positions in sales and customer contact and advice, medical representatives
- **Institutes of Research and Research & Development**
  technical, research and scientific positions; conducting basic research studies and research studies with application potential
- **Universities**
  laboratory, scientific and teaching positions; conducting basic research studies, teaching
- **Law firms, patent offices, government institutions**
  specialist advice, consulting
- **Government agencies**
  work on projects related to safety of food, drugs, and medical therapies and on research funding programmes
- **Media**
  scientific journalism, popularisation of science



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