BIOMEDICAL SCIENCES
Molecular Medicine

Radboud Universiteit Radboudumc

Molecular Medicine

A specialisation in the Biomedical Sciences Master's

Delve into the world of molecular medicine and make a difference in healthcare through molecular knowledge and innovation.

Specialisation Coordinators

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The BMS Master's

Our Master's programme in Biomedical Sciences offers eight specialisations and four career profiles. In the first semester, each specialisation starts with four courses that reflect its central topics and methodology, followed by an elective course. In the second semester of the first year students do a research internship.
In the second year students follow elective courses and courses of their career profile, followed by a profile internships.
Furthermore, the course 'Personal & Professional Development' runs throughout the entire programme under the guidance of a coach. It covers topics such as personal learning goals, responsible research & innovation, well-being, and career prospects.

The specialisation

Understanding how genes, proteins, and cellular components work in diseases is at the core of molecular medicine. This field integrates biology, bioinformatics, chemistry, and medicine to explore molecular structures and mechanisms, uncover genetic and molecular disease origins, and work out interventions to improve on these issues. It's dedicated to diagnosing, treating, and preventing. Molecular medicine rapidly translates laboratory findings into innovative diagnostics and therapies, making it an essential driver of future medical practices and advancements. Within this specialisation, we address questions such as:

- How do genetic mutations contribute to the development of disease at the molecular level?
- What are the latest advances in targeted therapies for treating cancer and other genetic disorders?
- How can we use molecular diagnostics to improve early detection and personalised treatment of diseases?
- What role do molecular pathways play in the progression and treatment of chronic diseases?

Internship possibilities

You will choose a research, consultancy or communication profile and you will do two internships of your own choice. One research internship and one profile internship. Internships in the field of molecular medicine can be done at different world renowned research groups from various departments of the Radboudumc, but

there are also plenty opportunities at other locations in the Molecular Medicine A specialisation in the Biomedical Sciences Master's Netherlands or abroad. We have many connections with research institutes, companies, and universities all over the world. So the possibilities are endless! Examples are: other universities, academic hospitals, research organisations, pharmaceutical companies, governmental institutes such as RIVM, GGD, and medical consultancy companies.

Career perspectives for Molecular Medicine alumni

Graduates work in clinical and public health research, consultancy, or communication roles. They often find positions in academic hospitals and universities as PhD candidates, focusing on molecular mechanisms of disease, and some progress to postdoctoral roles, eventually becoming assistant or associate professors in biomedical sciences. Others find their niche as molecular biologists or disease specialists, contributing to research in both academic and clinical settings. Additionally, graduates often secure positions as junior scientists at pharmaceutical companies, where they play a role in drug development. Some also take on roles as scientific coordinators, managing research projects and facilitating collaboration across disciplines.

Internship example: Magnesium deficiency in HDR patients.

"I worked with mouse cells on magnesium deficiency in patients with HDR syndrome at the department of Medical BioSciences. I used methods such as qPCR, Western blot, and DNA and plasmid extraction. I not only gained technical skills but also learned the importance of teamwork, and that making mistakes is part of the learning process."
2nd year Molecular Medicine student

Specialisation courses

ADVANCED MOLECULAR TOOLBOXES

This course offers a look into the world of advanced molecular tools for studying protein localisation and function in living cells. Students will learn to design primers and expression plasmids for cloning, perform genetic perturbation experiments, and work with fluorescently tagged proteins to understand protein behavior. The course covers various techniques, from transformation and DNA isolation to CRISPR/Cas9 deletion experiments and PCR. You will further explore protein structure and its impact on function. You will learn to navigate protein databases, visualise and analyse structures, and use software to understand how mutations affect structure and function. Students will acquire hands-on experience in fluorescence microscopy image analysis and interpretation.

FROM FLIES TO ORGANOIDS: DISEASE MODELING APPROACHES

This course explores organismal and tissue models used to understand human disease at the molecular and cellular level. You will discover how model organisms like mice, zebrafish, and fruit flies, along with cutting-edge 3D organoids, provide systems for disease research and therapeutic development. Through hands-on learning, you will master selecting the most appropriate models for specific research questions, understand genetic manipulation techniques, and evaluate the translational value of different systems. The course includes facility tours and practical training in analyzing

disease phenotypes, preparing you to make informed decisions in biomedical research and justify your experimental choices to the scientific community.

THERAPY DEVELOPMENT

In this course, you will focus on the classical small molecules, the newer biologics and the most recent cell-based therapeutics. The classical drug development pipeline will be illustrated by focusing on targeting metabolism by means of small molecules. Next, you will identify differences in the development of biologics as compared to small molecules. The biologics that will be studied are used in inflammation and cancer to target cell migration. The challenges of the cell-based therapeutics will be analysed in the context of stem cell differentiation of regenerative medicine. In the second part of the course, you will zoom out and go through the preclinical steps of the pipeline focusing on a genetic target and an immunological target. This will cover several model systems for target identification and validation, and understanding the development of key assays to test and optimize a drug candidate.

CELL AND TISSUE DYNAMICS

This course explores the fascinating intersection of cell movement and tissue regeneration in health and disease. You will discover how cellular motions drive fundamental processes from embryonic development to wound healing, while learning how deregulated cell migration contributes to cancer metastasis and immune disorders. Through studying stem cell behavior, biomaterials, and tissue mechanics, you will understand how scientists harness these natural processes to develop groundbreaking regenerative therapies. The course covers different types of cell migration, extracellular matrix interactions, and cutting-edge approaches like 3D bioprinting and tissue engineering. You will gain practical insights into how cell-ECM dynamics can be targeted for therapeutic interventions and tissue reconstruction

Other courses

In your elective space you can take additional courses at other faculties or universities if you want. Many students choose to do courses outside of the Radboudumc, for example at the other programmes with a focus on molecular medicine the Netherlands. Also, some students choose to go abroad to follow courses.

Internship example: Migration of melanoma cell in 3D spheroid models

"I did this internship because I loved the cell motility course. During my internship, I explored the fascinating field of melanoma cell migration in 3D models. Inspired by my interest in cell motility, I tracked the movement of melanoma cells over seven days using 3D collagen droplet models. I incorporated melanoma spheroids (clusters of cancer cells) into these models and studied their migration patterns. I thoroughly enjoyed the comprehensive research process, from culturing the cells to analyzing them under a microscope. This hands-on experience gave me a deeper appreciation for the entire research pipeline."
1st year Molecular Medicine student

Please email us for more information about the programme, the specialisation or the application process.
Admissions@radboudumc.nl

For general information, or a chat with current students, please visit our website.
www.ru.nl/masters/bms

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