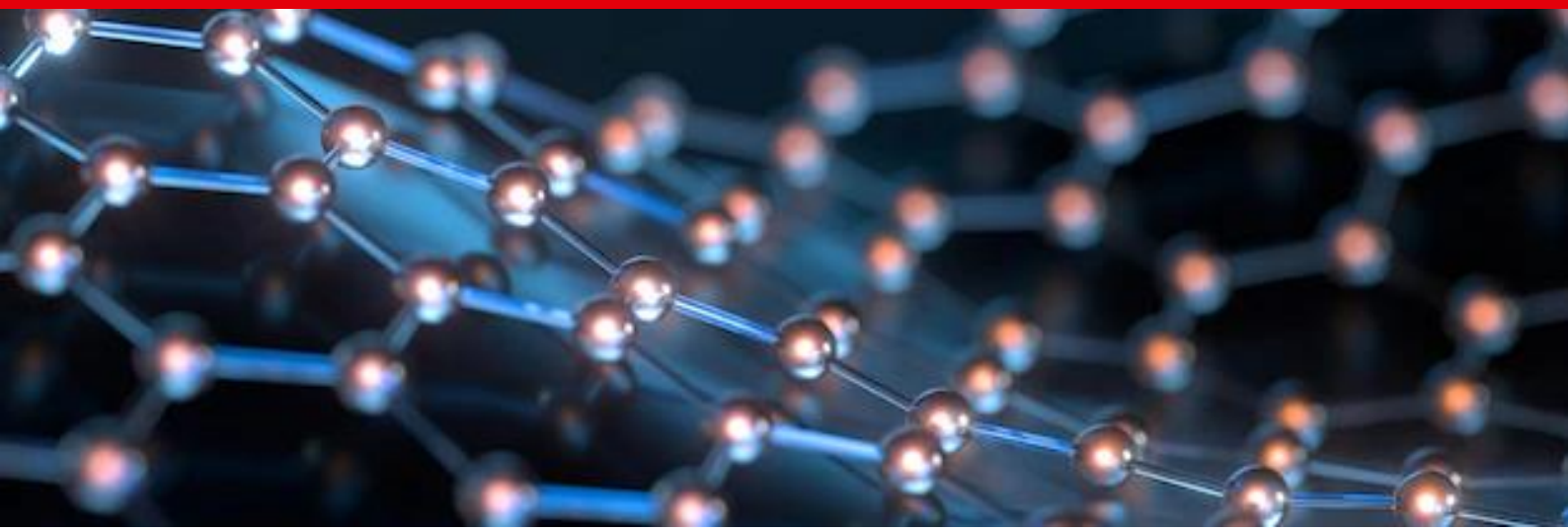
Specialisation – Master's in Biomedical Sciences

Molecular Medicine



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

The BMS Master's has seven specializations to choose from. Each specialization contains a number of courses that reflect its central topics and methodology. Molecular medicine 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. Understanding how genes, proteins, and cellular components function in diseases is at the core of this field. 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.

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Courses within this specialization (1/3)

W36 = September, W40 = October, W44 = November,
A = Monday/Tuesday contact hours, time for self study or exam (final week) on Wednesdays,
B = Thursday/Friday contact hours, time for self study on Wednesdays.

Period	Code	Course
W36-A	MED-BMS75	**Advanced tools in molecular biology**

This course offers a look into the world of advanced molecular tools for studying protein localization 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. Students will acquire hands-on experience in fluorescence microscopy image analysis and interpretation.

Period	Code	Course
W36-B	MED-BMS40	**Nanomedicine**

In this course, students will explore nanomedicine, with a focus on creating nanoscale molecular assemblies for diagnostics and disease treatment. They will learn to design multifunctional molecular units to deliver drugs efficiently, enhance specificity, and reduce side effects. The curriculum spans various disciplines, from bioorganic chemistry to cell biology and histology. Students will go into bioconjugation strategies, detection methods, and the principles of nanoscale cell biology and histology to understand how nanomedicines interact with cells and tissues for targeted drug delivery. The course also covers essential topics like nanoparticles for drug delivery and organ-on-a-chip technology.

Period	Code	Course
W40-A	MED-BMS43	**From target to therapy**

This course offers a journey through the initial stages of drug development, concentrating on preclinical steps. Students will look into the identification, validation, and optimization of therapeutic targets, primarily focusing on immunological and genetic diseases. Using proteomics and genomics, they'll explore target identification, followed by target validation through human disease models. The course encompasses an array of topics, including cellular and animal models, toxicity studies, biological assay development, and lead discovery and optimization. By the course's end, students will have a solid grasp of the main preclinical phases in drug development.

Courses within this specialization (2/3)

Period	Code	Course
W40-B	MED-BMS42	**Targeting cellular processes to treat disease**

This course focuses 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, students 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 analyzed in the context of stem cell differentiation for regenerative medicine.

Period	Code	Course
W44-A	MED-BMS39	**Understanding proteins in 3D**

This course delves into the intricate world of protein structure and its impact on function. Students will learn to navigate protein databases, visualizing and analyzing structures. By employing software tools, they'll grasp the consequences of mutations on both structure and function. They'll master the art of searching for the right protein structure, choosing between solved structures, homology models, or sequence-based predictions. Furthermore, students will explore the unique properties of amino acids in the context of a protein's 3D conformation. This course emphasizes the critical ability to evaluate protein structure quality and its suitability for research applications.

Period	Code	Course
W44-B	MED-BMS37	**Cell death in life and disease**

This is the first of two courses from which students can choose in the period W44-B. In this course, students will explore the intricate world of cell death and its crucial role in both the maintenance of life and the development of various diseases. They will look into the mechanisms of cell death, cell survival, and their profound implications in the context of aging and disease. Students will learn to critically analyze and reflect upon scientific literature, enabling them to grasp the complexities of (immunogenic) cell death. They'll also acquire the skills to translate this knowledge into potential therapeutic strategies for intervening in these cellular processes.

Courses within this specialization (3/3)

Period	Code	Course
W44-B	MED-BMS76	**Cell motility in physiology and pathology**

This is the second of two courses from which students can choose in the period W44-B. In this course, students will explore the intricate world of cell motility, delving into the molecular and biomechanical foundations of this essential cellular process. They will gain an understanding of the various ways cells move in both healthy and disease states, with a particular focus on cancer dissemination and immune cell migration during pathogen removal and immunotherapy. Throughout the course, students will critically evaluate scientific literature related to cell migration studies.

Internship testimonial

Demythalase in neonatal cadiomyocytes

During my time at the Max Planck Institute for Heart and Lung Research in Germany, I delved into a fascinating project exploring the role of KDM5B, a demethylase, in cardiac proliferation and regeneration in neonatal cardiomyocytes. One of my major milestones during this Internship was mastering complex laboratory techniques, like isolating cardiac cells from newborn mice hearts and utilizing biochemical methods such as co-immunoprecipitation, western blots, and immunofluorescence for testing. These skills helped me unravel the intricate relationship between epigenetics, metabolism, and cardiac regeneration, leading to valuable insights.

Beyond the lab, I had the opportunity to present my work at the “Molecular Control for Gene Expression” Spring School in Austria, connecting with researchers from various countries. I also joined my colleagues for the JP Morgan Corporate Challenge Run in Frankfurt for a 6 km race. As a Lebanese international student at RadboudUMC, embracing life in Germany and my interaction with colleagues broadened my international horizons and shed light on the importance of collaborative spirit in the scientific community. This internship was not just a learning experience, but a journey filled with exciting challenges and wonderful people.

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