Specialisation – Master's in Biomedical Sciences

Drug Safety and Toxicology

Explore different aspects of drug safety and toxicology, from molecular level to real-world applications

The BMS Master's has seven specialisations to choose from. Each specialisation contains a number of courses that reflect its central topics and methodology. Drug Safety and Toxicology addresses the need for skilled toxicologists in an era where environmental exposures to chemicals and prescription drugs rank as prominent risk factors for chronic diseases and mortality. With a focus on both pharmaceutical and environmental toxicology, this unique specialization offers a comprehensive set of courses. The program's strong medical foundation, along with opportunities for internships at influential institutions, positions Radboudumc as a key player in shaping the future of toxicology education and research.

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Courses within this specialization (1/2)

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-BMS64	**Molecular and cellular toxicology**

This course provides an exploration of the molecular aspects underlying drug-induced toxicity and harmful effects of toxic compounds. Students develop the ability to distinguish toxicokinetic and toxicodynamic mechanisms, understand toxicity induced by drugs and chemicals binding to different receptors, and comprehend the role of biotransformation enzymes and drug transport proteins. The curriculum covers risk factors influencing inter-individual susceptibility, including genetic polymorphisms, drug-drug interactions, and environmental factors. Students apply structure-activity relationship predictions in toxicology, gaining insights into methodological approaches for studying drug and chemical interference with key cellular processes.

Period	Code	Course
W36-B	MED-BMS67	**Chemical mutagenesis and carcinogenesis**

This course provides insights into the mechanisms of chemical carcinogenesis, equipping students with the knowledge to assess and mitigate cancer risks associated with xenobiotic chemicals. The course covers the induction of cancer by chemical compounds, detection methods for tumor-inducing properties, animal experiments, and the sequence of events leading from mutation to tumor formation. Students explore the measurement of internal exposure to cancer-causing chemicals and the relationship between research and legislation on carcinogenic compounds. Additionally, the course addresses the potential link between chemical exposure and hereditary malformations.

Period	Code	Course
W40-A	MED-BMS63	**Biodynamic and toxicokinetic modeling**

This course delves into advanced pharmacokinetic modeling. Through non-compartmental and compartmental approaches, participants learn to derive relevant parameters using a top-down modeling approach. The curriculum extends to physiology-based pharmacokinetic modeling (PBPK-modeling), providing a bottom-up method to predict clinical toxicokinetics based on xenobiotic properties. Students explore the impact of patient-specific factors and co-exposure on toxicokinetics, linking these to biodynamic effects using physiology-based PK/PD modeling. Emphasis is on real-world applications in toxicological risk assessment and drug development.

Courses within this specialization (2/2)

Period	Code	Course
W40-B	MED-BMS66	**Reproductive epidemiology and toxicology**

This course in reproductive epidemiology and toxicology equips students with the knowledge and skills to understand and assess the impact of non-genetic risk factors on reproductive outcomes. Covering fertility, pregnancy complications, perinatal outcomes, and birth defects, the curriculum explores mechanisms of reproductive toxicity and teratogenicity. Students learn to make informed choices between animal experiments and alternative test methods, applying advanced methods in reproductive and perinatal epidemiology.

Period	Code	Course
W44-A	MED-BMS65	**Clinical toxicology**

This course provides an understanding of diagnosing and treating both acute and chronic cases of intoxication. Students learn to apply principles of toxicokinetics and toxicodynamics, interpret analytical toxicological results, and explore variability in drug effects based on diverse factors. The curriculum emphasizes the recognition and treatment of human intoxications, with a practical focus on designing small-scale toxicological studies. Through a blend of theoretical and hands-on approaches, participants gain insights into drug classes and ethical evaluations of study proposals.

Period	Code	Course
W44-B	MED-BMS60	**Human risk asessment**

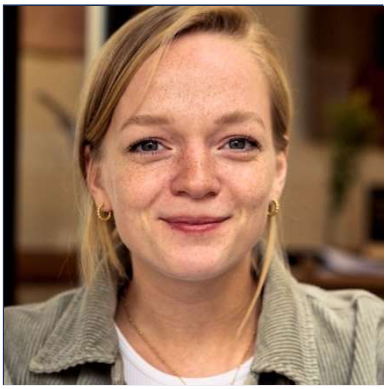
This module in Human Health Risk Assessment (HRA) equips students with essential skills for evaluating and mitigating potential health risks associated with various physical determinants. Students learn to apply terminology in the risk assessment process, perform hazard identification, and select relevant data. Real-world applications include assessing risks in environmental, occupational, and public health scenarios. Students acquire the ability to communicate risk assessment results effectively to policymakers, contributing to informed decision-making.

Internship testimonial (1)

Epigenetic analysis on cardiomyocytes

My fascination for the cardiac muscle and growing eagerness to learn techniques to study the (epi)genome, prompted me to move to the United Kingdom for my second internship. At the MRC Toxicology Unit, University of Cambridge, I had the incredible opportunity to work on a self-designed research project. This project involved an array of epigenetic analyses conducted on (spontaneously beating!) human embryonic stem cell-derived cardiomyocytes.

Both internships left an indelible mark on me, profoundly supporting my passion for molecular biology and contributing to my personal growth!



MRC Toxicology Unit,
University of Cambridge
United Kingdom

Internship testimonial (2)

In silico modelling

I had the privilege of completing two dynamic internships that aligned seamlessly with my specialization in Drug Safety and Toxicology. At Charles River Laboratories in Den Bosch and TNO in Utrecht, I delved into the intriguing realm of in silico modelling. At Charles River, I developed skills within the PBPK platform PKSim, while at TNO, I mastered the art of programming in R. These internships provided me with valuable insights into risk assessment for exposure to various chemicals, including PFOA and PFOS. Beyond the technical skills, I gained first-hand experience working in a Contract Research Organization (CRO) at Charles River and an independent non-profit research institution at TNO. The diversity of these experiences not only enriched my academic journey but also exposed me to the real-world applications of Drug Safety and Toxicology

Charles River
Laboratories, Den
Bosch, The Netherlands
&
TNO, Utrecht, The
Netherlands