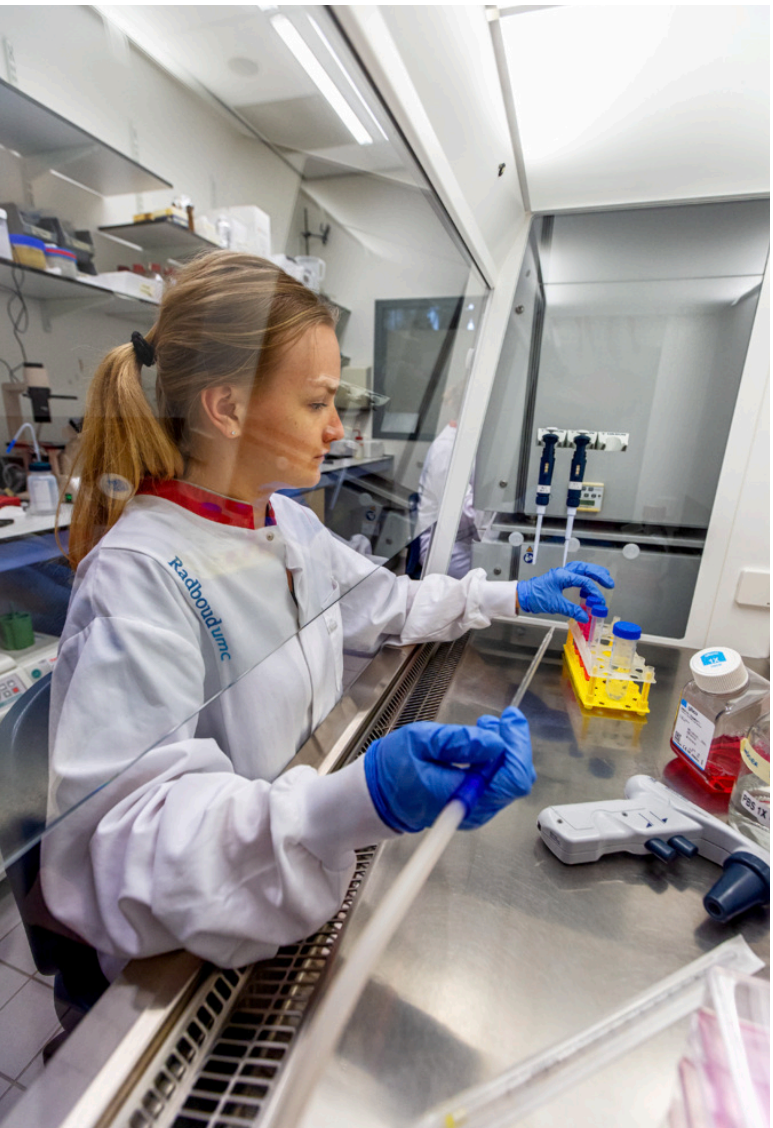
BIOMEDICAL SCIENCES
Drug Safety and Toxicology

Radboud Universiteit Radboudumc

Drug Safety and Toxicology

A specialisation in the Biomedical Sciences Master's

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



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

Drug safety and toxicology addresses the need for skilled toxicologists in an era where environmental exposures to chemicals rank as a prominent risk factor for chronic diseases and mortality. With a focus on medical toxicology, this unique specialisation offers a comprehensive set of courses. Within this specialisation, we address questions such as:

- How do various chemicals, toxins, and drugs impact human health at different exposure levels?
- What are the mechanisms by which toxic substances cause cellular and organ damage?
- How can we assess and predict the long-term risks of exposure to new drugs or industrial chemicals
- What methods are most effective for detecting and mitigating the effects of toxins of exposure?

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 Drug Safety and Toxicology can be done at various departments of the Radboudumc, but there are also plenty opportunities at other locations in the 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 such as Charles River Laboratories, governmental institutes such as RIVM, GGD, and consultancy companies.

Career perspectives for Drug Safety &Toxicology alumni

Career perspectives for a Drug Safety and Toxicology alumnus are diverse and span across various sectors. Graduates work as toxicologists in clinical and public health research, consultancy, or communication roles. They often find positions in academic hospitals and universities as PhD candidates, researchers, or academic teachers. Research organisations such as Johnson & Johnson, Byondis, AbbVie, and TNO also employ toxicology graduates. Governmental institutes like RIVM, CBG-MEB, the Health Council, and ZonMW are common employers, as are consultancy companies such as SURUS Consultancy and 3D-PharmXchange.

Specialisation courses

DRUG DEVELOPMENT & SAFETY

This collaborative course offers an essential introduction to the foundational principles of drug development, pharmacology and pharmaceutical toxicology, offering an overview of the development pipeline of cell, drug and gene therapies while emphasizing the critical importance of both efficacy and safety in the development of therapeutics. Reflecting the core medical principle of “first, do no harm”, the course explores how this principle guides every stage of developing new therapeutic modalities. Students will gain insight into the scientific and regulatory considerations that underpin the translation of laboratory discoveries into effective and safe patient treatments.

Internship example: In silico modelling

"I completed two internships that were closely related to my specialisation. At TNO in Utrecht, I explored in silico modeling and developed skills in programming in R. This internship provided me with valuable insights into risk assessment for exposure to various chemicals, such as PFOA and PFOS, and their real-world applications."
- 2nd year Drug Safety and Toxicology student

MOLECULAR & CELLULAR TOXICOLOGY

This course explores the molecular and cellular mechanisms underlying drug- and chemical-induced toxicity. Students study how toxic compounds interfere with intracellular signalling, metabolic processes, and cellular homeostasis, and how cells respond through repair or cell death mechanisms. Topics include mitochondrial dysfunction, reactive intermediate formation and detoxification (e.g. cytochrome P450, glutathione S-transferases), transporter function, and computational prediction of toxicity. The influence of genetic polymorphisms on susceptibility is addressed, as well as mechanisms of chemical carcinogenesis, mutagenesis, and DNA damage. Learning activities include lectures, literature study, and computer-based modules, complemented by practical training in mutagenicity testing and scientific reporting. Students gain skills to link molecular toxicology to human health effects and safety assessment.

ORGAN & REPRODUCTIVE TOXICOLOGY

This course offers an integrated understanding of organ physiology, dysfunction, and the toxicological and pharmacological effects of compounds on specific organ systems. Students learn to predict and interpret complex adverse outcomes in humans and evaluate drug

safety by analysing the severity, frequency, and clinical relevance of adverse reactions in relation to therapeutic benefit. The course includes developmental and reproductive toxicology, addressing fertility, pregnancy complications, and birth outcomes related to environmental and lifestyle exposures. Students are trained to detect and interpret organ dysfunction, assess adverse drug reactions, and apply advanced pharmacokinetic and toxicokinetic modelling to predict organ-specific effects. Learning is supported by lectures, group assignments, excursions, and practical sessions in modelling and reporting of drug-induced organ toxicity.

CLINICAL TOXICOLOGY & HUMAN HEALTH RISK ASSESSMENT

This course integrates the principles of clinical toxicology with human health risk assessment. Students learn to recognize, diagnose, and manage intoxications caused by pharmaceuticals, substances of abuse, and environmental chemicals. Emphasis is placed on toxicokinetics, toxicodynamics, and interpretation of clinical and analytical findings. Parallel to this, students apply quantitative and qualitative methods for human health risk assessment, linking molecular mechanisms to population-level health outcomes. The course highlights ethical and regulatory frameworks for safety evaluation, as well as emerging risks in modern society. Learning is supported by lectures, group assignments, debates, excursions, and practical training in ethical study design and human health risk reporting. Students develop the ability to critically assess toxicological data and translate findings into informed risk management strategies.

Other courses

In your elective space, you have the opportunity to take additional courses either at Radboudumc or at other faculties and universities. Some students opt to follow courses outside of Radboudumc, such as Toxicology programs at other institutions. Others choose to go abroad to take courses as part of their elective period.

Internship examples:

Epigenetic analysis on cardiomyocytes

"My interest in the cardiac muscle and eagerness to learn techniques for studying the epigenome led me to the United Kingdom for my second internship. At the MRC Toxicology Unit, University of Cambridge, I had the chance to work on a self-designed research project involving various epigenetic analyses on human embryonic stem cell-derived cardiomyocytes. Both internships significantly impacted me, deepening my passion for molecular biology and contributing to my personal growth."

- 2nd year Drug Safety and Toxicology student

Setting up an animal model to test endocrine disruption

I love organizing and communicating and I have always wanted to learn how to apply these skills within the pharmaceutical industry. During my internship at Charles River Laboratories in 's Hertogenbosch, I had the opportunity to do exactly that by setting up an *in vivo* endocrine disruption study. The comparative thyroid study aims to detect a compound's potential to disrupt thyroid hormones. The three most important things I learned was how different companies and universities operate, how crucial clear communication in a professional setting is, and how fulfilling it is to be the main coordinator of a study.

- 1st year Drug Safety and Toxicology 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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