# BIOMEDICAL SCIENCES
# Medical Neuroscience

Radboud Universiteit Radboudumc

# Medical Neuroscience

## A specialisation in the Biomedical Sciences Master's

Study cognitive, molecular, behavioral, and clinical neuroscience in the medical neuroscience specialisation to bridge the gap between fundamental neurobiology and clinical neurosciences.


### 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

The field of medical neuroscience has a strong multidisciplinary character with topics like cognition, molecular biology, behavioral neuroscience, and clinical neuroscience; these form the basics of the specialisation. At Radboud University, the specialisation Medical Neuroscience is characterised by a strong interdisciplinary approach with a translation to healthcare innovations. We focus on bridging the gap between fundamental neurobiology and clinical neurosciences. Within this specialisation we deal with questions such as:

- How does brain imaging help us understand brain function?
- What are the key processes in brain cells that differ in healthy and diseased states?
- How do factors like for example stress impact brain function?"
- How do animal models help us understand human brain disorders?

### Internship possibilities

You will choose between the research, consultancy or communication profiles. As part of the programme will do two internships; one research internship and one profile internship. Internships in the field of medical neursocience can be done at the Donders Institute and 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. The possibilities are endless!

### Career perspective for Medical Neuroscience alumni

Career perspectives for Medical Neuroscience alumni are varied. Many work in academia, pursuing PhDs in clinical, behavioral, or molecular neuroscience, or in related fields like molecular, nutrition, or movement science. They also find roles as research technicians, assistants, or in project and grant management. In industry, alumni often engage in business consultancy or data science roles. Others transition to HR, data management, or data stewardship roles both within and outside of academia.

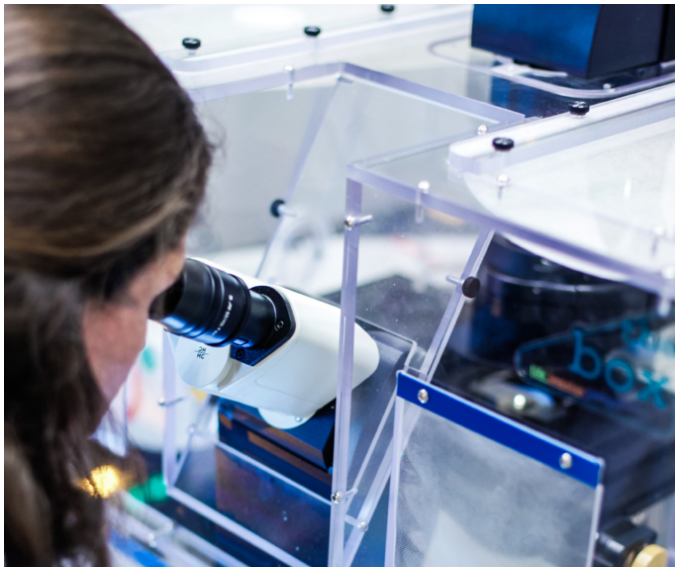
## Specialisation courses

### Advanced methods in neurobiology

The course will familiarize the students with the molecular, cellular, and animal toolkits used to infer causal mechanisms of neuronal processes in the central nervous system. This module provides comprehensive basic and advanced knowledge of the molecular and cellular biology of neurons and glia. The course also covers the major molecular pathways and mechanisms underlying learning. The course bridges neuroscience topics across scales, all the way to the study of living organisms with animal experimental models to advance our understanding of brain structure and function.

### Methods in human neuroscience

The course gives an overview of state-of-the art data acquisition and analysis techniques in human neuroscience. The course first introduces brain anatomy and how to image and analyze human brain structure using magnetic resonance imaging. It further explains electrophysiological and hemodynamic neuroscience techniques in humans. For each technique, the course covers acquisition methods, processing pipelines, and analyses approaches and provides a comparative summary of their respective utility. The course provides opportunities to work with human brain data and puts emphasis on how and when these methods are used in basic and clinical human neuroscience.



### Brains in Motion: Neural Control, Aging, and Neurodegeneration

This course explores the neural control of movement, sensorimotor integration, and the impact of brain aging on motor and cognitive functions. It bridges basic neuroscience with clinical and translational applications. The course covers motor systems (motor cortex, basal ganglia, cerebellum, and spinal mechanism of motor control) and sensory systems (sensory feedback, perception-action coupling, computational models of sensorimotor integration). The content is discussed through the lens of the neural and behavioral changes taking place in healthy aging and compensatory mechanisms taking place in pathophysiological conditions such as Parkinson's and Alzheimer's disease.

## Internship example: Development of labelling technique for remote fear memory

**"During this internship, I got to learn how to use animal models in neuroscience research as well as experiencing molecular wet lab with immunohistochemistry and confocal microscopy."**

**2nd year Medical Neurosciences student**

### Cognition and mental health

This course provides a general introduction to the neurobiological underpinnings of the mind and the cognitive control of behavior and emotions. Building on this content, the course links healthy cognition to mental health and its breakdown. Basic human neuroscience and clinical practice are being bridged by exploring preventative and treatment strategies. The course puts special emphasis on the topic of stress and its risk for mental and general health. The links between stress and basic cognitive functions such as learning and memory, emotion regulation, attention, and motivation are discussed. Circling back to the clinical practice, the link of stress to anxiety disorders, depression, and addiction is studied.

### Neurodevelopmental disorders from biology to bedside

This course covers neurodevelopmental disorders, starting from genetics to the development of cellular and animal models, to drug therapies. In the genetics part, the student explores both monogenic aspects as well as the polygenic interactions associated with complex phenotypes of neurodevelopmental disorders. This course is an optional elective, but integral to the medical neuroscience track.

### Other courses

In your elective space, you can take additional courses at other faculties or universities if you wish. Radboud University offers several master programmes that are topically close to the Medical Neuroscience specialisation of the BMS master and that span the field of neuroscience well. On the website www.ru.nl/en/donders-institute/talent-development you can get an overview of the Neuroscience related programmes at Radboud University. Students can also follow focused courses on neuropharmacology at University of Galway. Additionally, students can follow courses on neurotechnology and related fields at NeurotechEU.

### Internship example: Variability of sensory-evoked Functional MRI data in rat models.

**"In collaboration with international laboratories, we gathered more than 20 datasets of rodents' brain images through fMRI. At the Donders Institute, I analyzed and compared them to point out the heterogeneity of the data and identify the best protocols. I could present my work as a poster during a workshop in Italy, which was an awesome experience!"**

**2nd year Medical Neurosciences 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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