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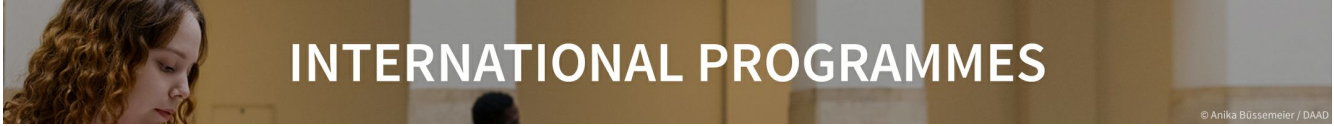
INTERNATIONAL PROGRAMMES

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Master's degree

Master's Programme in Computational Neuroscience

Technische Universität Berlin • Berlin

Overview

Degree	Master of Science
In cooperation with	Humboldt-Universität zu Berlin and Charité – Universitätsmedizin Berlin
Teaching language	• English
Languages	Courses are held in English only.
Full-time / part-time	• full-time
Programme duration	4 semesters
Beginning	Winter semester
Additional information on beginning, duration and mode of study	All courses take place in-person. The programme may switch to online formats if necessary, e.g. during a pandemic.
Application deadline	15 March for the following winter semester
Tuition fees per semester in EUR	None
Combined Master's degree / PhD programme	No
Joint degree / double degree programme	Yes
Description/content	Computational Neuroscience is a fast-growing discipline within the exciting field of neuroscience. It uses theoretical approaches from a variety of disciplines including mathematics, physics, computer science and engineering to understand the brain. Computational Neuroscience integrates experiment, data analysis and modelling. Furthermore, it makes a scientific language available that can be used across disciplines and levels for neurobiology, cognitive science and information technology. Computational Neuroscience may thus help to solve long-standing research questions, contribute to better prevention and treatment strategies for neural disorders, lead to unified concepts about biological processes, advance information technologies and human-machine interactions and, last but not least, provide new insight for designing efficient strategies for teaching and learning.

Structure of the programme

Within the first year of the programme, students are individually brought to a high level of competence in the basic fields of the programme. The second year of the programme is strongly research-oriented, including lab rotations and the Master's thesis.

Foundations (first and second semesters)

The modules "Models of Neural Systems" (12 CP), "Models of Higher Brain Functions" (12 CP), "Acquisition and Analysis of Neural Data" (12 CP) each cover both the theoretical and experimental aspects of each respective field. The module "Machine Intelligence" (12 CP) covers topics in machine learning and artificial neural networks. The module "Programming Course and Project" (6 CP) teaches the students a programming language and how to use it to specify, develop, document and test a larger programme. Within the first two semesters, students also have the opportunity to fill gaps in their knowledge by individual studies tailored to their needs with the aid of their mentors (6 CP).

Research-oriented phase (third and fourth semesters)

The third semester is devoted to lab rotations. Every student will participate in research projects in three different laboratories affiliated with the Bernstein Center. Each of the three projects lasts for approx. two months (3 x 9 CP). The projects will be tailored to give intensive hands-on experience to the students. They will carry out individual research projects and will be supervised by a senior researcher. The three projects include at least one theoretical and one experimental project. Additionally, students will take an obligatory course on ethical issues and the societal implications of brain research (3 CP) as well as elective courses on advanced topics (10 CP).

The fourth semester is primarily devoted to thesis research (20 CP) and complemented by courses on advanced topics (10 CP). The Master's thesis is concluded by an oral presentation (defence).

The BCCN Berlin also offers preparatory courses in mathematics and neurobiology for admitted students, which take place from September to October before the beginning of the winter semester.

This is a joint degree programme of the TU Berlin and the HU Berlin, organised by the BCCN Berlin. Teaching takes place at HU Berlin (BCCN Berlin, Campus Nord, postal code 10115) and at TU Berlin (postal code 10587).

Course Details

Course organisation

The programme consists of modules. The Master's programme covers 120 credit points in total. Most modules are followed by an oral exam. The teaching methods employed are as follows: lectures; tutorials, i.e. solving of analytical and mathematical exercises, solving of programming tasks; practicals, i.e. experimental laboratory work; projects, i.e. programming projects; and seminars. Within a module, the different teaching methods complement one another by covering different aspects of the same topic.

Models of Neural Systems: The module provides the relevant, basic neurobiological knowledge and the relevant theoretical approaches as well as the findings resulting from these approaches. Students will learn to appropriately choose the theoretical methods for modelling neural systems and how to apply these methods.

Models of Higher Brain Functions: The module provides basic knowledge about how to model higher brain functions with an emphasis on basic neurobiological and psychophysical concepts. Examples will be drawn from vision, memory, attention and executive functions.

Acquisition and Analysis of Neural Data: Students will gain knowledge about the most important methods for experimental acquisition of neural data and the respective analytical methods. Students will learn about the different fields of application, the advantages and disadvantages of the different methods and will become familiar with the respective raw data.

Machine Intelligence: Students will learn about the most important methods in artificial

intelligence and machine learning. After completing the module, students will be able to evaluate the performance of the methods discussed and to apply them successfully to the respective application domains.

Programming Course and Project: Students will be able to understand and use basic and advanced concepts of a programming language and to develop complex programmes. Furthermore, they will be able to develop a larger programme (in collaboration with other students) including the necessary specifications, documentation and tests.

Individual Studies: As the Master's programme in Computational Neuroscience is an interdisciplinary study programme, this module serves to fill individual gaps in the student's background knowledge.

Ethical Issues and Implications for Society: Students will learn to reflect on the ethical and societal consequences of modern neuroscience.

Courses on Advanced Topics: In this module, students will deepen their studies on specific topics in computational neuroscience according to their individual interests.

Lab Rotation: In the lab rotation, students will learn to work on a research-related scientific question in collaboration with the supervising research group and to present their results adequately.

Furthermore, elective courses on advanced topics in Computational Neuroscience may be attended.

The BCCN Berlin also offers preparatory courses in mathematics and neurobiology for admitted students, which take place from September to October before the beginning of the official programme.

A fast track option is possible via the Einstein Center for Neurosciences Berlin. Please contact BCCN Berlin.

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A Diploma supplement will be issued	Yes
Certificates for specific modules are awarded	Yes
International elements	• Projects with partners in Germany and abroad
Integrated internships	During the second year, students do three lab rotations in different BCCN Berlin member labs. One of the lab rotations may be completed in an external lab.
Course-specific, integrated German language courses	No
Course-specific, integrated English language courses	No

Costs / Funding

Tuition fees per semester in EUR	None

Semester contribution	Approx. 315 EUR per semester
Costs of living	- Rent for a room: 300 to 600 EUR per month (300 EUR only in the university housing facilities, which are very sought after and difficult to find.) - Health insurance: around 90 EUR per month - Living costs: around 400 EUR per month - Public transportation is included in the semester contribution. - Total monthly cost of living: around 900 to 1100 EUR
Funding opportunities within the university	Yes
Description of the above-mentioned funding opportunities within the university	Limited funding through the Deutschlandstipendium is available. This can cover part of the cost of living (300 EUR per month).

Requirements / Registration

Academic admission requirements	- Bachelor's degree (or equivalent) in natural sciences, engineering or mathematics - Sufficient mathematical knowledge (at least 24 credit points) particularly in linear algebra (at least six credit points), analysis/calculus – including dynamical systems (at least six credit points), probability theory and statistics (at least six credit points) - Proficiency in English: See the language requirements below.
Language requirements	Proficiency in English: Non-native speakers need to document this via the TOEFL test (570 points on the paper-based test, 230 points on the computer-based test, 88 points on the Internet-based test) or an equivalent certificate. Students holding a degree from a programme taught entirely in English are not required to submit a language certificate.
Application deadline	15 March for the following winter semester
Submit application to	If you have / will have obtained your degree from a German university: - submit your application directly to the TU Berlin All other applicants apply via the uni-assist portal: - https://www.uni-assist.de

Services

Possibility of finding part-time employment	The member labs of the Bernstein Center for Computational Neuroscience Berlin offer research assistant jobs to students. These jobs are regularly announced via e-mail and on websites and interested students can apply. Working hours range from 41 hours per month (more common) to 60

hours per month, paid at an hourly rate of 12.50 EUR.

Accommodation	Finding accommodation in Berlin can be a challenge. Students of the programme have several possibilities to find accommodation. Whatever district they prefer to live in, it is advisable to find a place with access to public transport. This is very convenient in everyday life and can save a lot of time. If students are interested in residential accommodation, the "Berliner Studentenwerk" offers a number of different options, such as single rooms, apartments, or a shared flat. Rent starts at approx. 300 EUR but these accommodations are quite sought after and thus very difficult to find. Students should expect to pay approx. 500 EUR for rent. Students can also choose to find a room or flat privately. The coordination office and the "Studentenwerk Berlin" provide links and recommendations for finding accommodation.
Career advisory service	Master's students have mentors who can give career advice. Additionally, there are possibilities to talk to BCCN Berlin alumni and PhD students during the BCCN Berlin events, social gatherings, workshops, at the graduate programme's table ("Stammtisch"), common classes, the yearly retreat and alumni workshops. Universities offer career advice and workshops. Participation in the BCCN Berlin alumni workshops with career sessions is possible every three years.
Support for international students and doctoral candidates	- Welcome event - Tutors - Specialist counselling - Visa matters
Supervisor-student ratio	1:20

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Liz Weerdmeester
MSc

This Master's programme is very research oriented and aims to entice students to answer unknown questions about the brain. It does this by requiring internships in different labs where students do research on various neuroscience topics. The theory provided in the lectures is very comprehensive and offers a great background to get started in the labs. I loved the hands-on and project-oriented approach of the programme and would definitely recommend it to anyone who is interested in the subject.

Our Partners

Technische Universität Berlin

Yard of the BCCN Berlin

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The Bernstein Center for Computational Neuroscience Berlin (BCCN Berlin)

The graduate programmes in Computational Neuroscience are closely associated with the BCCN Berlin. The centre comprises more than 60 research groups working across levels from the single-cell level up to the macroscopic level, both experimentally and theoretically. It was established with support from the German Federal Ministry for Education and Research (BMBF). The BCCN Berlin is part of the

Bernstein Network for Computational Neuroscience and integrates research groups from Humboldt-Universität zu Berlin, Technische Universität Berlin, Charité-Universitätsmedizin Berlin, Freie Universität Berlin, Potsdam University and the Max Delbrück Center for Molecular Medicine. The BCCN Berlin offers a unique scientific environment for students in this programme.

Technische Universität Berlin (TU Berlin) – Paving the Way to the Future

The university's activities focus on achieving four sharply-defined core goals: building a distinctive profile, ensuring exceptional performance in research and teaching, providing our graduates with excellent qualifications, and promoting a forward-looking approach to efficient university governance. TU Berlin strives to promote the accumulation of knowledge and to facilitate technological progress by adhering to the fundamental principles of excellence and quality. Strong regional, national and international networking with partners in science and industry is an important aspect in all these endeavours.

Humboldt-Universität zu Berlin (HU Berlin) – The Unity of Research and Teaching

Humboldt's ideal of the co-existence of research and teaching has become a model for universities all over the world. Central to this model is the idea of research-oriented teaching and the transfer of knowledge from the spirit of research. Students and teachers join in an endeavour to critically examine traditional bodies of knowledge and to actively advance learning. For this reason, the HU Berlin promotes social and communicative competence among all of its members and supports their initiatives wherever it can. Since 2012, HU Berlin has been the recipient of funding by the German federal and state governments for its Institutional Strategy "Bildung durch Wissenschaft. Educating Inquiring Minds: Individuality - Openness - Guidance".

Charité-Universitätsmedizin Berlin (Charité) – Medical School

The Charité is one of the largest university hospitals in Europe. Here, 3,700 doctors and scientists heal, carry out research, and teach at the top international level. The Charité also has an international reputation for excellence in training. It extends over four campuses, with almost 100 clinics and institutes bundled under 17 Charité Centers. In 2010, the Charité was able to look back and joyously celebrate its 300th anniversary.

University location

Berlin is both the capital city of Germany and one of sixteen German federal states. Berlin is Germany's largest city, with 3.7 million inhabitants. The city spreads across 892 km² and is divided into twelve districts. Incorporated into the city area are numerous forests, parks and garden plots – a total of more than 2,500 public recreational and green spaces, making Berlin a green city.

Founded in the 13th century, Berlin has had an eventful history. Practically no other metropolis has experienced such frequent, radical change, which has transformed the face of the city. Although Berlin has seen a steady growth in its importance, dazzling epochs have alternated with darker eras. Nevertheless, the formerly divided city has succeeded in becoming a vibrant metropolis in the heart of Europe.

Berlin offers a large number of things to do in your spare time. For example, there are 52 theatres and stages, 153 museums and 279 cinemas. Several magazines detailing cultural events taking place in Berlin can help you decide what to do. Exberliner, for example, is an English-language paper for Berlin.

Contact

Technische Universität Berlin
Institute of Software Engineering and Theoretical Computer Science

Lisa Velenosi

Marchstr. 23
10587 Berlin

Tel. +49 3020936773
✉ graduateprograms@bccn-berlin.de
🌐 Course website: https://www.bccn-berlin.de/master-program.html

⚫ https://twitter.com/bccn_berlin

in https://www.linkedin.com/company/86173244/admin/feed/posts/

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