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**UNIVERSITÄT  
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**Module handbook**  
**Neural and Behavioural Sciences**  
**Master of Science**

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**Faculty of Science and Medical Faculty**  
**Graduate Training Centre of Neuroscience**



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## 1. Objectives of the program

The Master of Science program in *Neural and Behavioural Sciences* is an international, research-oriented two-year master's program offered by the Graduate Training Centre of Neuroscience at the University of Tübingen. We invite students with a first academic degree (BSc) in biology, psychology, cognitive science, medical sciences, computer science or in another relevant field of natural or engineering sciences. The theoretical training focuses on systems and cognitive neuroscience, neurophysiology, neuropsychology and clinical neuroscience, theoretical neuroscience, and brain imaging methods. The practical training covers state-of-the-art methods of neuroscience research offered by our internationally renowned partner institutes.

The Graduate Training Centre of Neuroscience creates an interdisciplinary environment through its three Master of Science programs with complementary focus and curricula: *Neural and Behavioural Sciences*, *Cellular and Molecular Neuroscience*, and *Computational Neuroscience*. The curricula in all three programs are synchronized and comprise large elective modules. We encourage our students to cross borders during their theoretical training in their first year. Depending on their individual skills, interests, and motivation the students are welcome in labs beyond their specific master's program for their practical research activities in the second year.

- Our graduates have a sound standing in the interdisciplinary field of neuroscience, extending from molecular, cellular and physiological neuroscience, sensory and motor systems, to clinical and cognitive neuroscience.
- Our graduates have profound skills in mathematics, statistics and programming, allowing them to measure, analyse, and visualize data and results.
- Our graduates have solid theoretical and hands-on expertise in a wide range of state-of-the-art brain imaging methods in humans, neurophysiological recordings (in vivo and in vitro), and psycho-physical and behavioural experimental approaches.
- Our graduates scrutinize and evaluate the suitability of experimental approaches, allowing them to choose the most appropriate methods for a given problem. They combine techniques in a meaningful way to attack complex scientific problems.
- Our graduates communicate their findings competently and convincingly in oral and written form. They communicate and discuss with experts in the field and contribute to discussions on current neuroscientific topics.
- Our graduates acquired general competencies such as time and conflict management, coping with stressful situations, as well as social skills.
- Our graduates gained cross-cultural competencies allowing them to succeed and thrive in international teams.

After successful graduation, our students are prepared for a career in research and development in internationally competitive institutes and companies. Beyond research and development, our graduates excel in the acquisition of new knowledge, project management, and problem-solving.

## 2. Curriculum

### 2.1 Module Overview

(according to the module overview of the study and examination regulations)

Module Code	Compulsory Elective	Module title	Semester	CP
<b>NB01</b>	<b>c</b>	<b>Neuroanatomy and Neurophysiology</b>	<b>1</b>	<b>9</b>
<b>NB02</b>	<b>c</b>	<b>Sensorimotor Systems</b>	<b>1 &amp; 2</b>	<b>9</b>
<b>NB03</b>	<b>c</b>	<b>Cognitive Neuroscience</b>	<b>2</b>	<b>6</b>
<b>NB04</b>	<b>c</b>	<b>Neuropsychology</b>	<b>1 &amp; 2</b>	<b>6</b>
<b>NB05</b>	<b>c</b>	<b>Data Analysis</b>	<b>1 &amp; 2</b>	<b>6</b>
<b>NB06</b>	<b>c</b>	<b>Advanced Methods</b>	<b>1 &amp; 2</b>	<b>9</b>
<b>NB07</b>	<b>c</b>	<b>Advanced Neuroscience</b>	<b>1 &amp; 2</b>	<b>9</b>
<b>NB08</b>	<b>c</b>	<b>Electives</b>	<b>1 &amp; 2</b>	<b>6</b>
<b>NB09</b>	<b>c</b>	<b>Current Research and RCR</b>	<b>1 &amp; 2</b>	<b>3</b>
<b>NB10</b>	<b>c</b>	<b>Laboratory Rotations</b>	<b>3</b>	<b>27</b>
<b>NB11</b>	<b>c</b>	<b>Master's thesis</b>	<b>4</b>	<b>30</b>

*c = compulsory, ce = compulsory elective, e = elective*

Semesters 1 and 2 comprise theoretical courses with a total workload equivalent to 61 CPs. A core curriculum of compulsory courses (c) accounts for 37 CPs (NB01 – NB05, NB09).

In the compulsory elective (ce) modules NB06 and NB07 the students complete 1-3 courses, which sum up to 9 CPs. In contrast to the compulsory modules, the students can choose from multiple courses that all address the respective module's title and general description. The individual module descriptions for NB06 and NB07 in chapter 3.2 comprise an exclusive list of available courses for the current academic year.

The elective module NB08 allows the students to choose courses from any master's program at the University of Tübingen except for sports courses. While all other modules contribute to the final grade, the elective module NB08 does not. The students are invited to explore the field of neural and behavioural sciences and other disciplines.

In the program's 2<sup>nd</sup> year the students join labs of their choice for two lab rotations and, finally, their master's thesis.

## 2.2 Module overview by suggested time course

The coursework is completed in the semesters 1 and 2 with the only exception of a block course in module NB09.

The compulsory module *NB05 – Data Analysis* offers a choice between courses depending on the individual student’s skills and interests. It consists of one statistical course and one programming or mathematics course. The students choose between basic and advanced courses. Depending on the student’s choice of courses for *NB05 – Data Analysis*, these courses will be completed in the 1<sup>st</sup> or the 2<sup>nd</sup> semester. Please see the following chapter 2.3 overview by study progress and the individual module description in chapter 3.1 for more details.

For the compulsory elective and elective modules CM06 – CM08 the workload per semester is determined by the individual students’ choice of available courses. A workload of 36 CPs per semester should not be exceeded.

**It is strongly recommended to complete all coursework requirements before the commencement of the 1<sup>st</sup> lab rotation.** Depending on the lab and the project to be completed during a rotation, additional coursework during this period represents an additional burden that must not be taken lightly.

**Modules NB01 – NB10 must be completed before admission to the master’s thesis.**

Study area	Nr.	Module	Semester				Σ
			1	2	3	4	CP
Foundations	NB01	Neuroanatomy and Neurophysiology	9				6
	NB02	Sensorimotor Systems	6	3			9
	NB03	Cognitive Neuroscience		6			6
	NB04	Neuropsychology	3	3			6
	NB05	Data Analysis	0-6	0-6			6
Advanced Specialisations	NB06	Advanced Methods	0-9	0-9			9
	NB07	Advanced Neuroscience	0-9	0-9			9
Individual Perspectives	NB08	Electives	0-6	0-6			6
Research Practise	NB09	Current Research and Conduct	0.5	0.5	2		3
	NB10	Laboratory Rotations			27		27
	NB11	Master thesis				30	30
		Σ Compulsory with <i>Data Analysis</i> in Sem 1	24.5	12.5	29	30	
		Σ Electives with <i>Data Analysis</i> in Sem 1	6	18			120
		Σ Compulsory with <i>Data Analysis</i> in Sem 2	18.5	18.5	29	30	
		Σ Electives with <i>Data Analysis</i> in Sem 2	12	12			120

## 2.3 Overview by study progress and credit requirements

		Assessment				Course			Total CP	Semester			
		Grading	Type of exam	Duration of the exam	Weight for the module	Credit hours (SWS)	Status	Type of course		The allocation of exams to semesters is only a recommendation. Compulsory allocations are marked as such.			
										1.	2.	3.	4.
Abbreviations are explained below in chapter 3 (Module descriptions).										CP	CP	CP	CP
<b>Foundations</b>													
NB01	Neuroanatomy and -physiology								6				
NB01-1	Functional Organization of Vertebrate CNS	ne				2	c	L/P		3			
NB01-2	Neurophysiology	g	w	90	100	2	c	L/T		3			
NB01-3	Molecular and Cellular Neuroscience	ne				2	c	L/T		3			
NB02	Sensorimotor Systems								9				
NB02-1	Sensory Systems 1	g	w	90	50	2	c	L/T		3			
NB02-2	Sensory Systems 2	g	w	90	50	2	c	L/T			3		
NB02-3	Motor Systems	ne				2	c	L/T		3			
NB03	Cognitive Neuroscience								9				
NB03-1	Lecture	g	w	120	100	2	c	L			3		
NB03-2	Seminar	ne				2	c	S			3		
NB04	Neuropsychology								6				
NB04-1	Methods in Neuropsychology	ne				2	c	L/T		3			
NB04-2	Neuropsychology	g	w	60		2	c	L/T			3		
NB05	Data Analysis								6				
NB05-1.1	Essential Statistics	g	h/e	90		2	c/e	L/E		3			
NB05-1.2	Advanced Statistics	g	h	90		2	c/e	L/E			3		
NB05-2.1	Essential Mathematics	ne				2	c/e	L/E		3			
NB05-2.2	Basic Programming	ne				2	c/e	S/E/P		3			
<b>Advanced Specialisations</b>													
NB06	Advanced Methods								9				
NB06-1	Elective Advanced Methods 1	g/ng/ne				2	ce	L/S/E/P					
NB06-2	Elective Advanced Methods 2	g/ng/ne				2	ce	L/S/E/P					
NB06-3	Elective Advanced Methods 3	g/ng/ne				2	ce	L/S/E/P					
NB07	Advanced Neuroscience								9				
NB07-1	Elective Adv. Neuroscience 1	g/ng/ne				2	ce	L/S/E/P					
NB07-2	Elective Adv. Neuroscience 2	g/ng/ne				2	ce	L/S/E/P					
NB07-3	Elective Adv. Neuroscience 3	g/ng/ne				2	ce	L/S/E/P					
<b>Individual Perspectives</b>													
NB08	Free Elective								6				
NB08-1	Free Elective 1	g/ng/ne				2	e	L/S/E/P					
NB08-2	Free Elective 2	g/ng/ne				2	e	L/S/E/P					
<b>Research Practise</b>													
NB09									3				
NB09-1	Neurocolloquium	ne				2	c	L		0.5	0.5		
NB09-2	Scholarly Research	ne				2	c	S/P				2	
NB10	Laboratory Rotations								27				
NB10-1	Laboratory Rotation 1	g	lr/pr				c	P/S				13	
NB10-2	Laboratory Rotation 2	g	lr/pr				c	P/S				14	
<b>Final module</b>													
NB11	Master thesis	g	th										30

## 2.4 Suggested timeline for individual courses

1. Semester // Winter Semester		Credits
Functional Organization of Vertebrate CNS ( <i>block, 1<sup>st</sup> week lecture period</i> )	3	
Neurophysiology	3	
Molecular and Cellular Neuroscience	3	
Sensory Systems 1	3	
Motor Systems	3	
Methods in Neuropsychology	3	
Essential Mathematics	3	
Advanced Methods – Course I	3	
Advanced Neuroscience – Course I	3	
Individual Perspectives – Course I	3	
NeuroColloquium	0,5	<b>Σ 30,5</b>
2. Semester // Summer Term		Credits
Sensory Systems 2	3	
Cognitive Neuroscience (Lecture + Seminar)	6	
Neuropsychology	3	
Advanced Statistics	3	
Advanced Methods – Course II	3	
Advanced Methods – Course III	3	
Advanced Neuroscience – Course II	3	
Advanced Neuroscience – Course III	3	
Individual Perspectives – Course II	3	
NeuroColloquium	0,5	<b>Σ 30,5</b>
3. Semester // Winter Semester		Credits
Scholarly conduct of research ( <i>1-week block, before rotations</i> )	2	
Essay / Laboratory Rotations	27	<b>Σ 29</b>
4. Semester // Summer Term		Credits
Master Thesis	30	<b>Σ 30</b>
		<b>Σ 120</b>

### 3. Module descriptions

The following module descriptions provide an overview of the *Neural and Behavioural Sciences* master's program for the current academic year. Please note that the content elements of individual modules and the lecturers might be subject to changes between academic years. The following abbreviations are used in the following module descriptions and in the previous overview of the study progress.

Key	
Grading:	g = graded; ng = not graded (pass/fail); ne = no examination
Type of exam:	w = written exam; pj = project; lr = lab report, pr = presentation, lr = lab report
Duration:	Duration of the examination in minutes.
Weight:	Courses: Weighting of the examination grade towards the module grade. Modules: Weighting of the module grade towards the final grade.
Credit hours (SWS):	Hours spent in the classroom per week during the semester.
Status:	c = compulsory; e = elective
Type of course:	L = lecture; S = seminar; E = exercise, T = tutorial, P = practical work
CP:	credit points (ECTS)



### 3.1. Foundations

<b>Modul code:</b> NB01	<b>Module title:</b> Neuroanatomy and Neurophysiology			<b>Type of module:</b> compulsory					
<b>CP (ECTS credits)</b>	9								
<b>Workload</b> - Contact hours - Self-study	Total workload: 270 h	Contact hours: 90 h / 6 SWS	Self-study: 180 h						
<b>Duration</b>	1 Semester								
<b>Frequency</b>	once a year, during the winter semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Lectures with practical work and tutorials.								
<b>Content</b>	This module teaches the fundamental anatomy and physiology of the mammalian CNS with an emphasis on the human brain. The lecture on cellular and molecular neuroscience introduces to the lower levels of neural function, genes, proteins and sub-cellular compartments.								
<b>Qualification goals</b>	Students understand and can explain basic principles of the functional and anatomical organization of the nervous system on the microscopic and macroscopic level. Students understand electrical signal generation, signal processing and integration in neurons, and signal transmission at the chemical synapse. They understand the basics of the techniques used to study neuronal processing at the single cell and small neuronal network level.								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (SWS)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Functional Organization of Vertebrate CNS</i>	<i>L/P</i>	<i>c</i>	<i>2</i>	<i>3</i>				
	<i>Neurophysiology</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>	<i>w</i>	<i>90</i>	<i>g</i>	<i>100</i>
	<i>Molecular and Cellular Neuroscience</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>				
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	Basic knowledge of cell biology, physiology, and brain organisation.								

<b>Modul code:</b> NB02	<b>Module title:</b> Sensorimotor Systems			<b>Type of module:</b> compulsory					
<b>CP (ECTS credits)</b>	9								
<b>Workload</b> - Contact hours - Self-study	Total workload: 270 h			Contact hours: 90 h / 6 SWS			Self-study: 180 h		
<b>Duration</b>	2 Semester								
<b>Frequency</b>	once a year, during the winter and summer semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Lectures with tutorials.								
<b>Content</b>	The module covers the functional and anatomical organisation of the sensory and motor systems of the mammalian brain, focusing on humans. Principles of neural coding and information processing will be emphasized. Based on the knowledge of the intact system, causes and consequences of disease are introduced.								
<b>Qualification goals</b>	The students understand the function of sensory receptor cells, receptor proteins, and signal transduction cascades. The students can differentiate common and specific features of the processing and coding of sensory information. The students know and understand dysfunctions and diseases of sensory systems in human patients. The students can explain the concepts of information processing in the motor pathways and circuits involved in sensorimotor integration and control.								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (SWS)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Sensory Systems I</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>	<i>w</i>	<i>90</i>	<i>g</i>	<i>50</i>
	<i>Sensory Systems II</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>	<i>w</i>	<i>90</i>	<i>g</i>	<i>50</i>
	<i>Motor Systems</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>				
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	Basic knowledge of cell biology, physiology, and brain organisation.								

<b>Modul code:</b> NB03	<b>Module title:</b> Cognitive Neuroscience		<b>Type of module:</b> compulsory						
<b>CP (ECTS credits)</b>	6								
<b>Workload</b> - Contact hours - Self-study	Total workload: 180 h	Contact hours: 60 h / 4 SWS	Self-study: 120 h						
<b>Duration</b>	1 Semester								
<b>Frequency</b>	once a year, during the summer semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Lecture, Seminar.								
<b>Content</b>	With an emphasis on evolutionary and comparative aspects, this module addresses the behavioural and neural foundations of cognition from insects to humans. Topics comprise: Theory of evolution; evolutionary neuroscience; phylogeny and ontogeny of communication & social cognition; neuroethological model systems of cognition, core knowledge of objects, actions, number, and space.								
<b>Qualification goals</b>	The students can identify the fundamental evolutionary and physiological constraints driving the design of different cognitive behaviours from a comparative point of view. The students understand the adaptive value of cognition and can characterize the similarities and differences of human compared to animal cognition. They understand the neural mechanisms giving rise to cognition across the animal kingdom. The students are familiar with the techniques used to link brain and cognition. They think critically about issues related to topical concepts in cognition.								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (SWS)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Lecture</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>	<i>w</i>	<i>120</i>	<i>g</i>	<i>100</i>
	<i>Seminar</i>	<i>S</i>	<i>c</i>	<i>2</i>	<i>3</i>				
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	Basic knowledge of cell biology, physiology, and brain organisation.								

<b>Modul code:</b> NB04	<b>Module title:</b> Neuropsychology		<b>Type of module:</b> compulsory						
<b>CP (ECTS credits)</b>	6								
<b>Workload</b> - Contact hours - Self-study	Total workload: 180 h	Contact hours: 60 h / 4 SWS	Self-study: 120 h						
<b>Duration</b>	1 Semester								
<b>Frequency</b>	once a year, during the winter and summer semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Lecture with tutorials.								
<b>Content</b>	Understanding impairments of brain functions and their causal link with cognitive impairments provides crucial information for the development and validation of models of intact brain functions. Beyond behavioural studies in patients, further techniques for investigations in human cognitive neuroscience are functional neuroimaging, electro- and magnetoencephalography, as well as interference methods such as transcranial magnetic stimulation. The module presents the fundamentals of these different methods as well as clinical and scientific results obtained by using these techniques, all with respect to their contribution for our understanding of cognitive functions in healthy humans and patients.								
<b>Qualification goals</b>	Students know brain networks underlying cognitive functions in humans and understand the effects of brain diseases and damage. Students understand the fundamentals of methods for studies on brain structure and function in humans. They critically reflect the clinical and scientific results obtained from these different methods and the respective contributions to our understanding of cognitive functions such as language, attention, perception, action control, learning, consciousness etc.								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>									
		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (SWS)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Neuropsychology</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>	<i>w</i>	<i>90</i>	<i>g</i>	<i>100</i>
	<i>Methods in Neuropsychology</i>	<i>L/T</i>	<i>c</i>	<i>2</i>	<i>3</i>				
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	Basic knowledge of cell biology, physiology, and brain organisation.								

<b>Modul code:</b> NB05	<b>Module title:</b> Data analysis		<b>Type of module:</b> compulsory							
<b>CP (ECTS credits)</b>	6									
<b>Workload</b> - Contact hours - Self-study	Total workload: 180 h			Contact hours: 60 h / 4 SWS			Self-study: 120 h			
<b>Duration</b>	1 or 2 Semester, depending on chosen courses									
<b>Frequency</b>	once a year, during the winter and summer semester									
<b>Language of instruction</b>	English									
<b>Teaching methods</b>	Lectures with exercises and tutorials. Seminar with practical work.									
<b>Content</b>	The module comprises courses that cover statistics, mathematics, and programming skills for neuroscience.									
<b>Qualification goals</b>	The statistics course provides students with an understanding of and practical skills for basic or advanced statistical data analysis. The students apply statistical approaches to their own data and evaluate analyses in publications. The course on basic programming provides students with programming skills for data analysis and visualization. The students formalize neuroscientific concepts mathematically and understand the mathematical concepts, which are required for reading journal papers in neurophysiology and systems neuroscience.									
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>			Type of course	Status	Contact hours (SWS)	CP	Type of exam	Exam duration	Grading	Weight for module
	Choose 1 course	Essential Statistics	L/E/T	c/e	2	3	h/e	90	g	100
		Advanced Statistics	L/E	c/e	2	3	h	90	g	100
	Choose 1 course	Basic programming	S/P	c/e	2	3	h	90	ne	
Essential Mathematics		L/E/T	c/e	2	3	h	90	ne		
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences and MSc Cellular and Molecular Neuroscience. Courses not chosen here can be used for module NB06 <i>Advanced Methods</i> .									
<b>Participation requirements</b>	Basic mathematical and statistical skills are required.									

### 3.2. Advanced Specialisations

The compulsory elective study area *Advanced Specialisations* offers the students a choice of courses that build on knowledge and skills acquired in the compulsory study area *Foundations* and during their individual first-degree studies. The study area consists of two modules with 9 CPs each, one module comprising methods and applications, and another module focusing on specific topics in neuroscience. A list of available courses for these modules is curated by the study commission before each semester. Criteria for the selection of courses in these modules are the fit to the course program and the general theme of the respective module, the quality and reliability of the courses, and the range of interests among the students in the program. Available courses for each semester are published in the updated module handbook and in the university’s course catalogue.

<b>Modul code:</b> NB06	<b>Module title:</b> Advanced methods		<b>Type of module:</b> compulsory/elective
<b>CP (ECTS credits)</b>	9		
<b>Workload</b> - Contact hours - Self-study	Total workload: 270 h	Contact hours: 90 h / 6 SWS	Self-study: 180 h
<b>Duration</b>	2 Semester		
<b>Frequency</b>	once a year, during the summer or winter semester		
<b>Language of instruction</b>	English		
<b>Teaching methods</b>	Depends on chosen course: lecture, seminar, exercise, tutorial, practical work.		
<b>Content</b>	<p>Students can choose from a closed list of methods courses beyond the study area <i>Foundations</i>. These courses introduce methods and techniques for data acquisition, e.g. brain imaging methods, data analysis and interpretation, e.g. advanced statistics and machine learning, or applications and modelling, e.g. neural modelling. Students choose courses with a total workload of 9 CP irrespective of the number of courses, e.g. 1 course of 9 CP or 3 courses of 3 CP each. At least 3 CP must be graded and will be included in the cumulative, final grade. Students can choose courses from the module NB05, which they have not completed for this module (e.g. “Essential Statistics” for NB05 and “Advanced Statistics” for NB06). The list of available courses is curated by the study commission. Students can choose from:</p> <p><b>Winter term 2023/24:</b></p> <ul style="list-style-type: none"> <li>• Courses from module NB05 Data analysis (please see above).</li> <li>• <a href="#">Physiol and Physic Basis of Brain Imaging (Bartels &amp; Siegel; 3 CP; graded)</a></li> <li>• <a href="#">Machine Learning + Exercises (Berens; 6 CP; graded)</a></li> </ul>		

	<ul style="list-style-type: none"> <li>• <a href="#">Intro to Computational Neuroscience (Veit; 3 CP; graded)</a> <ul style="list-style-type: none"> <li>• <a href="#">... optional with exercises (Veit; 3 CP; grade from lecture exam)</a></li> </ul> </li> <li>• <a href="#">Models of neural systems (Benda; 6 CP; graded)</a></li> <li>• <a href="#">Data-driven Computational Psychiatry (Kaufmann; 3 CP; graded)</a></li> <li>• <a href="#">Neural Modelling (Dayan et al.; 6 CP; graded)</a></li> <li>• <a href="#">Methods in Molecular Neurobiology (Himmelbach; 3 CP; graded)</a></li> <li>• <a href="#">Neural Experimental Techniques (Euler; 3 CP; graded)</a></li> <li>• <a href="#">Electrophysiology Practical (Schwarz; 3 CP; not graded; block course)</a></li> <li>• <a href="#">Courses of the Dr. Eberle Zentrum für dig. Kompetenzen (not graded)</a></li> </ul> <p><b>Summer term 2024:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Cognitive Modeling (Butz; 6 CP; graded)</a></li> <li>• <a href="#">Novel Therap Approaches for Sens Disorders (Reisinger; 3 CP; not graded)</a></li> <li>• <a href="#">Method Frontiers in the Cogn Neurosci (Himmelbach; 3 CP; not graded)</a></li> <li>• <a href="#">MRI-appl for Neurosc &amp; Clin Res + Sem (Hagberg; 6 CP; not graded)</a></li> <li>• <a href="#">Clinic Cases and Conseq for Med Devices (Gharabaghi; 6 CP; not graded)</a></li> <li>• <a href="#">Electrophysiology (Nieder; 6 CP; graded)</a></li> <li>• <a href="#">Microscopy and Optogenetics (Arrenberg; 6 CP; graded; block course)</a></li> <li>• <a href="#">Laboratory Animal Handling Course (3 CP; not graded; online)</a></li> <li>• <a href="#">Courses of the Dr. Eberle Zentrum für dig. Kompetenzen (not graded)</a></li> </ul>																																				
<p><b>Qualification goals</b></p>	<p>The students build on their individual skills and interests. They extend their theoretical and practical expertise in an advanced methods area of their choice.</p>																																				
<p><b>Requirements for Obtaining Credit, Grading, weight if applicable:</b></p>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #f2f2f2;"> <th style="width: 30%;"></th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Type of course</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Status</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Contact hours (SWS)</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">CP</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Type of exam</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Exam duration</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Grading</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Weight for module</th> </tr> </thead> <tbody> <tr> <td><i>Advanced Methods I</i></td> <td>L/S/E/P</td> <td>e</td> <td>2</td> <td>0-9</td> <td></td> <td></td> <td><i>g</i></td> <td>100</td> </tr> <tr> <td><i>Advanced Methods II</i></td> <td>L/S/E/P</td> <td>e</td> <td>2</td> <td>0-6</td> <td></td> <td></td> <td><i>g/ng/ne</i></td> <td></td> </tr> <tr> <td><i>Advanced Methods III</i></td> <td>L/S/E/P</td> <td>e</td> <td>2</td> <td>0-6</td> <td></td> <td></td> <td><i>g/ng/ne</i></td> <td></td> </tr> </tbody> </table>		Type of course	Status	Contact hours (SWS)	CP	Type of exam	Exam duration	Grading	Weight for module	<i>Advanced Methods I</i>	L/S/E/P	e	2	0-9			<i>g</i>	100	<i>Advanced Methods II</i>	L/S/E/P	e	2	0-6			<i>g/ng/ne</i>		<i>Advanced Methods III</i>	L/S/E/P	e	2	0-6			<i>g/ng/ne</i>	
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<i>Advanced Methods I</i>	L/S/E/P	e	2	0-9			<i>g</i>	100																													
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<i>Advanced Methods III</i>	L/S/E/P	e	2	0-6			<i>g/ng/ne</i>																														
<p><b>Applicability and Transfer</b></p>	<p>Compulsory module MSc Neural and Behavioural Sciences.</p>																																				
<p><b>Participation requirements</b></p>	<p>Depends on the student's choice.</p>																																				

<b>Modul code:</b> NB07	<b>Module title:</b> Advanced Neuroscience		<b>Type of module:</b> compulsory/elective
<b>CP (ECTS credits)</b>	9		
<b>Workload</b> - Contact hours - Self-study	Total workload: 270 h	Contact hours: 90 h / 6 SWS	Self-study: 180 h
<b>Duration</b>	2 Semester		
<b>Frequency</b>	once a year, during the summer or winter semester		
<b>Language of instruction</b>	English		
<b>Teaching methods</b>	Depends on chosen course: lecture, seminar, exercise, tutorial, practical work.		
<b>Content</b>	<p>Students can choose from a closed list of courses on topics beyond the study area <i>Foundations</i>. These courses extend topics, which have been introduced in the study area <i>Foundations</i>, e.g. Comparative Neuroscience of Communication, or add new topics, not yet covered, e.g. Learning and Memory and Social and Affective Disorders. Students choose courses with a total workload of 9 CP irrespective of the number of courses, e.g. 1 course of 9 CP or 3 courses of 3 CP each. At least 3 CP must be graded and will be included in the cumulative, final grade. The list of available courses is curated by the study commission. Students can choose from:</p> <p><b>Winter term 2023/24:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Birdsong as a Model (Veit; 3 CP; WiSe; graded)</a></li> <li>• <a href="#">Comp Motor Control and Rehabilitation Robotics (Häufle; 3 CP; not graded)</a></li> <li>• <a href="#">Current Topics in Sleep &amp; Circadian Health (Spitschan; 3 CP; not graded)</a></li> <li>• <a href="#">Regulation of Eating Behaviour (Giel; 3 CP; not graded)</a></li> </ul> <p><b>Summer term 2024:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">(Neuro)Prosthetics &amp; Robotics in Medicine and Tech (Prahm; 3 CP; graded)</a></li> <li>• <a href="#">Theory-driven Computational Psychiatry (Hauser; 3 CP; graded)</a></li> <li>• <a href="#">Molecules to Circuits - The Retina as a Model System (Euler; 3 CP; graded)</a></li> <li>• <a href="#">Social and Affective Disorders in Psychiatry (Derntl; 3 CP; graded)</a></li> <li>• <a href="#">Sleep: Phenomena, Physiology and Function (Gais; 3 CP; graded)</a></li> <li>• <a href="#">Comp and Evol Neurobiol of Communication (Hage&amp;Veit; 3 CP; not graded)</a></li> <li>• <a href="#">How does vision work? (Li Zhaoping; 6 CP; graded)</a></li> <li>• <a href="#">Progress in Motor Systems (Schwarz; 3 CP; SoSe; not graded)</a></li> <li>• <a href="#">Bionic Intelligence (Giese &amp; Schwarz; 3 CP; not graded)</a></li> </ul>		
<b>Qualification goals</b>	The students build on their individual knowledge and interests. They extend their theoretical expertise in topic areas of their choice.		



		Type of course	Status	Contact hours (SWS)	CP	Type of exam	Exam duration	Grading	Weight for module
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>L/S/E/P</i>	<i>e</i>	<i>2</i>	<i>3-9</i>			<i>g</i>	<i>100</i>
		<i>L/S/E/P</i>	<i>e</i>	<i>2</i>	<i>0-6</i>			<i>g/ng/ne</i>	
		<i>L/S/E/P</i>	<i>e</i>	<i>2</i>	<i>0-6</i>			<i>g/ng/ne</i>	
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	Depends on the student's choice.								

### 3.3. Individual Perspectives

The study area *Individual Perspectives* gives students the opportunity to learn about related fields of research, development, and applications (e.g., artificial intelligence, neurorehabilitation), improve their language skills in German (for foreign students) or English (for German students), or reflect upon ethical or philosophical aspects and challenges in neuroscience.

<b>Modul code:</b> NB08	<b>Module title:</b> Free Electives		<b>Type of module:</b> elective
<b>CP (ECTS credits)</b>	6		
<b>Workload</b> - Contact hours - Self-study	Total workload: 180 h	Contact hours: 60 h / 4 SWS	Self-study: 120 h
<b>Duration</b>	2 Semester		
<b>Frequency</b>	every semester		
<b>Language of instruction</b>	English		
<b>Teaching methods</b>	Depends on chosen courses: lecture, seminar, exercise, tutorial, practical work.		
<b>Content</b>	In the study area <i>Individual Perspectives</i> students can choose courses from all courses, except for sports courses, offered for students in master's programs at the University of Tübingen. This includes particularly the University's <a href="#">Transdisciplinary Course Program</a> . The students can also choose additional courses from the module CM05 Data Analysis and the study area <i>Advanced Specialisations</i> (please see above).		
<b>Qualification goals</b>	The students build on and extend their individual knowledge and interests. They develop and broaden transdisciplinary competencies. They extend their theoretical expertise in topic areas of their choice.		
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>	Depends on the student's choice. <b>Courses taken in this area are included in the transcript of records, but the grades will not be considered for the cumulative grade of the master's program.</b>		
<b>Applicability and Transfer</b>	Elective module MSc Neural and Behavioural Sciences.		
<b>Participation requirements</b>	Depends on the student's choice.		

### 3.4. Research Practise

The study area *Research Practise* comprises three modules. It offers students an overview of frontiers topics in neuroscience across the three master’s programs of the Graduate Training Centre of Neuroscience. It lays the foundations for the scholarly, good conduct of research and offers each student active participation in current research projects during two laboratory rotations of their choice. The study area comprises the master’s thesis, which concludes the master’s program in *Neural and Behavioural Sciences* with a 6 months research project.

<b>Modul code:</b> NB09	<b>Module title:</b> Current Research and Responsible Conduct of Research		<b>Type of module:</b> compulsory
<b>CP (ECTS credits)</b>	3		
<b>Workload</b> - Contact hours - Self-study	Total workload: 90 h	Contact hours: 30 h / 2 SWS	Self-study: 60 h
<b>Duration</b>	3 Semester		
<b>Frequency</b>	once a year, during the summer or winter semester		
<b>Language of instruction</b>	English		
<b>Teaching methods</b>	Lecture, Seminar with exercises and practical work.		
<b>Content</b>	<p>This module introduces the students not only to current research in the field of neuroscience but also initiates and fosters discussions among students and with guests and lecturers about a broad range of topics. The NeuroColloquium is a lecture series organized by the Tübingen Neuroscience Campus. It presents internationally renowned researchers from various fields of neuroscience. The speakers provide an overview of state-of-the-art neuroscience topics, from genes to behaviour and new methodologies. Every semester, students from the three master’s programs at the GTC choose a speaker of their interest.</p> <p>The seminar on scholarly conduct of research offers the opportunity to learn about, discuss and practice scholarly writing and good scientific conduct. The seminar is offered as a block course immediately before the first laboratory rotation.</p>		
<b>Qualification goals</b>	<p>The NeuroColloquium introduces students to a wide range of neuroscience research and invites them to look beyond their own noses and think outside the box of their immediate interests and studies. The students learn to participate in and contribute to discussions with speakers and the audience. In the seminar on scholarly conduct of research, the students understand and acquire current standards of research practise and communication.</p>		

Requirements for Obtaining Credit, Grading, weight if applicable:		Type of course	Status	Contact hours (SWS)	CP	Type of exam	Exam duration	Grading	Weight for module
	<i>Neurocolloquium</i>	L	c	1	1			ne	
	<i>Scholarly conduct of research</i>	S/E/P	c	2	2			ne	
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	none								

<b>Modul code:</b> NB10	<b>Module title:</b> Laboratory rotations				<b>Type of module:</b> compulsory				
<b>CP (ECTS credits)</b>	27								
<b>Workload</b> - Contact hours - Self-study	Total workload: 820 h	Contact hours: 680 h			Self-study: 140 h				
<b>Duration</b>	1 Semester								
<b>Frequency</b>	once a year, during the winter semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Supervised practical work and seminar.								
<b>Content</b>	<p>Students perform two laboratory rotations working on small research projects in laboratories of their choice. In general, the assigned study is in line with currently ongoing research in the respective laboratory. The lab projects are concluded with a written report and an oral presentation during a seminar at the end of each rotation period. Each student presents the project and results to all fellow students from the master's programs at the GTC Neuroscience and answers questions from fellow students and supervisors.</p> <p>Ideally, the students accomplish their two lab rotations in two different research groups with distinct scientific questions and different methods.</p>								
<b>Qualification goals</b>	<p>The students acquire a wide range of practical skills in state-of-the-art methods. Further skills trained during lab rotations include literature survey, planning of a research project and the design of experiments, documentation of data, evaluation and interpretation of results, compiling data for and writing of a report. The students learn to prepare and give an oral presentation on their research project for a large expert audience.</p>								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (sum)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Lab rotation I</i>	P/S	c	320	13	lr/pr	lr: 20 h pr: 20 min	g	50
	<i>Lab rotation II</i>	P/S	c	360	14	lr/pr	lr: 20 h pr: 20	g	50
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	At least 50 of 60 CPs from NB01 – NB08 must be completed.								

<b>Modul code:</b> NB11	<b>Module title:</b> Master's thesis		<b>Type of module:</b> compulsory						
<b>CP (ECTS credits)</b>	30								
<b>Workload</b> - Contact hours - Self-study	Total workload: 900 h	Contact hours: 30 h	Self-study: 870 h						
<b>Duration</b>	1 Semester								
<b>Frequency</b>	once a year, during the summer semester								
<b>Language of instruction</b>	English								
<b>Teaching methods</b>	Independent, individually supervised research project.								
<b>Content</b>	In-depth study of a problem in neuroscience. Independent implementation of a relevant research project, which includes literature search and review, formulating a research question, planning, data collection, data analysis, and evaluation of the findings in the context of current research. The research project is reported in the master's thesis and in an oral presentation in a colloquium of the host workgroup, department, or institute.								
<b>Qualification goals</b>	The students familiarize themselves independently with a complex, new subject area and develop new, relevant questions in this subject area. They can investigate new questions using appropriate methods, i.e. plan and implement a scientifically sound approach. Students can evaluate, prepare, and communicate the resulting findings in writing and orally in the context of the research field.								
<b>Requirements for Obtaining Credit, Grading, weight if applicable:</b>		<i>Type of course</i>	<i>Status</i>	<i>Contact hours (sum)</i>	<i>CP</i>	<i>Type of exam</i>	<i>Exam duration</i>	<i>Grading</i>	<i>Weight for module</i>
	<i>Master's thesis</i>		<i>c</i>	<i>30</i>	<i>30</i>	<i>th</i>	<i>-</i>	<i>g</i>	<i>100</i>
<b>Applicability and Transfer</b>	Compulsory module MSc Neural and Behavioural Sciences.								
<b>Participation requirements</b>	NB01 – NB10 must be completed.								