

## Research Master Neuroscience Programme

### Course Outline

Course Code	RMNS-1.5
Course Name	The changing brain: Mechanisms underlying neurodevelopment, experience dependent plasticity, aging and neurodegeneration
Teaching Methods	Lectures, workshops, self-study, group discussion
Aims of the Course	To discuss the development of the brain by intrinsic mechanisms as well as experience dependent mechanisms, the critical period, plasticity of the mature brain required for experience dependent learning, aging and the genetics and molecular mechanisms underlying neurodevelopmental and neurodegenerative disorders.
Learning Goals	<p>This module aims to achieve the following learning goals:</p> <ol style="list-style-type: none"> <li>1. The student can explain the basic processes underlying early brain development</li> <li>2. The student can explain the role of glia in early brain development</li> <li>3. The student can explain the concept of the critical period</li> <li>4. The student can explain the concept of experience-dependent plasticity</li> <li>5. The student can explain the molecular mechanisms underlying hippocampus-dependent learning and memory</li> <li>6. The student can explain the concept of a memory engram</li> <li>7. The student can explain how germline genetic mutations can affect the development of the brain and give a few examples of genetic neurodevelopmental disorders</li> <li>8. The student is familiar with the tools to study neurodevelopmental disorders and/or basic brain function in animal models and can design a study to investigate a specific research question in this field.</li> <li>9. The student can explain what happens in the aging brain</li> <li>10. The student can explain what a neurodegenerative disorder is, and give a few examples.</li> </ol>
Target Group	MSc Neuroscience students
Organisation	Erasmus MC – Department of Neuroscience
Level	2 (Master)
Credits	6 EC's
Study load	168
Testing:	Written exam and group assignments
Language	English
Number of Participants	1st year students MSc Neuroscience curriculum
Location	Erasmus MC – Education Center
Date	March / April
Registration	This course is part of the MSc Neuroscience curriculum. Separate registration is not necessary for admitted students

Absent	If you are unable to attend class, you are kindly requested to report your absence in advance, via <a href="mailto:masterneuroscience@erasmusmc.nl">masterneuroscience@erasmusmc.nl</a> .
Responsibility	Erasmus MC – Department of Neuroscience
Coordination	Dr. G.M. van Woerden / Prof. Dr. Y. Elgersma
Contact	E. Buitenhuis-Linssen E-mail: <a href="mailto:masterneuroscience@erasmusmc.nl">masterneuroscience@erasmusmc.nl</a>
Alumni	LinkedIn Group RM Neuroscience, Erasmus MC <a href="https://www.linkedin.com/groups/8133912">https://www.linkedin.com/groups/8133912</a>

<b>Information</b>	
	<p><b>Summary of the Course</b></p> <p>The aim of this course is to go through the different elements of the changing brain. From early brain development to experience dependent plasticity (and critical periods) to adult plasticity and encoding of memories at the molecular, cellular and systems level (focused on hippocampus-dependent learning and memory), and finally aging and neurodegeneration.</p>
	<p><b>Teaching Methods</b></p> <p>Lectures, workshops, self-study and group assignments/discussions.</p>
<b>Programme</b>	
	<p><b>Content</b></p> <p>During the first half of the course we will describe the basic (intrinsic) processes of the embryological developing brain, starting from the early brain development, neuronal differentiation and the development of glia, followed by the later stages of neurodevelopment, discussing cerebral and cerebellar cortical development. There will be (guest) lectures, about genetics and brain development, and on cellular and animal models used in the field (mice, <i>Drosophila</i>, <i>C. elegans</i>).</p> <p>In the second half we shift to the (postnatal) experience dependent maturation of the brain, first focusing on critical periods and experience-dependent plasticity, then moving towards the plasticity of the adult brain, aging and neurodegeneration. As an example of adult brain plasticity, we will focus on hippocampus-dependent learning and memory, from molecular mechanisms to the encoding of the memory engram in the brain. During these lectures, the use of different tools will be discussed (e.g. mouse models, but also molecular tools such as dreads and channelrhodopsin), to offer the students some insight in the possibilities to study basal brain function as well as the mechanisms behind learning and memory or neurodevelopmental disorders. For the neurodegeneration we will focus on a few neurodegenerative disorders, including Alzheimer's disease.</p> <p>The course will finish coming back to neurodevelopmental disorders, focusing on the future perspectives, the genetics of autism and intellectual disability, including a guest lecture about the use of induce pluripotent stem cells (iPS cells) to study disorders of the brain.</p> <p>At the end the students will have a good overview of neurodevelopment, neuronal plasticity and neurodevelopmental and neurodegenerative disorders, as well as the techniques being used in this field.</p>
	<p><b>Duration of the Course</b></p> <p>7 weeks</p>

	<p><b>Expected Resources for Students</b></p> <ul style="list-style-type: none"> <li>▪ Purves (6<sup>th</sup> edition): chapter 22, 25, 26, 30.</li> <li>▪ Articles provided by coordinators</li> </ul>
	<p><b>Teachers</b></p> <p>Prof. Dr. Ype Elgersma, Dr. Geeske van Woerden, Dr. Femke de Vrij, Dr. Catarina Osorio, Dr. Dick Jaarsma. Dr. Laurens Bosman, Dr. John van Swieten, Dr. Grazia Mancini, Prof. Dr. Gert Jansen, Dr. Nael Nadif Kasir, Dr. Annette Schenk.</p>
	<p><b>Graduate Attributes</b></p> <p>If you have attended and actively participated in the classes, passed the group assignments and the written exam with sufficient results, you are awarded 6 EC's.</p>
<b>Testing and Assessments</b>	
	<p><b>Testing</b></p> <p>Written exam with multiple choice and essay questions. The exam will cover all 8 learning goals, with max. 10 points for each goal (max. 80p total).</p>
	<p><b>Testing Procedure</b></p> <p>The test will be assessed by a MSc faculty member. You will receive a grade on a scale from 1 (worst) to 10 (best). Grade appeal is subject to the rules laid out in the Teaching and Examinations Regulations of Erasmus MC. On every component of an exam a 5,5 or higher must be scored!</p>
<b>Quality Management</b>	
	<p><b>Course evaluation and development</b></p> <p>The MSc programme co-ordinators are open for suggestions from course participants on possible improvements. Course adjustments can be made on the basis of your direct feedback. Additionally, at the end of the course, you will receive an invitation for an online survey on the contents and setup of the course.</p> <p>Course contents and setup are re-evaluated periodically, at least once a year, by the course directors and MSc programme chair members.</p>