Course Title: Retinal Immunology and Gene Regulation

Module Identification-Nr.	Workload	Credit Points	Frequency of Occurence	Duration
M-Neuro-AM7 a-d	180h	6CP	Summer- and Winterterm	3 weeks

	Type of lessons	Contact times	Self-study times	Intended group size
1	a) Lectures (L) b) Practical/Lab (P) c) Seminar (S)	a) 8 h b) 41 h c) 4 h	127 h Preparation and revision of L, P and S; Seminar presentation; oral exam)	a) max. 5 b) max. 5 c) max. 5

2 **Aims of the module and aquired skills**

This module provides a general introduction into retinal function and biology with a special emphasize on innate immunity and gene regulation of retinal cells. Students are offered to obtain detailed knowledge about the role of microglia in the retina during health and diesease. Furthermore students will extend their theoretical knowledge about the epigenetic basis of transcriptional regulation with a special focus on retinal genes.

The practical part provides training to culture retinal explants and to investigate retinal microglia under diseased conditions in vitro and in vivo. The students will extend their bioinformatical skills to determine regulatory regions of retinal genes and apply reporter gene assays in retinal tissue to test the influence of regulatory regions on initiation of gene expression. Intense usage of fluorescence microscopy in this module promotes confident handling of this technique.

The accompanying seminar talk gives students the opportunity to perform background research on a topic related to retinal immunology and to plan and prepare an oral presentation.

3 **Contents of the module**

- Function of the retina (cell biology, physiology, signal transduction)
- Retinal disease (degenerative diseases of the retina)
- Innate immune system: microglial biology in the retina (immune privilege, microglial phenotypes, blood retinal barrier, human genetic aspects)
- Visualisation of microglial cells in the retina by immunohistochemistry and use of transgenic reporter animals
- Organotypic culture of retinal tissue
- Genetic basis of gene regulation (promoter, enhancer, transcription, mRNA)
- Epigenetics, transcription factors
- Bioinformatic prediction of regulatory regions (Genomatix, UCSC genome browser)
- Reportergene analysis by ex vivo electroporation
- Analysis of reportergene expression by fluorescence microscopy
- Quantification of microscopic images with ImageJ

4 **Teaching/Learning methods**

Lectures; Seminar; Introduction to bioinformatic tools; Training on presentation techniques in oral and written form, hands-on lab work

5 **Requirements for participation**

Bachelor; enrollment in the Master´s degree course “Biological Sciences” (see examination regulations for details) or Master’s degree course Clinical and Experimental “Neurosciences”

6 **Type of module examinations**

Exam prerequisites: Regular and active participation

Exams: Oral examination (30 min)

7 **Requisites for the allocation of credits**

Total module mark at least “adequate”

8	**Compatibility with other Curricula*** None
9	**Significance of the module mark for the overall grade** In the Master´s degree course “Experimental and Clinical Neuroscience”: 6 % of the overall grade (see also appendix of the examination regulations)
10	**Module coordinator:** Univ.-Prof. Dr. Thomas Langmann, phone 478-7324, thomas.langmann@uk-koeln.de **Participating faculty:** Dr. rer.nat. Anne Wolf
11	**Additional information** **Subject module** of the Master´s degree course “Master of Experimental and Clinical neuroscience” **Focus of research:** Retinal Microglia, Photoreceptor Genetics **Literature:** • Corbo JC, Lawrence KA, Karlstetter M, Myers CA, Abdelaziz M, Dirkes W, Weigelt K, Seifert M, Benes V, Fritsche LG, Weber BH, Langmann T.CRX ChIP-seq reveals the cis-regulatory architecture of mouse photoreceptors. Genome Res. 2010 Nov;20(11):1512-25. doi: 10.1101/gr.109405.110. • Karlstetter M, Scholz R, Rutar M, Wong WT, Provis JM, Langmann T. Retinal microglia: just bystander or target for therapy? Prog Retin Eye Res. 2015 Mar;45:30-57 **General time schedule:** 3 weeks

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