

Department of Ophthalmology, University of Cologne, Cologne

Introduction

The Dept. of Ophthalmology at UoC is one of the largest, most subspecialized and scientifically active Departments in Germany (Chairman and Managing Director: Prof. Dr. med. C. Cursiefen; Chairman Vitreoretinal Surgery: Prof. Dr. med. B. Kirchhof). The Dept. is a national reference center for glaucoma, corneal transplantation, vitreoretinal surgery and AMD, ocular oncology and strabismology/neuroophthalmology (Head of Section: Prof. Dr. med. A. Neugebauer). The Dept. amongst others has the highest number of inpatients of all German University eye hospitals, performs the most glaucoma surgeries in Germany and is the largest center for minimally invasive lamellar corneal transplant surgery. Since 2012, the Stock Foundation supports the endowed Chair for Experimental Immunology of the Eye at the Dept. with a research focus on inherited retinal degenerations and age-related maculopathy (Prof. Dr. rer.-nat. T. Langmann). There are strong clinical and scientific ties of the Dept. with international renowned institutions including Schepens Eye Research Institute, Harvard Medical School, Boston; Johns Hopkins University, Baltimore; Doheny Eye Institute, USC, Los Angeles; University of Nijmegen, NL; University Hospital of Zürich, and Filatov Eye Institute, Odessa.

Research and teaching

The Dept. is the main player of the eFA “Inflammatory and age-related diseases of the eye” of the Medical Faculty which aims at a better understanding of and the development of new treatment modalities for inflammatory and age-related diseases of the eye. Through collaborations with colleagues from Dermatology (Cologne) as well as Genetics and Hematology (University of Erlangen-Nuremberg) in 2015 a DFG Research group (RU) FOR2240: „(Lymph)angiogenesis And Cellular Immunity In Inflammatory Diseases Of The Eye“ (www.for2240.de; Speaker: Prof. Cursiefen; Vice-Speaker: Prof. Langmann) could be established focussing the already strong research activities on age-related and inflammatory eye diseases. FOR2240 consists of 7 projects, which deal with clinically relevant research topics of the Dept. including dry eye disease, ocular allergy, ocular GvHD (“UoC Competence Center in oGvHD”), corneal transplant rejection and wound healing, ocular melanomas, uveitis, age-related maculopathy, and inherited retinal degenerations. For each of these entities corresponding specialized outpatient clinics exist.

The Dept. has a strong focus on translational research in the areas of anti-inflammatory, anti(lymph)angiogenic and neuroprotective therapies for blinding ocular diseases. Two

clinical reading and image analysis centers (CIRCL and CORIC), the EUGENDA AMD database, the Cologne DMEK database, our certified clinical study center (15 ongoing phase II-IV trials), a pilot project within CIO on ocular melanoms as well as the UoC Competence Center on Ocular GvHD are instrumental in this respect.

In addition to the DFG FOR2240 and individual DFG grants (as e.g. the recently funded multicenter clinical trial on the prevention of proliferative vitreoretinopathy), our research areas are supported by EU grants, an EU COST action being chaired in Cologne (BM 1302 “Joining Forces in Corneal Regeneration”; www.biocornea.eu), 3 projects in the Bayer Graduate School of Pharmacology, funding obtained from the Hans und Marlies Stock foundation to establish the endowed Chair for Experimental Immunology of the Eye, DAAD grants as well as support from industry and private foundations including the Velux foundation, the ProRetina foundation and the Lingen Foundation. In addition, this eFA has secured postdoctoral funding of the excellence program of the UoC. The third party funding in the last 3 years was over 6 million Euros, with about 80 original publications per year and an impact factor sum of around 250 (IF of top journal in Ophthalmology is 3.5).

The Dept. is actively involved in teaching medical students, ophthalmologists and orthoptists and offers science modules in the master programs for Experimental Neuroscience, Human Genetics and the ResearchTrack.

Key publications

Cursiefen C, Viaud E, Bock F et al. Aganirsen antisense oligonucleotide eye drops inhibit keratitis-induced corneal neovascularization and reduce need for transplantation: The I-CAN study. *Ophthalmology*. 2014;121:1683-92

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Hoerster R, Hermann MM, Rosentreter A, Muether PS, Kirchhof B, Fauser S. Profibrotic cytokines in aqueous humour correlate with aqueous flare in patients with rhegmatogenous retinal detachment. *Br J Ophthalmol*. 2013;97:450-3.

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Karlstetter M, Walczak Y, Weigelt K, Ebert S, Van den Brulle J, Schwer H, Fuchshofer R, Langmann T. The novel activated microglia/macrophage WAP domain protein, AMWAP, acts as a counter-regulator of proinflammatory response. J Immunol 2010, 185:3379-3390.

Langmann T, Di Gioia SA, Rau I, Stohr H, Maksimovic NS, Corbo JC, Renner AB, Zrenner E, Kumaramanickavel G, Karlstetter M, Arsenijevic Y, Weber BH, Gal A, Rivolta C. Nonsense mutations in FAM161A cause RP28-associated recessive retinitis pigmentosa. Am J Hum Genet 2010, 87:376-381.

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, 20:1512-1525.

Future

Clinically, we thrive to provide the best care for our patients and aim to become the leading academic center for ophthalmology in Germany, providing excellent and subspecialized patient care. We want to further strengthen our 5 areas of national and international clinical (and translational) expertise: (i) glaucoma: diagnosis, medical and surgical therapy, (ii) cornea: transplant surgery, artificial cornea and stem cell therapy (W2 Professorship Prof. Dr. med. B. Bachmann), (iii) retina: age related maculopathy and vitreoretinal surgery, (iv) strabismology and neuroophthalmology (Head of Section: Prof. Dr. med. A. Neugebauer/Dr. Fricke) and (v) oncology: personalized medical and surgical therapy especially of ocular melanoms with a focus on anti(lymph)angiogenic therapy and tumor vaccination (W2 Professorship under recruitment).

Scientific goals for the next five years are: (i) to intensify the cooperation with inflammation, ageing, and neuroscience specialists from Cologne (incl. CECAD, CRCs and MPI), to bring more interdisciplinary expertise into the eFA and vice versa to highlight the eye as a translational model system for novel anti-inflammatory, anti(lymph)angiogenic and neuroprotective therapies. (ii) A second future focus is to strengthen our experimental and clinical imaging facilities for non-invasive phenotyping of age-related ocular inflammatory, vascular, malignant, and neurodegenerative processes. (iii) The third aim is to intensify the translational research activity in the above mentioned areas with the help of our clinical study center, our reading centers as well as consortial EU funding.

Overall aim is to position the Department of Ophthalmology at UoC not only as one of the leading clinical centers in Germany and to deliver very good teaching, but also to establish an internationally leading discovery center for research, early development and

clinical translation focusing on targeted modulation of macrophages/microglial cells and (lymph)angiogenesis to identify urgently required new therapeutic approaches for blinding inflammatory and age-related eye diseases.

3.3 Forschung (Strategie für die nächsten 5 Jahre)

eFA: Inflammatory and age-related diseases of the eye

Aims of this emerging FA are a better understanding of and the development of new treatment modalities for inflammatory and age-related diseases of the eye. Ophthalmology is amongst the medical subspecialties being most significantly affected by ageing of our population. Most blinding diseases are age-related and associated with pathological inflammation and dysregulated ocular (lymph)angiogenesis. In addition, the easily accessible eye is a prominent experimental model system to study inflammation and (lymph)angiogenesis as well as neurodegeneration. The Cologne University Eye Hospital is amongst the largest in Germany and is a national reference center for age-related diseases such as glaucoma, corneal degenerations, dry eye and ocular GvHD, age-related maculopathy and ocular tumors.

Through collaborations between the Dept. of Ophthalmology and colleagues from Dermatology (Cologne) as well as Genetics and Hematology (University of Erlangen-Nuremberg) in 2015 a DFG Research group (RU FOR2240: „(Lymph)angiogenesis And Cellular Immunity In Inflammatory Diseases Of The Eye“; www.for2240.de) could be established focussing the already strong research activities on age-related and inflammatory eye diseases. FOR2240 consists of 7 projects, all being at connected to the Dept. of Ophthalmology. The FOR has a strong impetus to support young scientists and clinician scientists and therefore has established two rotation posts for clinician-scientists.

Goals for the next five years are: (i) to intensify the cooperation with inflammation and ageing specialists from Cologne (incl. CECAD, CRCs and MPI), to bring more basic science expertise into the eFA and vice versa to highlight the eye as a translational model system for novel anti-inflammatory, anti(lymph)angiogenic and neuroprotective therapies. This will help with the medium-term goal to extend the DFG FOR2240 and subsequently - upon completion of the final funding period - to build an eye organ-centered CRC. (ii) A second future focus is to strengthen our experimental and clinical imaging facilities for non-invasive phenotyping of age-related ocular inflammatory, vascular, neurodegenerative and malignant processes. Here we apply for support by a Heisenberg Fellowship on ocular functional imaging in cooperation with Laser Center Lübeck and want to expand cooperation with functional imaging expertise in FA 3. (iii) The third project is to intensify the translational research activity in the area of anti-inflammatory, anti(lymph)angiogenic and neuroprotective therapies for blinding ocular diseases. To foster translational antilymphangiogenic research in ocular oncology we just finished recruitment of a W2 professorship in that field and apply for

additional consortial EU funding (second round Horizon2020). In addition, our two clinical reading and image analysis centers (CIRCL and CORIC), the EUGENDA AMD database, the Cologne DMEK database, our certified clinical study center (15 ongoing phase II-IV trials), a pilot project within CIO as well as the University of Cologne Competence Center on Ocular GvHD will be instrumental. The FA is also supported by EU grants, a COST action being chaired in Cologne (BM 1302 “Joining Forces in Corneal Regeneration”), 3 projects in the Bayer Graduate School of Pharmacology, the Chair for Experimental Immunology of the Eye supported by the Stock foundation, DAAD grants as well as support from private foundations and other individual DFG grants. In addition, this FA has secured postdoctoral funding in the framework of the funding line of the excellence program of the UoC.

Overall aim is to position the Department of Ophthalmology at UoC as the internationally leading center developing new therapeutic approaches for blinding inflammatory and age-related eye diseases based on targeted modulation of macrophages/microglial cells and (lymph)angiogenesis. We will therefore strive to expand on this focus, to support the recruitment of new junior faculty e.g. in ocular (lymph)angiogenesis and neuroprotection and to bundle the ever-growing expertise in one dedicated research area.