

## **Wissenschaftliche und klinische Schwerpunkte der Universitätsklinik für Augenheilkunde im Pius-Hospital Oldenburg**

Der Schwerpunkt des klinischen und wissenschaftlichen Interesses unserer Arbeitsgruppe liegt im Bereich Hornhauttransplantation und Augenoberflächenrekonstruktion, sowie der Entwicklung neuer Ansätze zur Augenoberflächen- und Tränendrüsenregeneration.

Ein besonderer Forschungsschwerpunkt liegt in der Entwicklung von Ersatzgeweben zur Rekonstruktion von Bindehaut und Hornhaut, sowie der Stimulation der kornealen Nervenregeneration zur Entwicklung neuer Therapien für die Neurotrophe Keratopathie. Ein weiterer Schwerpunkt ist die Evaluation des regenerativen Potentials epithelialer und mesenchymaler Tränendrüsen-Stammzellen im Hinblick auf eine klinische Anwendung bei Patienten mit schwerstem trockenem Auge, sowie die Etablierung vaskularisierter 3D-Modelle zur Rekonstruktion der Tränendrüse.

Im Einzelnen beinhaltet dies aktuelle Projekte zu folgenden beispielhaften Themen:

### **Entwicklung neuer Techniken zur Hornhaut- u. Bindehaut-Rekonstruktion**

**Schrader S**, Notara M, Beaconsfield M, Tuft S, Geerling G, Daniels JT. Conjunctival epithelial cells maintain stem cell properties after long-term culture and cryopreservation. *Regen Med.* 2009 Sep;4(5):677-87

**Schrader S**, Notara M, Tuft SJ, Beaconsfield M, Geerling G, Daniels JT. Simulation of an in vitro niche environment that preserves conjunctival progenitor cells. *Regen Med.* 2010 Nov;5(6):877-89

Notara M, **Schrader S**, Daniels JT. The porcine limbal epithelial stem cell niche as a new model for the study of transplanted tissue-engineered human limbal epithelial cells. *Tissue Eng Part A.* 2011 Mar;17(5-6):741-50.

**Schrader S**, O'Callaghan AR, Tuft SJ, Beaconsfield M, Geerling G, Daniels JT. Wnt signalling in an in vitro niche model for conjunctival progenitor cells. *Tissue Eng Regen Med.* 2014 Dec;8(12):969-77. doi: 10.1002/term.1599. Epub 2012 Aug 30.

**Schrader S**, Tuft SJ, Beaconsfield M, Borrelli M, Geerling G, Daniels JT. Evaluation of human MRC-5 cells as a feeder layer in a xenobiotic-free culture system for conjunctival epithelial progenitor cells. *Curr Eye Res.* 2012 Dec;37(12):1067-74. doi: 10.3109/02713683.2012.713155.

Borrelli M, Reichl S, Feng Y, Schargus M, **Schrader S**, Geerling G. In vitro characterization and ex vivo surgical evaluation of human hair keratin films in ocular surface reconstruction after sterilization processing. *J Mater Sci Mater Med.* 2012 Sep 27.

Feng Y, Borrelli M, Meyer-Ter-Vehn T, Reichl S, **Schrader S\***, Geerling G\*. Epithelial wound healing on keratin film, amniotic membrane and polystyrene in vitro. *Curr Eye Res.* 2014 Jun;39(6):561-70. doi: 10.3109/02713683.2013.853804. Epub 2014 Jan 8.

Borrelli M, Joepen N, Reichl S, Finis D, Schoppe M, Geerling G, **Schrader S.** Keratin films for ocular surface reconstruction: evaluation of biocompatibility in an in-vivo model. *Biomaterials.* 2015 Feb;42:112-20. doi: 10.1016/j.biomaterials.2014.11.038.

Drechsler CC, Kunze A, Kureshi A, Grobe G, Reichl S, Geerling G, Daniels JT, **Schrader S.** Development of a conjunctival tissue substitute on the basis of plastic compressed collagen. *J Tissue Eng Regen Med.* 2015 Feb 10. doi: 10.1002/term.1991.

Massie I, Kureshi AK, **Schrader S**, Shortt AJ, Daniels JT. Optimization of optical and mechanical properties of real architecture for 3-dimensional tissue equivalents: Towards treatment of limbal epithelial stem cell deficiency. *Acta Biomater.* 2015 Sep;24:241-50. doi: 10.1016/j.actbio.2015.06.007. Epub 2015 Jun 17.

**Schrader S**, Witt J, Geerling G. Plastic compressed collagen transplantation - a new option for corneal surface reconstruction? *Acta Ophthalmol.* 2017 Nov 30. doi: 10.1111/aos.13649.

Spaniol K, Witt J, Mertsch S, Borrelli M, Geerling G, **Schrader S.** Generation and characterisation of decellularised human corneal limbus. *Graefes Arch Clin Exp Ophthalmol.* 2018 Feb 1. doi: 10.1007/s00417-018-3904-1.

Witt J, Mertsch S, Borrelli M, Dietrich J, Geerling G, **Schrader S**, Spaniol K. Decellularised conjunctiva for ocular surface reconstruction. *Acta Biomater.* 2018 Feb;67:259-269. doi: 10.1016/j.actbio.2017.11.054.

### **Evaluation neuer Keratoplastik- und Keratoprothesen-Techniken**

Spaniol K, Borrelli M, Holtmann C, **Schrader S**, Geerling G. Complications of Descemet's membrane endothelial keratoplasty]. *Ophthalmologe.* 2015 Dec;112(12):974-81.

Finis D, Ralla B, Karbe M, Borrelli M, **Schrader S**, Geerling G. Comparison of two different scheimpflug devices in the detection of keratoconus, regular astigmatism, and healthy corneas. *J Ophthalmol.* 2015;2015:315281. doi:10.1155/2015/315281. Epub 2015 Apr 14.

Blasberg C, Geerling G, **Schrader S.** [Bowman Layer Transplantation in Progressive Keratoconus - What Is It Good For?]. *Klin Monbl Augenheilkd.* 2017 Jun;234(6):776-779. doi: 10.1055/s-0043-111085. Epub 2017 Jun 6. German.

Bachmann BO, **Schrader S**. [Biomaterials or Donor Tissue - What is the Future of Tissue Engineering for Cornea Reconstruction?]. *Klin Monbl Augenheilkd*. 2017 Jun;234(6):758-762. doi: 10.1055/s-0043-109024. Epub 2017 Jun 6. German.

### Entwicklung Regenerativer Strategien zur Therapie des trockenen Auges

**Schrader S**, Wedel T, Moll R, Geerling G. Combination of serum eye drops with hydrogel bandage contact lenses in the treatment of persistent epithelial defects. *Graefes Arch Clin Exp Ophthalmol*. 2006 Oct;244(10):1345-9. Epub 2006 Mar 17

**Schrader S**, Wedel T, Kremling C, Laqua H, Geerling G. Amniotic Membrane As A Carrier for Lacrimal Gland Acinar Cells. *Graefes Arch Clin Exp Ophthalmol*. 2007 Nov;245(11):1699-704. Epub 2007 Jun 12

**Schrader S**, Kremling C, Klinger M, Laqua H, Geerling G. Cultivation of lacrimal gland acinar cells in a microgravity environment. *Br J Ophthalmol*. 2009 Aug;93(8):1121-5. Epub 2009 May 4

Finis D, Pischel N, **Schrader S\***, Geerling G\*. Evaluation of lipid layer thickness measurement of the tear film as a diagnostic tool for Meibomian gland dysfunction. *Cornea*. 2013 Dec;32(12):1549-53. doi: 10.1097/ICO.0b013e3182a7f3e1.

Finis D, Hayajneh J, König C, Borrelli M, **Schrader S\***, Geerling G\*. Evaluation of an automated thermodynamic treatment (LipiFlow®) system for meibomian gland dysfunction: a prospective, randomized, observer-masked trial. *Ocul Surf*. 2014 Apr;12(2):146-54. \*shared senior authorship

Finis D, Pischel N, Borrelli M, **Schrader S\***, Geerling G\*. [Factors influencing the measurement of tear film lipid layer thickness with interferometry]. *Klin Monbl Augenheilkd*. 2014 Jun;231(6):603-10. doi: 10.1055/s-0034-1368536. Epub 2014 Jun 18. German. PubMed PMID: 24940758.

Finis D, Pischel N, König C, Hayajneh J, Borrelli M, **Schrader S\***, Geerling G\*. [Comparison of the OSDI and SPEED questionnaires for the evaluation of dry eye disease in clinical routine.]. *Ophthalmologe*. 2014 Jul 18. [Epub ahead of print] German.

Finis D, Ackermann P, Pischel N, König C, Hayajneh J, Borrelli M, **Schrader S\***, Geerling G\*. Evaluation of Meibomian Gland Dysfunction and Local Distribution of Meibomian Gland Atrophy by Non-contact Infrared Meibography. *Curr Eye Res*. 2015;40(10):982-9. doi: 10.3109/02713683.2014.971929. Epub 2014 Oct 20.

Finis D, König C, Hayajneh J, Borrelli M, **Schrader S\***, Geerling G\*. Six-Month Effects of a Thermodynamic Treatment for MGD and Implications of Meibomian Gland Atrophy. *Cornea*. 2014 Oct 15.

Roth M, Spaniol K, Kordes C, Schwarz S, Mertsch S, Häussinger D, Rotter N, Geerling G, **Schrader S**. The Influence of Oxygen on the Proliferative Capacity and Differentiation Potential of Lacrimal Gland-Derived Mesenchymal Stem Cells. *Invest Ophthalmol Vis Sci*. 2015 Jul;56(8):4741-52.

Spaniol K, Metzger M, Roth M, Greve B, Mertsch S, Geerling G, **Schrader S**. Engineering of a Secretory Active Three-Dimensional Lacrimal Gland Construct on the Basis of Decellularized Lacrimal Gland Tissue. *Tissue Eng Part A*. 2015 Oct;21(19-20):2605-17.

Massie I, Spaniol K, Geerling G, **Schrader S**: Cryopreservation and Hypothermic Storage of Lacrimal Gland – Towards Enabling Delivery of Regenerative Medicine Therapies for Treatment of Dry Eye Syndrome; *Journal of Tissue Engineering and Regenerative Medicine*. Date accepted: 03/07/2016

Massie I, Spaniol K, Barbian A, Poschmann G, Stühler K, Geerling G, Metzger M, Mertsch S, **Schrader S**. Evaluation of Decellularized Porcine Jejunum as a Matrix for Lacrimal Gland Reconstruction In Vitro for Treatment of Dry Eye Syndrome. *Invest Ophthalmol Vis Sci*. 2017 Oct 1;58(12):5564-5574. doi: 10.1167/iovs.16-20759.

Massie I, Spaniol K, Barbian A, Geerling G, Metzger M, **Schrader S**. Development of lacrimal gland spheroids for lacrimal gland tissue regeneration. *J Tissue Eng Regen Med*. 2017 Dec 22. doi: 10.1002/term.2631. [Epub ahead of print] PubMed PMID: 29272079.

### **Reviews und Buchbeiträge**

1. **Schrader S**, Mircheff AK, Geerling G: Animal Models of Dry Eye. *Dev Ophthalmol*. 2008;41:298-312. (Buchbeitrag)
2. Geerling G, Unterlauff JD, Kasper K, **Schrader S**, Opitz A, Hartwig D: Autologous serum and alternative blood products for the treatment of ocular surface disorders. *Ophthalmologe*. 2008 Jul;105(7):623-31. (Review)
3. Notara M, Alatzas A, Gilfillan J, Harris AR, Levis HJ, **Schrader S**, Vernon A, Daniels JT. In sickness and in health: Corneal epithelial stem cell biology, pathology and therapy. *Exp Eye Res*. 2010 Feb;90(2):188-95. Epub 2009 Oct 17. (Review)
4. **Schrader S**, Notara M, Beaconsfield M, Tuft SJ, Daniels JT, Geerling G. Tissue engineering for conjunctival reconstruction: established methods and future outlooks. *Curr Eye Res*. 2009 Nov;34(11):913-24. (Review)
5. **Schrader S**, Liu L, Kasper K, Geerling G. Generation of two- and three-dimensional lacrimal gland constructs. *Dev Ophthalmol*. 2010;45:49-56. Epub 2010 May 18 (Buchbeitrag)
6. Finis D, **Schrader S**, Geerling G. Meibomian Gland Dysfunction. *Klinische Monatsblätter für Augenheilkunde* 2012 Apr;229:506-513 (Review)
7. Borrelli M, Feng Y, Spaniol K, Geerling G, **Schrader S**. New Developments in Matrices for Ocular Surface Reconstruction, *Current Tissue Engineering*, 2012 (Accepted 05/2012) (Review)

8. Finis D, Gerber PA, **Schrader S**, Geerling G. Okuläre Rosazea und Meibomdrüsendiffunktion. *Z. prakt. Augenheilkd.* 33: 457 – 467 (2012) (Review)
9. Feng Y, Borrelli M, Reichl S, **Schrader S**, Geerling G. Review of alternative carrier materials for ocular surface reconstruction. *Curr Eye Res.* 2014 Jun;39(6):541-52. doi: 10.3109/02713683.2013.853803. Epub 2014 Jan 9. (Review)
10. **Schrader S**, Tost HW, Geerling G. Lacrimal punctal occlusion. Chapter 37 of the Book „Ocular Surface Disorders by Jose M Benitez-del-Castillo and Michael A Lemp. JP Medical Publisher 2013. ISBN 978-1-907816-31-4 (Buchbeitrag)
11. **Schrader S**, Finis D, Spaniol K, Roth M, Ackermann P, Geerling G. [Clinical Diagnostics for the Tear Film and the Ocular Surface.]. *Klin Monbl Augenheilkd.* 2014 Aug 12. [Epub ahead of print] German. (Review)
12. **Schrader S**, Knop E, Knop N, Finis D, Geerling G. Klinisches Bild und Diagnostik. Kapitel 6 des Buches Meibom-Drüsen-Dysfunktion – Aktuelle Diagnose und Therapieoptionen. Uni-Med Verlag 2015. ISBN 978-3-8374-1437-0. (Buchbeitrag)
13. Finis D, **Schrader S**, Geerling G. Therapieoptionen und Konzepte. Kapitel 7 des Buches Meibom-Drüsen-Dysfunktion – Aktuelle Diagnose und Therapieoptionen. Uni-Med Verlag 2015. ISBN 978-3-8374-1437-0. (Buchbeitrag)
14. Roth M, **Schrader S**, Finis D, Spaniol K, MacKenzie C, Ackermann P, Geerling G. [Diagnostics of Infectious Corneal and Conjunctival Diseases]. *Klin Monbl Augenheilkd.* 2015 Jun;232(6):789-803; quiz 804-6. doi: 10.1055/s-0033-1358135. Epub 2015 May 27. German. (Review)
15. Finis D, Ackermann P, **Schrader S**, Geerling G. [Special Diagnostics of the Cornea]. *Klin Monbl Augenheilkd.* 2015 Nov;232(11):1319-32; quiz 1333-4. doi: 10.1055/s-0033-1358205. Epub 2015 Nov 17. German. (Review)
16. Chao W, Belmonte C, Benitez Del Castillo J, Bron A, Dua H, Nichols K, Novack G, **Schrader S**, Willcox M, Wolffsohn J, Sullivan DA. Report of the Inaugural Meeting of the TFOS i2 = initiating innovation Series: Targeting the Unmet Need for Dry Eye Treatment (London, United Kingdom, March 21, 2015). *Ocul Surf.* 2016 Jan 13. pii: S1542-0124(15)00205-0. doi: 10.1016/j.jtos.2015.11.003. [Epub ahead of print] (Review)
17. Dietrich J, Massie I, Roth M, Geerling G, Mertsch S, **Schrader S**. Development of Causative Treatment Strategies for Lacrimal Gland Insufficiency by Tissue Engineering and Cell Therapy. Part 1: Regeneration of Lacrimal Gland Tissue: Can We Stimulate Lacrimal Gland Renewal In Vivo? *Curr Eye Res.* 2016 Apr 26:1-12. [Epub ahead of print] PubMed PMID: 27116653. (Review)
18. Spaniol K, Guthoff R, **Schrader S**, Borrelli M, Kajasi N, Schramm M, Geerling G. Diagnostik von Binde- und Hornhauterkrankungen Teil 4: Histologische Verfahren. *Klin Monbl Augenheilkd.* 2016 May 20. [Epub ahead of print] German. (Review)
19. Massie I, Dietrich J, Roth M, Geerling G, Mertsch S, **Schrader S**. Development of Causative Treatment Strategies for Lacrimal Gland Insufficiency by Tissue Engineering and Cell Therapy. Part 2: Reconstruction of Lacrimal Gland Tissue: What Has Been Achieved So Far and What Are the Remaining Challenges? *Curr Eye Res.* 2016 Jun 27:1-11. [Epub ahead of print] PubMed PMID: 27348234. (Review)

20. Spaniol K, Holtmann C, Geerling G, **Schrader S**. [New approaches to ocular surface reconstruction beyond the cornea]. *Ophthalmologe*. 2016 Dec 22. doi: 10.1007/s00347-016-0419-1. [Epub ahead of print] German. (Review)
21. Bachmann BO, **Schrader S**. [Biomaterials or Donor Tissue - What is the Future of Tissue Engineering for Cornea Reconstruction?]. *Klin Monbl Augenheilkd*. 2017 Jun;234(6):758-762. doi: 10.1055/s-0043-109024. Epub 2017 Jun 6. German. (Review)
22. Bramann EL, Schröder K, **Schrader S**, Geerling G. [Descemetectomy : An alternative to transplantation?]. *Ophthalmologe*. 2017 Jul;114(7):666-669. doi: 10.1007/s00347-017-0516-9. German. (Review)
23. Novack GD, Asbell P, Barabino S, Bergamini MVW, Ciolino JB, Foulks GN, Goldstein M, Lemp MA, **Schrader S**, Woods C, Stapleton F. TFOS DEWS II Clinical Trial Design Report. *Ocul Surf*. 2017 Jul;15(3):629-649. doi: 10.1016/j.jtos.2017.05.009. Epub 2017 Jul 20. Review)