

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 Patientinnen und 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

1. Hasenzahl M, Musken M, **Mertsch S, Schrader S**, Reichl S, Cell sheet technology: Influence of culture conditions on in vitro-cultivated corneal stromal tissue for regenerative therapies of the ocular surface, J Biomed Mater Res B Appl Biomater 109(10) (2021) 1488-1504.
2. **Mertsch S**, Hasenzahl M, Reichl S, Geerling G, **Schrader S**, Decellularized human corneal stromal cell sheet as a novel matrix for ocular surface reconstruction, J Tissue Eng Regen Med 14(9) (2020) 1318-1332.
3. Witt J, Dietrich J, **Mertsch S, Schrader S**, Spaniol K, Geerling G, Decellularized porcine conjunctiva as an alternative substrate for tissue-engineered epithelialized conjunctiva, Ocul Surf 18(4) (2020) 901-911.
4. Witt J, Borrelli M, **Mertsch S**, Geerling G, Spaniol S, **Schrader S**, Evaluation of Plastic-Compressed Collagen for Conjunctival Repair in a Rabbit Model, Tissue Eng Part A 25(15-16) (2019) 1084-1095.
5. 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.
6. 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

7. 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.
8. **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
9. 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.
10. 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.
11. 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. *Tissue Eng Regen Med*. 2015 Feb 10. doi: 10.1002/term.1991.
12. 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.
13. 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.
14. 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
15. 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
16. **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.
17. **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
18. Borrelli M, Feng Y, Spaniol K, Geerling G, **Schrader S**. New Developments in Matrices for Ocular Surface Reconstruction, *Current Tissue Engineering*, 2012
19. 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.

20. **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
21. **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
22. **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.

Entwicklung Regenerativer Strategien zur Therapie der Neurotrophen Keratopathie

1. Kheyrollah M, Brandt N, Bräuer AU, **Schrader S**, **Mertsch S.**, The role of lysophosphatidic acid and its receptors in corneal nerve regeneration. *Ocul Surf*. 2025 Apr;36:10-18. doi: 10.1016/j.jtos.2024.12.006. Epub 2024 Dec 20. PMID: 39709127
2. **Mertsch S**, Neumann I, Rose C, Schargus M, Geerling G, **Schrader S**, The effect of Rho Kinase inhibition on corneal nerve regeneration in vitro and in vivo, *Ocul Surf* 22 (2021) 213-223
3. **Mertsch S**, Alder J, Dua HS, Geerling G, [Pathogenesis and epidemiology of neurotrophickeratopathy], *Ophthalmologie* 116(2) (2019) 109-119.
4. Alder J, **Mertsch S**, Menzel-Severing J, Geerling G, [Current and experimental treatment approaches for neurotrophic keratopathy], *Ophthalmologie* 116(2) (2019) 127-137.

Entwicklung Regenerativer Strategien zur Therapie des trockenen Auges

1. Jaffet J, Singh V, **Schrader S**, **Mertsch S.**, The Potential Role of Exosomes in Ocular Surface and Lacrimal Gland Regeneration, *Curr Eye Res*. 2025 Dec;50(12):1211-1224.doi: 10.1080/02713683.2024.2424265. Epub 2024 Nov 7.
2. Malek, G., Schrader, S., Exosomes Across the Globe - How Essential are They to Ocular Biology, Pathology, and Therapy? *Curr Eye Res*. 2025 Dec;50(12):1195-1196. doi: 10.1080/02713683.2025.2567599. Epub 2026 Jan 11. PMID: 41521676
3. Veernala, I, Jaffet J, Fried J, **Mertsch S**, **Schrader S**, Basu S, Vemuganti G K, and Singh V; Lacrimal gland regeneration: The unmet challenges and promise for dry eye therapy. *Ocul Surf* 25, 129-141, 2022
4. Pleyer U, Geerling G, **Schrader S**, Jacobi C, Kimmich F, Messmer E, [If Artificial Tears Aren't Enough. The Importance of Inflammatory Processes in Dry Eye Disease. Practical Aspects of an Anti- Inflammatory Therapy of Dry Eye Disease], *Klin Monbl Augenheilkd* 237(5) (2020) 655-668.

5. Dietrich J, **Schrader S**, Towards Lacrimal Gland Regeneration: Current Concepts and Experimental Approaches, *Curr Eye Res* 45(3) (2020) 230-240.
6. Dietrich J, Roth M, König S, Geerling G, **Mertsch S, Schrader S**, Analysis of lacrimal gland derived mesenchymal stem cell secretome and its impact on epithelial cell survival, *Stem Cell Res* 38 (2019) 101477.
7. Dietrich J, Ott L, Roth M, Witt J, Geerling G, **Mertsch S, Schrader S**, MSC Transplantation Improves Lacrimal Gland Regeneration after Surgically Induced Dry Eye Disease in Mice, *Sci Rep* 9(1) (2019) 18299.
8. 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* 12(4) (2018) e2001- e2009.
9. Dietrich J, Schlegel C, Roth M, Witt J, Geerling G, **Mertsch S, Schrader S**, Comparative analysis on the dynamic of lacrimal gland damage and regeneration after Interleukin-1alpha or duct ligation induced dry eye disease in mice, *Exp Eye Res* 172 (2018) 66-77
10. Massie I, Spaniol K, Barbian A, Poschmann G, Stuhler 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* 58(12) (2017) 5564-5574.
11. 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* 41(10) (2016) 1255-1265.
12. 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* 41(9) (2016) 1131-42.
13. Chao W, Belmonte C, Benitez Del Castillo J, Bron A, Dua H, Nichols K, Novack G, **Schrader S**, Willco 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.
14. 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* 21(19-20) (2015) 2605-17.
15. Roth M, Spaniol K, Kordes C, Schwarz S, **Mertsch S**, Haussinger 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* 56(8) (2015) 4741-52.

16. Finis D, Gerber PA, **Schrader S**, Geerling G. Okuläre Rosazea und Meibomdrüsendysfunktion. Z. prakt. Augenheilkd. 33: 457 – 467 (2012)
17. Finis D, **Schrader S**, Geerling G. Meibomian Gland Dysfunction. Klinische Monatsblätter für Augenheilkunde 2012 Apr;229:506-513
18. **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
19. Notara M, Alatz 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
20. **Schrader S**, Mircheff AK, Geerling G: Animal Models of Dry Eye. Dev Ophthalmol. 2008;41:298- 312.

Entwicklung Regenerativer Strategien zur Therapie Retinaler Erkrankungen

1. Song F, Owczarek-Lipska M, Ahmels T, Book M, Aisenbrey S, Menghini M, Barthelmes D, **Schrader S**, Spital G, Neidhardt J, High-Throughput Sequencing to Identify Mutations Associated with Retinal Dystrophies, Genes (Basel) 12(8) (2021).
2. Ou K, Copland DA, Theodoropoulou S, **Mertsch S**, Li Y, Liu J, **Schrader S**, Liu L, Dick AD, Treatment of diabetic retinopathy through neuropeptide Y-mediated enhancement of neurovascular microenvironment, J Cell Mol Med 24(7) (2020) 3958-3970
3. Ou K, **Mertsch S**, Theodoropoulou S, Wu J, Liu J, Copland DA, Scott LM, Dick AD, **Schrader S**, Liu L, Muller Cells Stabilize Microvasculature through Hypoxic Preconditioning, Cell Physiol Biochem 52(4) (2019) 668-680.
4. Ou K, **Mertsch S**, Theodoropoulou S, Wu J, Liu J, Copland DA, **Schrader S**, Liu L, Dick AD, Restoring retinal neurovascular health via substance P, Exp Cell Res 380(2) (2019) 115-123.
5. **Mertsch S**, Schlicht K, Melkonyan H, Schlatt S, Thanos S, snRPN controls the ability of neurons to regenerate axons, Restor Neurol Neurosci 36(1) (2018) 31-43.

Evaluation verschiedener Behandlungsansätze für den vorderen Augenabschnitt

1. Teubert S, Borgardts K, Steindor F, Borrelli M, **Schrader S**, Geerling G, Spaniol K., Ten-Year Follow-Up After Descemet Membrane Endothelial Keratoplasty. Cornea. 2024 Oct 29;44(9):1119-1126. doi: 10.1097/ICO.0000000000003748. PMID: 39476369
2. Menzel-Severing J, **Schrader S**, Schlotzer-Schrehardt U and Geerling G; Transcorneal freezing and topical Rho-kinase inhibitor treatment in Fuchs endothelial corneal dystrophy. Eye (Lond) 36, 891- 893, 2022

3. Juergens L, Michiels S, Borrelli M, Spaniol K, Guthoff R, **Schrader S**, Frings A, Geerling G, Intraoperative OCT - Real-World User Evaluation in Routine Surgery, *Klin Monbl Augenheilkd*, 238(6) (2021) 693-699
4. Enders P, Hall J, Bornhauser M, Mansouri K, Altay L, **Schrader S**, Dietlein TS, Bachmann BO, Neuhaus T, Cursiefen C, Telemetric Intraocular Pressure Monitoring after Boston Keratoprosthesis Surgery Using the Eyemate-IO Sensor: Dynamics in the First Year, *Am J Ophthalmol* 206 (2019) 256-263.
5. Frings A, **Schrader S**, Hille K, Staab I, Geerling G, [Health-related quality of life after implantation of a keratoprosthesis with biological haptic], *Ophthalmologie* 115(1) (2018) 34-39.
6. Novack GD, Asbell P, Barabino S, Bergamini MW, 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.
7. 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.
8. 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.
9. 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.
10. **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.
11. 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.
12. **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.
12. **Schrader S**, Tost HW, Geerling G. Lacrimal punctal occlusion. Chapter 37 of the Book „Ocular Surface Disorders by Jose M Benitz-del-Castillo and Michael A Lemp. JP Medical Publisher 2013. ISBN 978-1-907816-31-4
13. 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. *Ophthalmologie*. 2008 Jul;105(7):623-31.

Evaluation neuer Keratoplastik- und Keratoprothesen-Techniken

1. Steindor FA, Menzel-Severing J, Borrelli M, **Schrader S**, and Geerling G; DMEK after penetrating keratoplasty: cohort with DMEK grafts and descemetorhexis larger than full-thickness graft. Graefes Arch Clin Exp Ophthalmol 260, 2933-2939, 2022
2. 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.
3. 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
4. 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
5. 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
6. Spaniol K, Borrelli M, Holtmann C, **Schrader S**, Geerling G. Complications of Descemet's membrane endothelial keratoplasty]. Ophthalmologe. 2015 Dec;112(12):974-81