



# GÖTTINGEN MINIPIGS

*Recommended papers 2024*



**ELLEGAARD** ••  
GÖTTINGEN MINIPIGS



## **We enable development of safer and more effective medicines**

*We believe in the value of scientific validity, research, background data, and collaboration, and invest an increasing share of our resources in the development and accumulation of new knowledge about Göttingen Minipigs, and in networking with scientists working actively with our animals.*

## **ELLEGAARD ••** GÖTTINGEN MINIPIGS

Ellegaard Göttingen Minipigs A/S breeds and supplies genetically well-defined and healthy Göttingen Minipigs for biomedical research. From our AAALAC-accredited facility in Denmark, we breed Göttingen Minipigs and IgG Humanized Göttingen Minipigs, and provide research services to enable the development of safer and more effective medicines.

Göttingen Minipigs are fully recognized as an established animal model by all regulatory authorities worldwide and should always be considered when choosing a non-rodent animal

model for preclinical studies due to their unique health status, well-documented genetic background, similarity to humans, and availability in large, uniform groups. They are bred in independent, full-barrier, SPF facilities to ensure high microbiological quality, and their well-defined health status is recorded in Health Monitoring Reports based on FELASA recommendations.

All of this based on our core values: Animal welfare, Quality, Respect, and Collaboration.

# Recommended papers on Göttingen Minipigs in biomedical research

Since the introduction of Göttingen Minipigs to the market in the 1980s, hundreds of scientific papers have been published about studies involving Göttingen Minipigs, proving their relevance as a non-rodent animal species in biomedical research. On the following pages, a selection of papers has been grouped in topics to illustrate areas in which Göttingen Minipigs have excelled. It is important to note, that **the list of topics and papers is far from complete**, but includes an excerpt of papers with a more general approach, which have contributed to the general understanding and characterisation of Göttingen Minipigs as a large animal model.

Ellegaard Göttingen Minipigs strives at collecting all available knowledge and relevant publications about Göttingen Minipigs in biomedical research. If you are looking for something specific, or references to a topic not included on the list, please contact [ellegaard@minipigs.dk](mailto:ellegaard@minipigs.dk).

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## ADME and PK/PD

### **Age-related Differences in CYP3A Abundance and Activity in the Liver of the Göttingen Minipig**

Els Van Peer, Lies De Bock, Koen Boussery, et al.  
*Basic & Clinical Pharmacology & Toxicology* | 2015  
DOI [10.1111/bcpt.12410](https://doi.org/10.1111/bcpt.12410)

### **In vitro Phase I- and Phase II-Drug Metabolism in The Liver of Juvenile and Adult Göttingen Minipigs**

Els Van Peer, Frank Jacobs, Jan Snoeys, et al.  
*Pharmaceutical Research* | 2017  
DOI [10.1007/s11095-017-2101-y](https://doi.org/10.1007/s11095-017-2101-y)

### **Utility of Göttingen minipigs for Prediction of Human Pharmacokinetic Profiles After Dermal Drug Application**

Syunsuke Yamamoto, Masatoshi Karashima, Noriyasu Sano, et al.  
*Pharmaceutical Research* | 2017  
DOI [10.1007/s11095-017-2247-7](https://doi.org/10.1007/s11095-017-2247-7)

### **Sex dictates the constitutive expression of hepatic cytochrome P450 isoforms in Göttingen minipigs**

Martin Krøyer Rasmussen, Carsten Scavenius, Sabine Gerbal-Chaloin, Jan Enghild  
*Toxicology Letters* | 2019  
DOI [10.1016/j.toxlet.2019.08.008](https://doi.org/10.1016/j.toxlet.2019.08.008)

### **A Physiology-Based Pharmacokinetic Framework to Support Drug Development and Dose Precision During Therapeutic Hypothermia in Neonates**

Anne Smits, Pieter Annaert, Steven Van Cruchten, Karel Allegaert  
*Frontiers In Pharmacology* | 2020  
DOI [10.3389/fphar.2020.00587](https://doi.org/10.3389/fphar.2020.00587)

### **Hepatic Cytochrome P450 Abundance and Activity in the Developing and Adult Göttingen Minipig: Pivotal Data for PBPK Modeling**

Laura Buysens, Laura De Clerck, Wim Schelstraete, et al.  
*Frontiers In Pharmacology* | 2021  
DOI [10.3389/fphar.2021.665644](https://doi.org/10.3389/fphar.2021.665644)

### **Utility of Göttingen minipigs for the prediction of human pharmacokinetic profiles after intravenous drug administration**

Ning Ding, Syunsuke Yamamoto, Ikumi Chisaki, et al.  
*Drug Metabolism and Pharmacokinetics* | 2021  
DOI [10.1016/j.dmpk.2021.100408](https://doi.org/10.1016/j.dmpk.2021.100408)

### **Characterisation of intravenous pharmacokinetics in Göttingen minipig and clearance prediction using established in vitro to in vivo extrapolation methodologies**

Kristine Langthaler, Christopher R Jones, Rasmus B Christensen, et al.  
*Xenobiotica* | 2022  
DOI [10.1080/00498254.2022.2115425](https://doi.org/10.1080/00498254.2022.2115425)

## Toxicology and Safety

### **The minipig as a platform for new technologies in toxicology**

Roy Forster, Philippe Ancian, Merete Fredholm, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2010  
DOI [10.1016/j.vascn.2010.05.007](https://doi.org/10.1016/j.vascn.2010.05.007)

### **The RETHINK project on minipigs in the toxicity testing of new medicines and chemicals: conclusions and recommendations**

Roy Forster, Gerd Bode, Lars Ellegaard, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2010  
DOI [10.1016/j.vascn.2010.05.008](https://doi.org/10.1016/j.vascn.2010.05.008)

### **The utility of the minipig as an animal model in regulatory toxicology**

Gerd Bode, Peter Clausing, Frederic Gervais, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2010  
DOI [10.1016/j.vascn.2010.05.009](https://doi.org/10.1016/j.vascn.2010.05.009)

### **The RETHINK project: Minipigs as models for the toxicity testing of new medicines and chemicals: an impact assessment**

Roy Forster, Gerd Bode, Lars Ellegaard, Jan Willem van der Laan  
*Journal of Pharmacological and Toxicological Methods* | 2010  
DOI [10.1016/j.vascn.2010.05.003](https://doi.org/10.1016/j.vascn.2010.05.003)

### **Regulatory acceptability of the minipig in the development of pharmaceuticals, chemicals and other products**

Jan Willem van der Laan, John Brightwell, Peter McAnulty, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2010  
DOI [10.1016/j.vascn.2010.05.005](https://doi.org/10.1016/j.vascn.2010.05.005)

### **A shortened study design for embryo-fetal development studies in the minipig**

Céline Pique, Edward Marsden, Paul Quesada, et al.  
*Reproductive Toxicology* | 2018  
DOI [10.1016/j.reprotox.2018.06.009](https://doi.org/10.1016/j.reprotox.2018.06.009)

### **Perspectives From the 12th Annual Minipig Research Forum: Early Inclusion of the Minipig in Safety Assessment Species Selection Should be the Standard Approach**

Keith Jones, Joanna Harding, Andy Makin, et al.  
*Toxicologic Pathology* | 2019  
DOI [10.1177/0192623319861940](https://doi.org/10.1177/0192623319861940)

### **Species selection for nonclinical safety assessment of drug candidates: Examples of current industry practice**

Rostam Namdari, Keith Jones, Samuel S. Chuang, et al.  
*Regulatory Toxicology and Pharmacology* | 2021  
DOI [10.1016/j.yrtph.2021.105029](https://doi.org/10.1016/j.yrtph.2021.105029)



## Metabolism

### **Contribution of animal models to the understanding of the metabolic syndrome: a systematic overview**

O Varga, M Harangi, I A S Olsson, A K Hansen  
*Obesity Reviews* | 2010  
DOI [10.1111/j.1467-789X.2009.00667.x](https://doi.org/10.1111/j.1467-789X.2009.00667.x)

### **Metabolic syndrome and extensive adipose tissue inflammation in morbidly obese Göttingen minipigs**

Simone Renner, Andreas Blutke, Britta Dobenecker, et al.  
*Molecular Metabolism* | 2018  
DOI [10.1016/j.molmet.2018.06.015](https://doi.org/10.1016/j.molmet.2018.06.015)

### **NASH-inducing Diets in Göttingen Minipigs**

Henrik D Pedersen, Elisabeth D Galsgaard, Berit Ø Christoffersen, et al.  
*Journal of Clinical and Experimental Hepatology* | 2019  
DOI [10.1016/j.jceh.2019.09.004](https://doi.org/10.1016/j.jceh.2019.09.004)

### **Characterization and Pharmacological Validation of a Preclinical Model of NASH in Göttingen Minipigs**

Valérie Duvivier, Stéphanie Creusot, Olivier Broux, et al.  
*Journal of Clinical and Experimental Hepatology* | 2021  
DOI [10.1016/j.jceh.2021.09.001](https://doi.org/10.1016/j.jceh.2021.09.001)

### **Quantifying energy expenditure in Göttingen Minipigs with the <sup>13</sup>C-bicarbonate method under basal and drug-treated conditions**

Simon K Bredum, Anja V Strathe, Julie Jacobsen, et al.  
*Clinical Nutrition ESPEN* | 2023  
DOI [10.1016/j.clnesp.2023.10.041](https://doi.org/10.1016/j.clnesp.2023.10.041)



## Immunology

### **Nonclinical evaluation of immunological safety in Göttingen Minipigs: The CONFIRM initiative**

Jacques Descotes, Linda Allais, Philippe Ancian, et al.  
*Regulatory Toxicology and Pharmacology* | 2018  
DOI [10.1016/j.yrtph.2018.02.015](https://doi.org/10.1016/j.yrtph.2018.02.015)

### **Skin immune cell characterization in juvenile and adult Göttingen Minipigs**

Linda Allais, Elise Brisebard, Nicolas Ravas, et al.  
*Regulatory Toxicology and Pharmacology* | 2021  
DOI [10.1016/j.yrtph.2021.104861](https://doi.org/10.1016/j.yrtph.2021.104861)

### **Immunosafety evaluation in Juvenile Göttingen Minipigs**

Linda Allais, Alicia Perbet, Fabienne Condevaux, et al.  
*Journal of Immunotoxicology* | 2022  
DOI [10.1080/1547691X.2022.2088904](https://doi.org/10.1080/1547691X.2022.2088904)

### **Characterization of the immune system of Ellegaard Göttingen Minipigs - An important large animal model in experimental medicine**

Clara P S Pernold, Emil Lagumdzic, Maria Stadler, et al.  
*Frontiers In Immunology* | 2022  
DOI [10.3389/fimmu.2022.1003986](https://doi.org/10.3389/fimmu.2022.1003986)

## Cardiovascular

### **Evaluation of cardiovascular and ECG parameters in the normal, freely moving Göttingen Minipig**

Miriam Stubhan, Michael Markert, Karin Mayer, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2008  
DOI [10.1016/j.vascn.2008.02.001](https://doi.org/10.1016/j.vascn.2008.02.001)

### **The adult Göttingen minipig as a model for chronic heart failure after myocardial infarction: focus on cardiovascular imaging and regenerative therapies**

Karl H Schuleri, Andrew J Boyle, Marco Centola, et al.  
*Comparative Medicine* | 2008  
PMCID [PMC2710749](https://pubmed.ncbi.nlm.nih.gov/PMC2710749/)

### **Hypertriglyceridemia and Atherosclerosis: Using Human Research to Guide Mechanistic Studies in Animal Models**

Debapriya Basu, Karin E Bornfeldt  
*Frontiers In Endocrinology* | 2020  
DOI [10.3389/fendo.2020.00504](https://doi.org/10.3389/fendo.2020.00504)

### **Novel Göttingen Miniswine Model of Heart Failure With Preserved Ejection Fraction Integrating Multiple Comorbidities**

Thomas E Sharp 3rd, Amy L Scarborough, Zhen Li, et al.  
*JACC: Basic to Translational Science* | 2021  
DOI [10.1016/j.jacbts.2020.11.012](https://doi.org/10.1016/j.jacbts.2020.11.012)

### **Heart Failure With Preserved Ejection Fraction: Heterogeneous Syndrome, Diverse Preclinical Models**

Jason Roh, Joseph A Hill, Abhilasha Singh, et al.  
*Circulation Research* | 2022  
DOI [10.1161/CIRCRESAHA.122.320257](https://doi.org/10.1161/CIRCRESAHA.122.320257)

### **Implantation of telemetric blood pressure transmitters in Göttingen Minipigs: Validation of 24-h systemic blood pressure and heart rate monitoring and influence of anaesthesia**

Michelle Fischer Carlsen, Berit Østergaard Christoffersen, Rikke Lindgaard, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2022  
DOI [10.1016/j.vascn.2022.107168](https://doi.org/10.1016/j.vascn.2022.107168)

### **Electrocardiography and heart rate variability in Göttingen Minipigs: Impact of diurnal variation, lead placement, repeatability and streptozotocin-induced diabetes**

Mille Kronborg Lyhne, Karina Poulsdóttir Debes, Terese Helgogaard, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2022  
DOI [10.1016/j.vascn.2022.107221](https://doi.org/10.1016/j.vascn.2022.107221)

### **Large animal models for cardiac remuscularization studies: A methodological review**

Yuexin Yu, Seng Kong Tham, Fatin Fazrina Roslan, et al.  
*Frontiers In Cardiovascular Medicine* | 2023  
DOI [10.3389/fcvm.2023.1011880](https://doi.org/10.3389/fcvm.2023.1011880)

## Biomaterial

### **Safety and efficacy of sFilm-FS, a novel biodegradable fibrin sealant, in Göttingen minipigs**

Yuval Ramot, Michal Steiner, Yossi Lavie, et al.  
*Journal of Toxicologic Pathology* | 2021  
DOI [10.1293/tox.2021-0030](https://doi.org/10.1293/tox.2021-0030)

### **The minipig intraoral dental implant model: A systematic review and meta-analysis**

Marta Liliana Musskopf, Amanda Finger Stadler, Ulf Me Wikesjö, Cristiano Susin  
*PLoS One* | 2022  
DOI [10.1371/journal.pone.0264475](https://doi.org/10.1371/journal.pone.0264475)

### **Angiopoietin-like 3-derivative LNA043 for cartilage regeneration in osteoarthritis: a randomized phase 1 trial**

Nicole Gerwin, Celeste Scotti, Christine Halleux, et al.  
*Nature Medicine* | 2022  
DOI [10.1038/s41591-022-02059-9](https://doi.org/10.1038/s41591-022-02059-9)

### **Articular Cartilage Repair After Implantation of Hyaline Cartilage Beads Engineered From Adult Dedifferentiated Chondrocytes: Cartibeads Preclinical Efficacy Study in a Large Animal Model**

Halah Kutaish, Philippe Matthias Tscholl, Erika Cosset, et al.  
*The American Journal of Sports Medicine* | 2023  
DOI [10.1177/03635465221138099](https://doi.org/10.1177/03635465221138099)

### **Long-term in vivo observations show biocompatibility and performance of ZX00 magnesium screws surface-modified by plasma-electrolytic oxidation in Göttingen miniature pigs**

Alexander Kopp, Heilwig Fischer, Ana Prates Soares, et al.  
*Acta Biomaterialia* | 2023  
DOI [10.1016/j.actbio.2022.11.052](https://doi.org/10.1016/j.actbio.2022.11.052)

### **Three-dimensional correction of scoliosis by a double spring reduction system as a dynamic internal brace: a pre-clinical study in Göttingen minipigs**

Justin V C Lemans, Sebastiaan P J Wijdicks, Gerrit Overweg, et al.  
*The Spine Journal* | 2023  
DOI [10.1016/j.spinee.2022.10.012](https://doi.org/10.1016/j.spinee.2022.10.012)

### **Inter-implant distance and buccal bone thickness for a novel implant design: a preclinical study**

Stephen Chen, Ivan Darby  
*Clinical Oral Investigations* | 2023  
DOI [10.1007/s00784-023-04942-2](https://doi.org/10.1007/s00784-023-04942-2)

### **A low-profile electromechanical packaging system for soft-to-flexible bioelectronic interfaces**

Florian Fallegger, Alix Trouillet, Florent-Valéry Coen, et al.  
*APL Bioengineering* | 2023  
DOI [10.1063/5.0152509](https://doi.org/10.1063/5.0152509)

### **Engineering 3D Printed Bioceramic Scaffolds to Reconstruct Critical-Sized Calvaria Defects in a Skeletally Immature Pig Model**

Evellyn M DeMitchell-Rodriguez, Chen Shen, Vasudev Vivekanand Nayak, et al.  
*Plastic and Reconstructive Surgery* | 2023  
DOI [10.1097/PRS.00000000000010258](https://doi.org/10.1097/PRS.00000000000010258)

### **The effect of connective tissue graft or a collagen matrix on epithelial differentiation around teeth and implants: a preclinical study in minipigs**

Alexandra Stähli, László Párkányi, Sofia Aroca, et al.  
*Clinical Oral Investigations* | 2023  
DOI [10.1007/s00784-023-05080-5](https://doi.org/10.1007/s00784-023-05080-5)

### **Bone healing around implants placed in subjects with metabolically compromised systemic conditions**

Edmara T P Bergamo, Lukasz Witek, Ilana Ramalho, et al.  
*Journal of Biomedical Materials Research* | 2023  
DOI [10.1002/jbm.b.35264](https://doi.org/10.1002/jbm.b.35264)

### **A Photopolymerizable Biocompatible Hyaluronic Acid Hydrogel Promotes Early Articular Cartilage Repair in a Minipig Model In Vivo**

Liang Gao, Riccardo Beninato, Tamás Oláh, et al.  
*Advanced Healthcare Materials* | 2023  
DOI [10.1002/adhm.202300931](https://doi.org/10.1002/adhm.202300931)





**An injectable and biodegradable zwitterionic gel for extending the longevity and performance of insulin infusion catheters**

Ershuai Zhang, Yuanjie Shi, Xiangfei Han, et al.

*Nature Biomedical Engineering* | 2023

DOI [10.1038/s41551-023-01108-z](https://doi.org/10.1038/s41551-023-01108-z)

**Neural Stimulation Hardware for the Selective Intrafascicular Modulation of the Vagus Nerve**

I Strauss, F Agnesi, C Zinno, et al.

*IEEE Transactions on Neural Systems and Rehabilitation Engineering* | 2023

DOI [10.1109/TNSRE.2023.3329735](https://doi.org/10.1109/TNSRE.2023.3329735)

**Two- and three-piece implants to boost data generation in preclinical in vivo research—A short technical report**

Andreas Stavropoulos, Benjamin Bellon, Benjamin Pipenger, Ole Z Andersen

*Clinical and Experimental Dental Research* | 2023

DOI [10.1002/cre2.805](https://doi.org/10.1002/cre2.805)

**Bone regeneration in critical-size defects of the mandible using biomechanically adapted CAD/CAM hybrid scaffolds: An in vivo study in miniature pigs**

Juliane Wagner, Sascha Luck, Klaas Loger, et al.

*Journal of Cranio-Maxillo-Facial Surgery* | 2024

DOI [10.1016/j.jcms.2023.11.007](https://doi.org/10.1016/j.jcms.2023.11.007)

**Osseointegration of implant surfaces in metabolic syndrome and type-2 diabetes mellitus**

Edmara T P Bergamo, Paula G F P de Oliveira, Tiago M B Campos, et al.

*Journal of Biomedical Materials Research* | 2024

DOI [10.1002/jbm.b.35382](https://doi.org/10.1002/jbm.b.35382)

**Sustained Release of Salicylic Acid for Halting Peri-Implantitis Progression in Healthy and Hyperglycemic Systemic Conditions: A Gottingen Minipig Model**

Edmara T P Bergamo, Lukasz Witek, Ilana Santos Ramalho, et al.

*ACS Biomaterials Science & Engineering* | 2024

DOI [10.1021/acsbiomaterials.4c00161](https://doi.org/10.1021/acsbiomaterials.4c00161)

## Methods

### **Online histological atlas of the Göttingen minipig brain**

Dariusz Orłowski, Andreas N Glud, Nicola Palomero-Gallagher, et al.  
*Heliyon* | 2019  
DOI [10.1016/j.heliyon.2019.e01363](https://doi.org/10.1016/j.heliyon.2019.e01363)

### **The minipig intraoral dental implant model: A systematic review and meta-analysis**

Marta Liliana Musskopf, Amanda Finger Stadler, Ulf Me Wikesjö, Cristiano Susin  
*PLoS One* | 2022  
DOI [10.1371/journal.pone.0264475](https://doi.org/10.1371/journal.pone.0264475)

### **Selecting the Best Animal Model of Parkinson's Disease for Your Research Purpose: Insight from in vivo PET Imaging Studies**

Caroline Cristiano Real, Karina Henrique Binda, Majken Borup Thomsen, et al.  
*Current Neuropharmacology* | 2023  
DOI [10.2174/1570159X21666230216101659](https://doi.org/10.2174/1570159X21666230216101659)

### **Development and characterization of an automated behavioral assessment platform for the Göttingen minipig**

Jeffrey L Langston, Todd M Myers  
*Toxicologic Letters* | 2024  
DOI [10.1016/j.toxlet.2024.02.009](https://doi.org/10.1016/j.toxlet.2024.02.009)

## Novel modalities

### **The genomic organization and expression pattern of the low-affinity Fc gamma receptors (Fc $\gamma$ R) in the Göttingen minipig**

Jerome Egli, Roland Schmucki, Benjamin Loos, et al.  
*Immunogenetics* | 2018  
DOI [10.1007/s00251-018-01099-1](https://doi.org/10.1007/s00251-018-01099-1)

### **Tissue Resistance during Large-Volume Injections in Subcutaneous Tissue of Minipigs**

Andrea Allmendinger, Stefan Fischer  
*Pharmaceutical Research* | 2020  
DOI [10.1007/s11095-020-02906-9](https://doi.org/10.1007/s11095-020-02906-9)

### **The CRISPR/Cas9 Minipig—A Transgenic Minipig to Produce Specific Mutations in Designated Tissues**

Martin Fogtmann Berthelsen, Maria Riedel, Huiqiang Cai, et al.  
*Cancers* | 2021  
DOI [10.3390/cancers13123024](https://doi.org/10.3390/cancers13123024)

### **Genomics Integrated Systems Transgenesis (GENISYST) for gain-of-function disease modelling in Göttingen Minipigs**

Joachim Maxeiner, Rahul Sharma, Carolin Amrhein, et al.  
*Journal of Pharmacological and Toxicological Methods* | 2021  
DOI [10.1016/j.vascn.2021.106956](https://doi.org/10.1016/j.vascn.2021.106956)

### **A humanized minipig model for the toxicological testing of therapeutic recombinant antibodies**

Tatiana Flisikowska, Jerome Egli, Krzysztof Flisikowski, et al.  
*Nature Biomedical Engineering* | 2022  
DOI [10.1038/s41551-022-00921-2](https://doi.org/10.1038/s41551-022-00921-2)

### **Application of the transgenic pig model in biomedical research: A review**

Jialin Wei, Wen Zhang, Jie Li, et al.  
*Frontiers In Cell and Developmental Biology* | 2022  
DOI [10.3389/fcell.2022.1031812](https://doi.org/10.3389/fcell.2022.1031812)

### **Investigating the effect of obesity on adipose-derived stem cells (ASCs) using Göttingen Minipigs**

Maria Meyhoff-Madsen, Esben Østrup, Merete Fredholm, Susanna Cirera  
*bioRxiv* | 2022  
DOI [10.1101/2022.02.11.477943](https://doi.org/10.1101/2022.02.11.477943)

## Neuro

### **The d-amphetamine-treated Göttingen miniature pig: an animal model for assessing behavioral effects of antipsychotics**

F Josef van der Staay, Bruno Pouzet, Michel Mahieu, et al.  
*Psychopharmacology* | 2009  
DOI [10.1007/s00213-009-1599-z](https://doi.org/10.1007/s00213-009-1599-z)

### **Validation of a Göttingen Minipig Model of Post-Operative Incisional Pain**

Castel D, Schauder A, Aizenberg I, Meilin S  
*JScholar* | 2021  
DOI [10.17303/jasc.2020.2.101](https://doi.org/10.17303/jasc.2020.2.101)

### **A systematic review of porcine models in translational pain research**

Suzan Meijs, Martin Schmelz, Sigal Meilin, Winnie Jensen  
*Lab Animal* | 2021  
DOI [10.1038/s41684-021-00862-4](https://doi.org/10.1038/s41684-021-00862-4)

## Ocular

### **Göttingen Minipigs in Ocular Research**

Stephanie M Shrader, William F Greentree  
*Toxicologic Pathology* | 2018  
DOI [10.1177/0192623318770379](https://doi.org/10.1177/0192623318770379)

### **Biochemical and Electroretinographic Characterization of the Minipig Eye in the Context of Drug Safety Investigations**

Luis Fernando Negro Silva, Christian Li, Paula Juliana Brizuela de Seadi Pereira, et al.  
*International Journal of Toxicology* | 2019  
DOI [10.1177/1091581819867929](https://doi.org/10.1177/1091581819867929)

### **POLYRETINA restores light responses in vivo in blind Göttingen minipigs**

Paola Vagni, Marta Jole Ildelfonsa Airaghi Leccardi, Charles-Henri Vila, et al.  
*Nature Communications* | 2022  
DOI [10.1038/s41467-022-31180-z](https://doi.org/10.1038/s41467-022-31180-z)



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