

## ... performing in Excellence

### Methodology

We established a comprehensive method catalogue for optical measurements of light driven population activity throughout the retina's entire vertical pathway based on synthetic and genetically encoded calcium sensors.

#### Exemplary Research Questions:

- What roles do parallel synaptic feedback mechanisms play in the outer retina?
- How are excitatory signals, from cones to bipolar cells to ganglion cells, relayed through the retina?
- What set of visual stimuli is required to functionally classify the ~20 types of retinal ganglion cells in optical population recordings?
- In view of the dorso-ventral opsin expression gradient of the mouse retina, how is chromatic information processed at different retinal locations?
- Where does the spontaneous oscillatory activity arise in the remodelled outer retina of rd1 mice, a model for human Retinitis Pigmentosa?

Our cornerstone technique is two-photon microscopy, which enables us to excite fluorescent probes within the tissue using infrared laser light. This avoids bleaching of the light-sensitive photoreceptor pigment and therefore allows recording of optical activity in intact retinal tissue while simultaneously stimulating with light patterns. This approach is complemented by single cell electrophysiology and immunocytochemistry.

## Contact

### Institute for Ophthalmic Research Ophthalmic Research

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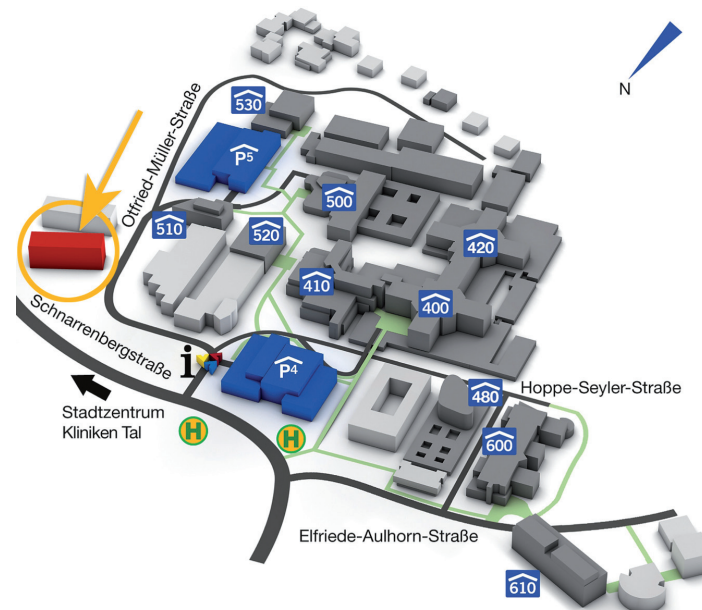
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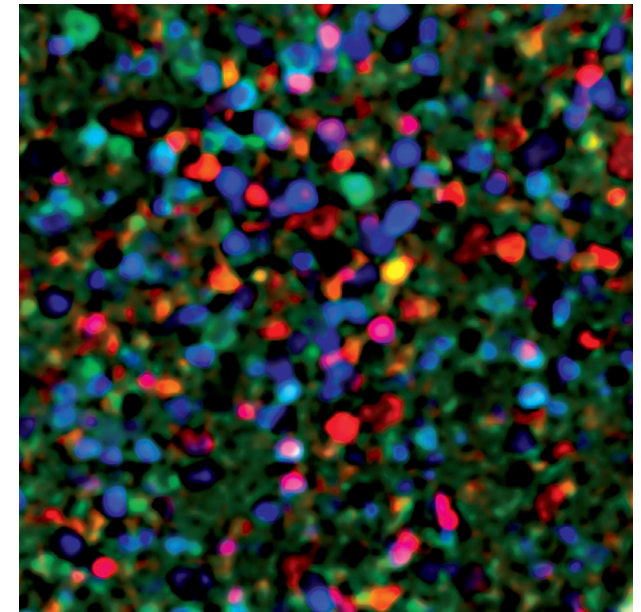
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#### How to find uns:



### Euler Lab Ophthalmic Research

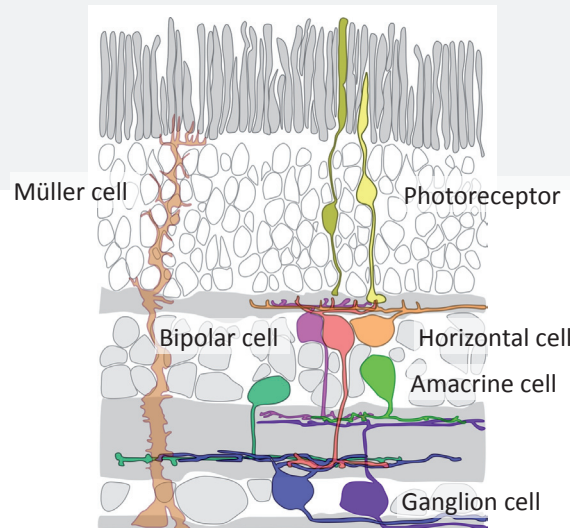




Visual information processing starts in the retina. This thin neuronal tissue lining the back of the eyeball does not only convert the incoming stream of photons into electrical signals, but critically performs a detailed and highly specific analysis of the observed scene. Therefore, the retina can be considered a highly specialized and sophisticated image processor.

All visual information sent from the retina to the brain travels along the optic nerve, a major bottleneck of the visual system – therefore prior to transmission to the brain, important aspects

of the visual scene (e.g. contrast, brightness, “colour”, edges, motion and its direction, edges and trajectories of potential objects, etc.) must be extracted and encoded as spike patterns. The importance of retinal signal processing is highlighted by the fact that the important decision – what information is relevant and therefore kept, and what can be safely discarded – is made already in the retina.



Cross-section of a mammalian retina

The computational capabilities of this intricate neuronal network rely on about 70 types of neurons organized in a plethora of interconnected microcircuits. Our work aims at unravelling function and organization of retinal microcircuits towards a better understanding of the underlying computational principles. Furthermore, we are interested in how these circuits change during development and degeneration.



## Thomas Euler

- Professor, Dr. rer. nat.
- CIN-Professor for Ophthalmic Research



## Timm Schubert

- Dr. rer. nat.
- Deputy Head of Ophthalmic Research

## Research toSee

### The Institute for Ophthalmic Research

The Institute for Ophthalmic Research is headed by Prof. Marius Ueffing and cooperates closely with the University Eye Hospital (Prof. Karl-Ulrich Bartz-Schmidt) under the common roof of the Centre for Ophthalmology in order to perform translational research.

The Institute aims at uncovering the causes for degenerative, inflammatory and vascular diseases of the eye and the visual pathways at molecular, cellular and systemic levels.

The Institute houses several teams of scientists who work together to develop and evaluate concepts for therapy and treatment and optimise clinical and research diagnostics.

Thus, the Institute provides an efficient infrastructure which supports research and education and mediates contacts to other research institutions and to industry.

The Institute enjoys not only a variety of national and international scientific activities, like intense partnerships and cooperations, but also offers courses and seminar opportunities to students and young researchers.

The list of publications and sponsors are the evidence for the success of its activities.