# Interdisciplinary Center of Ophthalmic Preventive Medicine and Imaging (IZPI)

**Speakers**
Prof. Dr. med. Georg Michelson
Prof. Dr.-Ing. Bernhard Schmauss

**Address**
IZPI
Schwabachanlage 6
91054 Erlangen
Phone: +49 9131 8544494
Fax: +49 9131 8536435
georg.michelson@uk-erlangen.de
www.izpi.de

## Aims and structure

The "Interdisciplinary Center of Ophthalmic Preventive Medicine and Imaging" (IZPI) was founded to increase the intensity and the efficiency of cooperation projects between the Faculties of Medicine and of Engineering of the FAU in the field of preventive medicine. The aim is to improve the conditions of research and the public communication of the arising results.

In the scientific areas medical imaging, pattern recognition, and preventive medicine, there was already scientific excellence in the Faculties of Medicine and Engineering. Embedded in the main research focus "Medical Engineering" of the FAU, IZPI should help to enforce and to improve the scientific excellence in these topics. The most important purpose of IZPI is the development of novel diagnostic methods in the area of preventive medicine. The goal is to develop new technologies for early detection of risk factors or symptoms of diseases.

Thus, the areas of interest of IZPI are
(1) Development of novel technologies and
(2) Improvement of well-established technologies by optimizing image acquisition, analysis, and medical prediction

The analysis of medical images and data comprises all processes, which lead to a medical interpretation or a transformation of the medical image in a symbolic description. To extract relevant risk factors from a given medical image, there is the necessity to develop an effective model of the disease. The model will allow elute relevant information from a given image.
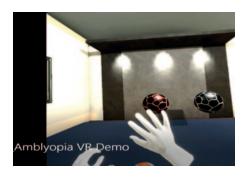
## Research

IZPI researchers from the Faculties of Medicine and of Engineering cooperate within third-party funded projects of the Leading Edge Cluster "Medical Valley EMN e.V." and the School of Advanced Optical Technologies "SAOT" (compare own reports).

### VR-Amblyopia Trainer
PI: Prof. Dr. G. Michelson, W. Mehringer, Prof. Dr. B. Eskofier

A telemedically controlled dichoptic visual-motoric perceptive learning system for amblyopia therapy by means of Virtual Reality (VR) called VR-AMBLYOPIE TRAINER is developed. This VR-supported system uses a new binocular therapy concept to improve the visual acuity of amblyopic children and adolescents. Through a telemedical, ophthalmologic connection, the integration of the new therapy concept into the regular medical operation takes place.


Amblyopia VR Demo

### Implicit Perimetry
PI: Prof. Dr. G. Michelson, H. Hähnlein, J. Martschinke, Prof. Dr.-Ing. M. Stamminger

The Implicit Perimetry project is a Next-Generation HomeCare application to improve glaucoma treatment. The cross-institutional network structure enables HomeCare applications and Big Data applications. In implicit VR perimetry, the view of the saccade to the light stimulus shown is evaluated as the reaction to the light stimulus. The patient no longer has to press a button and stare rigidly into the center for more than 15 minutes. Implicit VR perimetry no longer requires a controller. The saccades are conscious or unconscious, fast, jerky eye movements between fixations, they last about 20 - 100 ms and occur about 200 ms after the stimulus. A HMD (Head Mounted Display) allows the use of VR techniques. Implicit VR perimetry is an excellent basis for use in telemedicine and home care.



### Integrated diagnostic and e-Assistance system for patients with age-related macular degeneration (AMD)

Talkingeyes & More togetherwith IZPI is part of the BMBF project "Interactive Systems in Virtual and Real Spaces - Innovative Technologies for a Healthy Life" (IDeA). The project runs from 2019-2022. The keywords for this network are eye diseases, VR/AR, eye tracking, multi-user, telemedicine, human-machine interaction, assistive technologies. In this project, the Institute of Computer Science (Faculty of Engineering), Max-Planck-Institute for Biological Cybernetic (Tübingen), the Institute of Ophthalmology (university of Tübingen, IFA-UT), the International Center for Ethics in the Sciences and Humanities (university of Tübingen, IZEW), Blickshift GmbH, NMY GmbH and Talkingeyes & More GmbH at the Medical Valley Center cooperate. The network coordinator is Prof. Dr. A. Schmidt, Human-Centered Ubiquitous Media Group, Department of Computer Science of the Ludwig-Maximilians-Universität in Munich.

The goal of IZPI and Talkingeyes & More GmbH is the development of AR/VR-based optometry and telemedical multi-user applications. In particular,

(1) Standardized methods for the investigation of visual function in AMD
(2) User interfaces for multi-user functions and
(3) Quality assurance of software and hardware development are to be developed.

In particular, HomeCare-based methods for visual function testing (TV monitor-, HTC VIVE- and SmartPhone-supported VR-based variants), a digital Amsler Grid, a VR system for testing a 30° visual field, a VR system for testing binocular fusion at different viewing directions and a VR system for testing contrast sensitivity will be developed and validated.

## Teaching

IZPI researchers give lectures within several interdisciplinary frameworks of the Faculties of Medicine and of Engineering. At the Faculty of Medicine, the lecture "retinal microangiopathy as early marker of cardio-vascular diseases" is given as well as lectures for students of the degree program Medical Engineering. The overall concept of these lectures which are called "Biological and Technical Vision" is to link mechanisms of human vision with the vision of machines. For students of the degree program Medical Engineering, we offer the lectures "Biological and Technical Vision" and "Medical Applications of Photonics".