

### **Project 3.5 Observation of the visual cycle in vivo using fluorescence with two-photon excitation**

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**Institute:** Physical Chemistry PAS

**Research group:** Research group No. 3. Physical Optics and Biophotonics Group – prof. dr hab. Maciej Wojtkowski

**www:** <https://icter.pl>

#### **Background:**

Two-photon excited fluorescence laser scanning ophthalmoscopy (TPEF-SLO) is at the forefront of innovations in ocular imaging and R& D efforts toward rapid, non-invasive and objective ways to measure subtle disease-related dysfunctions (optical or molecular). This method provides entirely new biomarkers for retinal disease and therapy monitoring, complementing those from electrophysiology. Combined with new robotic surgical systems, these methods will enable a new service for accurately localizing the insertion of therapeutic agents into the retina in an artificial intelligence (AI)-assisted process.

The study of optical response and photoreceptor activity is of great importance both for a more complete understanding of how our visual organ functions and for more effective monitoring of therapy.

In this PhD project, we propose to use new quantitative methods recently developed by ICTER research groups to accurately map functional changes in the retina. The information obtained on the neurosensory function of the retina will be used in conjunction with deep learning methods to introduce individualized therapeutic strategies, which in turn can be applied to interventional therapies using a robotic injection system.

#### **Aim:**

The aim of this project is to develop a new methodology for optical imaging of localized functional deficiencies of the eye using two-photon fluorescence scanning laser ophthalmoscopy (TPEF-SLO). The development of TPEF-SLO will allow quantitative and in vivo evaluation of the presence of retinol esters in retinal pigment epithelial cells. These pigments are actively involved in the visual process.

#### **Requirements:**

- the candidate is expected to have a degree in optical engineering or related field with additional skills in LabView, matlab programming and experience in photonic set-up design.