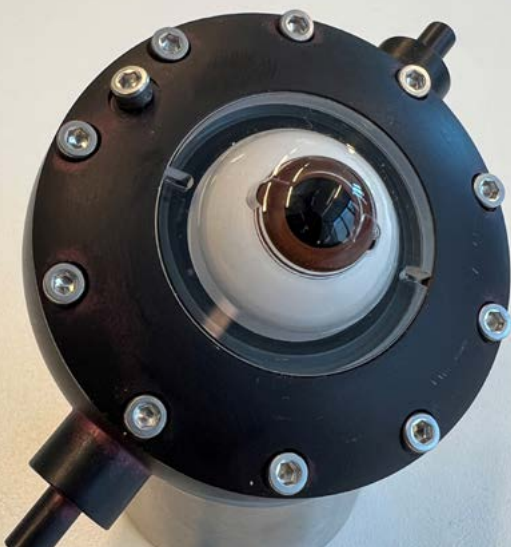


Model Eyes



TNO designs innovative retinal imaging devices in collaboration with partners. Before retinal imaging prototypes are validated on human subjects, it is essential to accurately test the prototype and to validate the optical model behind the innovative design.

For this validation, TNO has designed a series of Model Eyes which represent the tissue optical properties of the retina.

Optical tissue phantom types

TNO has developed 2 different types of optical tissue phantoms:

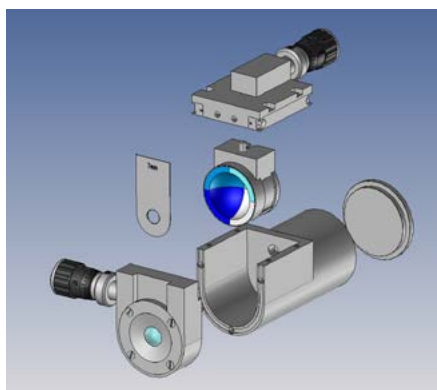
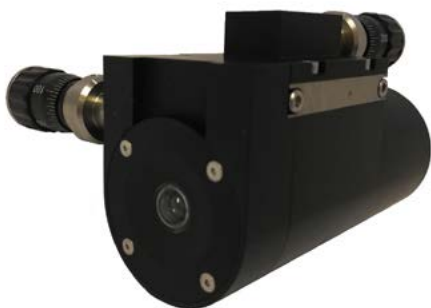
- **3D heterogeneous tissue optical phantoms**
3D heterogeneous phantoms mimic different tissue layers along with their scattering and absorption properties. They may be realized in a 3-dimensional shape.
- **3D dynamic phantoms**
In 3D dynamic phantoms at least one of the optical tissue mimicking properties can be dynamically controlled, such as the oximetry of blood in a retinal vessel.

The Model Eyes are typically water-filled to simulate the optical properties of the vitreous chamber.

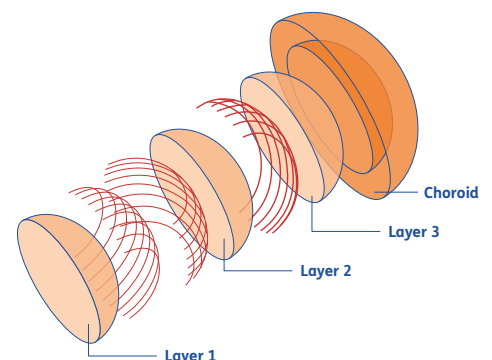
Tailor made Model Eyes

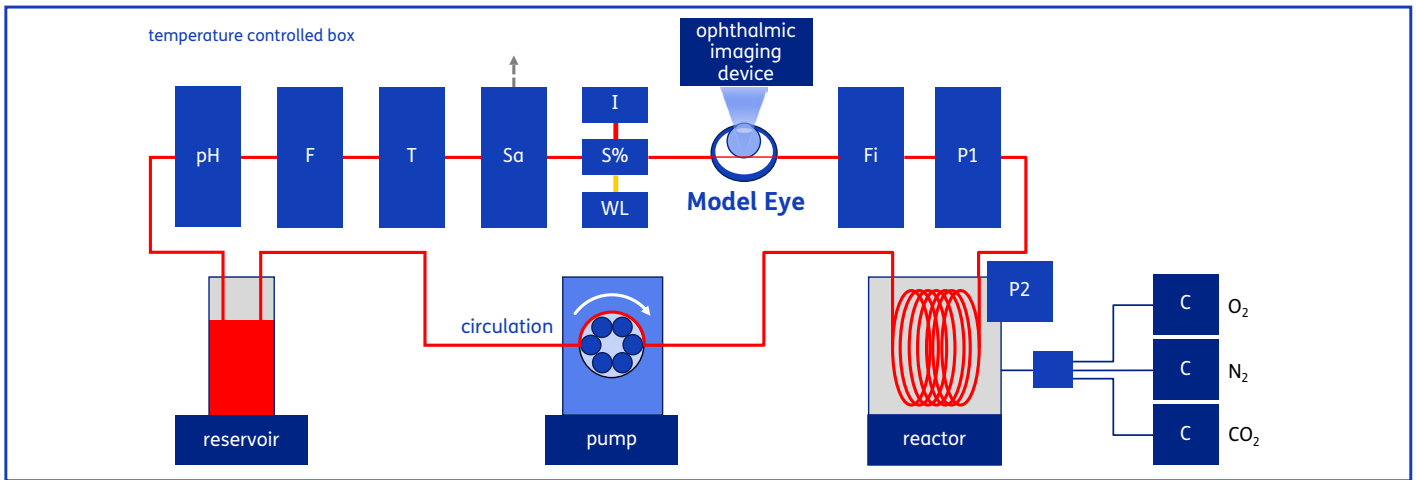
TNO is specialised in the development of Model Eyes. These Model Eyes can be customized with e.g. the following options:

- Adjustment of diopter through distance of lens to retina
- Interchangeable pupil sizes
- Adjusting the tissue optical properties of the retinal layers:
 - absorption properties
 - scattering properties
 - fluorescence properties
- Structural information can be added by addition of:
 - Fluorescent microspheres
 - Vascular structures



A 3D heterogeneous Model Eye with adjustable eye length and pupil size.





Real human blood is perfused through the Model Eye using a miniature heart-lung system.

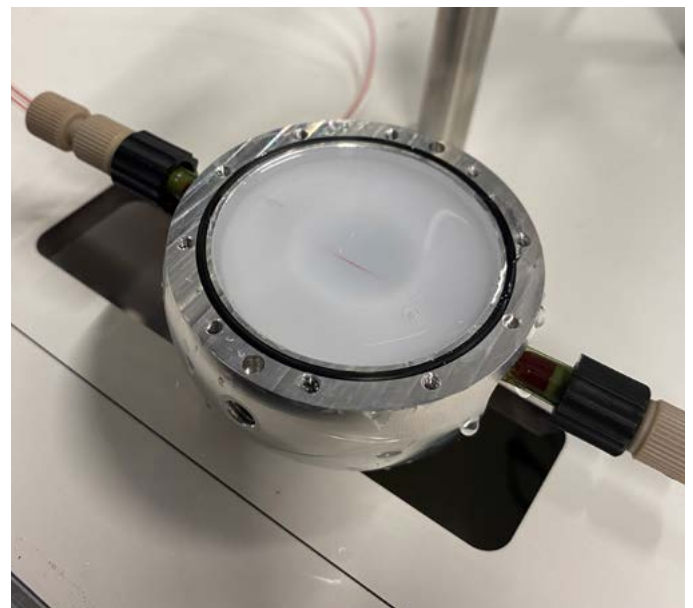
OCT-A, fluorescence angiography and retinal oximetry Model Eyes

The newest generation of TNO's Model Eyes is designed for the validation of OCT-angiography, fluorescence angiography and retinal oximetry. This Model Eye has a microvessel with a diameter of 50, 100 or 150 μm integrated in the retina. The matrix around the vessel mimics the scattering properties of the retina and choroid. With this Model Eye the perfusion of the retina is simulated by the perfusion of whole human blood or blood-like fluids, while also regulating the oxygenation level and flow speed of the blood.



A 3D dynamic Model Eye used for the validation of retinal oximetry devices. A 100 μm blood vessel is embedded in a silicone matrix layer with scatterers to simulate the light scattering properties of the retina and choroid.

Human blood is pumped through the vessel with a precisely controlled flow rate and oxygen saturation level.



More information

TNO is open for additional collaborations on these topics.

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