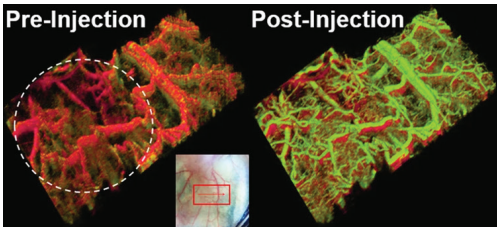
Skin Angiography

THORLABS
APP HIGHLIGHT

APPLICATION

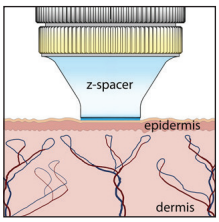


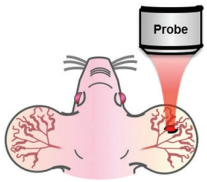
3D OCT image from a blood vessel network in a mouse ear before (left) and after (right) the injection of a contrast agent. The inset shows a photograph of the mouse ear; the scan area is highlighted by the red box.[1,*]

OCT Angiography uses the signal from blood cells to highlight blood vessels amongst the surrounding tissue; no dyes are needed.

TYPICAL SETUP

- A tilted glass window provides a smooth surface in order to decrease artifacts and increase signal intensity.
- For angiography in the skin, a spacer from Thorlabs can serve to fix the probe to the skin and provide a glass surface, as illustrated to the right.[4,*]
- Imaging on fixed, immobilized subjects is also possible without any additional spacer, as illustrated to the right.[5,*]

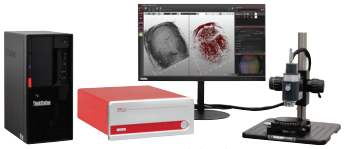




RECOMMENDED ITEMS

Choice of OCT System:

- **TEL321C1(/M):** High Resolution
- **VEG220C1(/M):** High Penetration Depth



TEL321C1

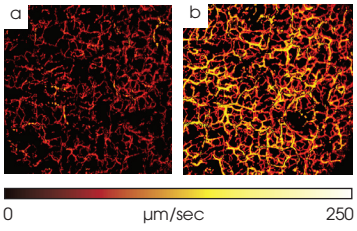
Useful Accessories:

- Different Objectives for Different Purposes:
  - **OCT-LK3** High-Resolution Objective for Small Capillary Imaging
  - **OCT-LK4** Long-Focus Objective for Large Depth of Focus (Deep Imaging)
- Immersion Spacers to Stabilize Scan Head and Provide Flat Surface
  - **OCT-IMM3** for OCT-LK3 Lens Kit
  - **OCT-IMM4** for OCT-LK4 Lens Kit

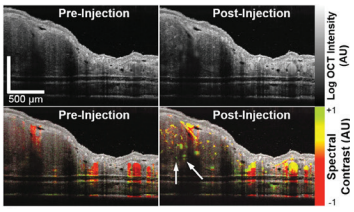
QUICK FACTS

- OCT uses infrared light with very low intensities (laser class 1M).
- OCT Angiography highlights blood vessels through changes in the OCT signal caused by moving blood cells.
- No dyes are necessary.
- OCT Angiography has to be performed *in vivo*.
- The Speckle Variance Angiography Mode is included in the complimentary ThorImage®OCT software package.
- Functionalized additives such as gold nanorods can be used to enhance the signal strength.[1]
- The typical imaging depth is 1 mm in skin.
- The blood flow velocity can be extracted via additional post processing.[2,3]
- For OCT imaging on cerebral blood vessels, please see our OCT App Highlight on Brain Angiography.
- Thorlabs' OCT systems are not for medical use.

EXAMPLE IMAGES



OCT Angiography Images from a Human Forearm. Gently heating from room temperature (a) to 44°C (b) causes a local increase in blood flow.[6] Blood vessels are identified and the blood flow velocity is extracted by a custom speckle decorrelation algorithm.[2,3,**]



OCT Images (Top Row) and Angiography Images (Bottom Row) of a Mouse Ear with a Tumor, Before (Left Column) and After (Right Column) Injection with Gold Nanorods. The nanorods are functionalized so they bind to the tumor in the left part of the image. A clear increase of signal strength can be observed in the blood vessels of the tumor (see arrows).[1,*]

Interested? Email OCT@thorlabs.com for more information.

PUBLICATIONS

1) O. Liba, E.D. SoRelle, D. Sen, A. de la Zerda, *Sci. Rep.*, **6**, 23337, 2016.
2) K. J. Smith, R. Argarini, H. H. Carter, B. C. Quirk, A. Haynes, L. H. Naylor, H. McKirdy, R. W. Kirk, R. A. McLaughlin, *Med. Sci. Sports Exerc.*, **51** (7), 1558, 2019.
3) R. Argarini, K.J. Smith, H.H. Carter, L.H. Naylor, R.A. McLaughlin, D.J. Green, *J. Appl. Physiol.*, **128** (1), 17, 2020.
4) M.J. Casper, J. Glahn, M. Evers, H. Schulz-Hildebrandt, G. Kositratna, R. Birngruber, G. Hüttmann, D. Manstein, *Lasers Surg. Med.*, **7**, 69, 2019.
5) H.H. Carter, P. Gong, R.W. Kirk, S. Es'haghian, C.L. Atkinson, D.D. Sampson, D.J. Green, R.A. McLaughlin, *J. Appl. Physiol.*, **121**, 965, 2016.
6) D. F. G. Sciarrone, R. A. McLaughlin, R. Argarini, M.-S. To, L. H. Naylor, L. M. Bolam, H. H. Carter, D. J. Green, *J. Physiol.*, **600** (17), 3921, 2022.
7) M. Casper, H. Schulz-Hildebrandt, M. Evers, R. Birngruber, D. Manstein, G. Hüttmann, *J. Biomed. Opt.*, **24** (4), 046005, 2019.
8) U. Baran, W.J. Choi, R.K. Wang, *Skin. Res. Technol.*, **22** (2), 238, 2016.

** Unpublished Images from the study described in publication, provided by Dr. Robert McLaughlin, Professor at The University of Adelaide.[6]