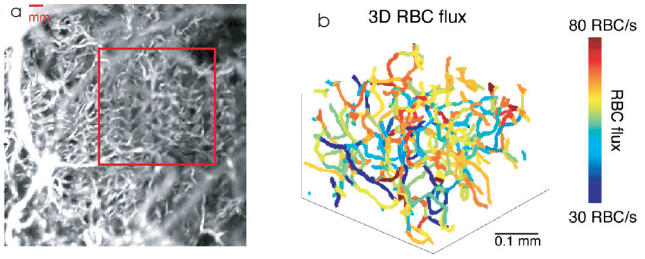
Brain Angiography

THORLABS
APP HIGHLIGHT

APPLICATION



(a) Maximum Intensity Projection (MIP) of blood vessel network in a mouse brain. (b) 3D red blood cell flux of the red square in (a) extracted via deep learning.[1,*]

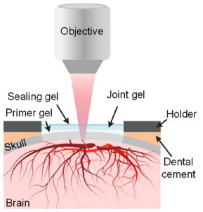
OCT Angiography uses the signal from moving blood cells to highlight blood vessels amongst the surrounding static tissue. Thus, it provides a useful tool for understanding brain damage caused by cerebrovascular dysfunctions.

QUICK FACTS

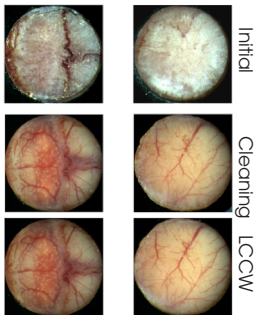
- OCT Angiography highlights blood vessels through changes in the OCT signal caused by moving blood cells.
- No dyes are necessary.
- OCT Angiography has to be performed *in vivo*.
- The Speckle Variance Angiography Mode is included in the complimentary ThorImage®OCT software package.
- Typical penetration depths are 1.5 to 2 mm in brain tissue.

TYPICAL SETUP

- Restraining the head reduces motion artifacts.
- It is recommended to thin the skull or use optical clearing to reduce signal losses due to absorption and scattering.[2]
- A cranial window preserves the integrity of the skull.[3,4,5,6,7]
- A novel long-term clearing cranial window (LCCW) can preserve the skull transparency for 2 months with a single surgery.[2]



OCT imaging through skull after optical clearing.[2,*]



Representative photograph of dry skull (Initial), optical clearing window (Clearing), and LCCW in eight-week-old mice.[2,*]

RECOMMENDED ITEMS

Choice of OCT System:

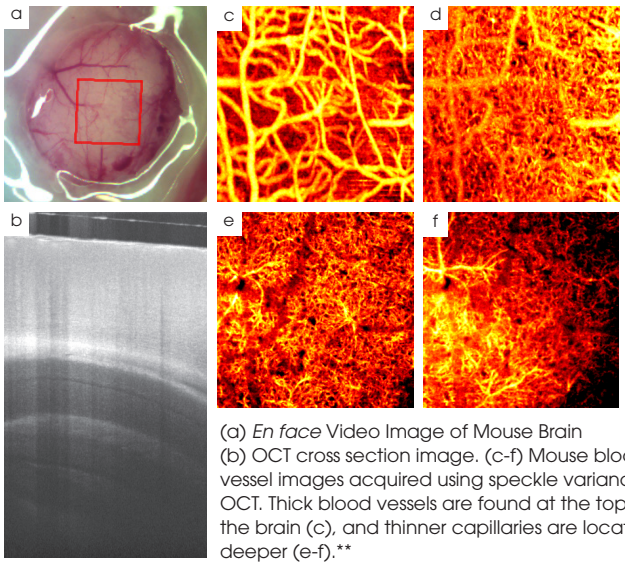
- High Resolution: **TEL221C1(/M)**
- High Penetration Depth: **VEG210C1(/M)**

TEL221C1

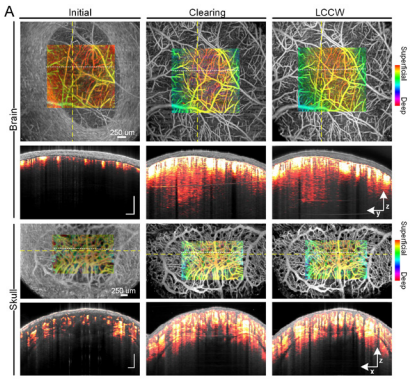
Useful Accessories:

- Different Objectives for Different Purposes:
  - High-Resolution Objective **OCT-LK2** for Small Capillary Imaging
  - Long-Focus Objective **OCT-LK4** for Large Depth of Focus (Deep Imaging)

EXAMPLE IMAGES



(a) *En face* Video Image of Mouse Brain
(b) OCT cross section image. (c-f) Mouse blood vessel images acquired using speckle variance OCT. Thick blood vessels are found at the top of the brain (c), and thinner capillaries are located deeper (e-f).**



Imaging blood vessels through dry skull (Initial), optical clearing window (Clearing), and LCCW in eight-week-old mice. The maps are vascular maximum intensity projection (MIP) views in the depth direction (from surface to 560 µm depth). The cross-sectional angiograms are from yellow dotted lines (Gray: OCT structure; Red hot: blood vessels)[2,*]

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

PUBLICATIONS

1) S. Stefan, A. Kim, P. J. Marchand, F. Lesage, J. Lee, *Front. Neurosci.*, **16**, 835773, 2022.
2) C. Zhang, C.-J. Liu, W. Feng, *Adv. Sci.*, **9** (17), 2105893, 2022.
3) J. Tang, S.E. Erdener, S. Sunil, D.A. Boas, *J. Biomed. Opt.*, **24** (3), 036005, 2019.
4) W.J. Choi, R.K. Wang, *J. Biomed. Opt.*, **20** (10), 106004, 2015.
5) A. Akif, K. Walek, C. Polucha, J. Lee, *Biomed. Opt. Express.*, **9** (11), 5340, 2018.
6) C.W. Merkle, V.J. Srinivasan, *NeuroImage*, **125**, 350, 2016.
7) Á. Nyúl-Tóth, S. Tarantini, J. DelFavero, F. Yan, P. Balasubramanian, A. Yabluchanskiy, C. Ahire, T. Kiss, T. Csipo, A. Lipecz, A. E. Farkas, I. Wilhelm, I. A. Krizbai, Q. Tang, A. Csiszar, Z. Ungvari, *Am. J. Physiol. Heart Circ. Physiol.* **320** (4), H1370, 2021.

** Images Acquired in Collaboration with MacVicar Lab, University of British Columbia.