Henk (Wenhao) Shang, Ph.D.

San Francisco, CA | henk_shang@outlook.com | linkedin.com/in/wenhao-shang | wenhaoshang.com

SUMMARY

Advanced light microscopy specialist with a decade of hands-on optical imaging and quantitative image analysis, spanning laser scanning confocal (Zeiss LSM 900/700), light-sheet, in vivo two-/three-photon, and live-cell Raman optical tweezers microscopy. Runs the lab's multiphoton microscopes as a shared resource: onboards and trains internal and external users, schedules instrument time, images samples for collaborating labs, and troubleshoots alignment, scanning and signal-synchronization faults. Designs tailored imaging assays with collaborators end to end, from tissue clearing and whole-mount staining through acquisition to quantitative 3D analysis in Fiji/ImageJ, Imaris and Cellpose, and builds pipelines other scientists use, including MicroMorph, a 3D morphometry platform.

MICROSCOPY AND IMAGE ANALYSIS EXPERTISE

Light microscopy: Laser scanning confocal (Zeiss LSM 900/700, ZEN): multi-channel fluorescence, Z-stacks, tile scans and stitching of IHC sections and retinal flatmounts; light-sheet imaging of cleared whole eyes (trained at the Gladstone Institutes imaging facility); in vivo two-/three-photon (trans-scleral) imaging and line-scan blood flow; live-cell imaging and optical-tweezer manipulation with confocal Raman microscopy; analysis of adaptive-optics SLO and OCTA data; user of the UCSF Ophthalmology imaging core

Sample preparation: Whole-eye tissue clearing and whole-mount immunostaining for volumetric imaging, retinal flatmounts, IHC on cryosections, RNAscope, cardiac perfusion, surgical preparation for in vivo imaging, intravitreal AAV injection; mammalian cell line culture and live single-cell isolation with optical tweezers

Image analysis: Fiji/ImageJ (macro automation), Imaris (filament tracing, 3D rendering), Cellpose, StarDist, napari, scikit-image, OpenCV; nnU-Net (trained) and vesselFM segmentation; registration, Z-stack stitching, 3D segmentation, skeleton tracing and network morphometry; publication figures, 3D renderings and movies

Scripting and automation: Python (NumPy, SciPy, pandas, PyTorch), R, MATLAB; interactive dashboards (Plotly/Dash, Streamlit); Git, pytest, packaged desktop releases

Instrument care: Independently troubleshoot and realign optical paths; diagnosed two-photon scan-signal synchronization and galvanometer scanner faults; laser alignment, objective cleaning and routine maintenance; maintained and aligned a Raman optical tweezers platform; 3D printing, soldering; set up and maintain the lab's Synology NAS for imaging data

Training and communication: Onboard and train new lab members, interns and external users on two-photon acquisition and on confocal microscopes; manage booking for the lab's multiphoton systems; wrote lab SOPs; trained 4 external labs on the analysis pipeline; mentored 5 student researchers; presented at ARVO and briefed the NEI Director

EXPERIENCE

University of California, San Francisco, Department of Ophthalmology — **San Francisco, CA**
Postdoctoral Researcher (PI: Tyson N. Kim) — *10/2022 – Present*

- Run the lab's two- and three-photon microscopes, a capability unique to the lab, as a shared resource: onboard and train new lab members, interns and external users, manage booking for all users, and image samples for collaborating labs.
- Ran confocal (Zeiss LSM 900/700) imaging of IHC sections and retinal flatmounts and light-sheet imaging of cleared eyes, including at the UCSF Ophthalmology imaging core and the Gladstone Institutes imaging facility; acquired and analyzed 1,000+ microscopy images of retinal vasculature, retinal ganglion cells and blood flow.
- Designed and ran tailored imaging assays with collaborators at UCSF, Cornell and in industry, matching modality (confocal, light-sheet, multiphoton) and sample preparation to each biological question.
- Designed imaging workflows end to end, from perfusion, whole-eye tissue clearing and staining through light-sheet and multiphoton acquisition to 3D reconstruction, across developmental and vascular disease mouse models.
- Independently troubleshot the two-photon system, including scan-signal synchronization and galvanometer scanner faults; realigned optical paths, handled routine maintenance (laser alignment, objective cleaning) and wrote lab SOPs.
- Acquired the images and performed the processing, 3D visualization and quantitative analysis for a Cell (2024) study of 3D vascular lattice formation and for my first-author 3D retinal microvasculature framework paper; prepared publication figures, 3D movies, ARVO posters and material for grant reviews.
- Validated 3D findings with confocal imaging of retinal flatmounts, artery-vein IHC on 100 cryosection slides (CD31, α-SMA for arteries, EphB4 for veins) and RNAscope; diagnosed artifacts such as dye signal leakage into non-vascular tissue and segmentation failures in dense vascular and neuronal structures.
- Industry collaboration with Science Corporation on optogenetic vision restoration: intravitreal AAV delivery across 5 cohorts (36 mice), perfusion and sample preparation.
- PI of an All May See Foundation fellowship project on neurovascular control of retinal perfusion, coordinating 2 technicians, a visiting scholar and 2 collaborators; mentored 5 student researchers.

BIOMed-X Center, Peking University **Beijing, China**
Graduate Student Researcher (Advisor: Anpei Ye) *09/2016 – 01/2022*

- Built, aligned and troubleshot a Raman optical tweezers platform that measures the Raman spectrum and transcriptome (scRNA-seq) of the same single cell; also developed a portable Raman detection system.
- Imaged and manipulated live cells: cultured cell lines, identified target cells by image-based recognition and isolated single cells with optical tweezers; acquired, labeled and analyzed roughly 2,000-3,000 single-cell images.
- Used high-NA confocal Raman microscopy to resolve subcellular compartments (nucleus, cytoplasm, 0.4-1 µm vesicles) in drug-treated cancer cells, revealing lipid-metabolism changes, nuclear DNA damage and autophagy/apoptosis.
- Generated 692 paired single-cell Raman and transcriptome profiles (10+ drugs); modeled with PCA, LDA, PLS-R and a DNN.

IMAGE ANALYSIS PIPELINES AND SOFTWARE

3D Retinal Vasculature Analysis Pipeline and RetinalVasc3D Dataset **2022 – 2026**
Conceived, built, deployed and maintained | Python, R, MATLAB, Imaris, Fiji

- Built an end-to-end pipeline for 3D reconstruction and network quantification of retinal microvasculature from multiphoton Z-stacks; it became the Kim lab's standard tool and is used by 3-4 other labs, which I trained remotely.
- Developed new 3D network metrics (fragmentation index, fractal dimension, lacunarity, inter-plexus connectivity) and an Imaris standard process with Python post-processing for 3D comparison.
- Curated a 99-volume two-photon dataset with expert filament graphs and six-way vascular-layer labels, and benchmarked segmentation methods (VesselExpress, vesselFM) against it.

MicroMorph: 3D Morphometric Analysis Platform for Microscopy **2025 – Present**
Sole developer | Python, FastAPI, three.js/WebGL, PyTorch, nnU-Net

- Cross-platform desktop application (Windows/macOS) for 3D visualization, segmentation and quantitative morphometry of confocal, light-sheet, two-photon, OCT/OCTA and adaptive-optics data; reads 10+ microscope formats (CZI, ND2, LIF, OIB, TIFF, HDF5, DICOM, NIfTI). A methods paper is in preparation.
- Implemented vessel, neuron and cell segmentation (including Cellpose and StarDist) and skeleton tracing, with morphometric metrics (diameter, branching, tortuosity) and automatically generated reports that include methods text.
- Integrated the vesselFM foundation model and a retinal-vessel nnU-Net model I trained; plugins add new models.
- Built an LLM agent that drives the analysis through tool calling across multiple providers, with reproducible workflow logs. The codebase is covered by an automated pytest suite.

EDUCATION

Ph.D., Biomechanics and Medical Engineering, Peking University 2016 – 2022
B.S., Biotechnology, Huazhong University of Science and Technology 2012 – 2016

SELECTED PUBLICATIONS

1. Toma K, Zhao M, Zhang S, ..., **Shang W**, et al. Perivascular neurons instruct 3D vascular lattice formation via neurovascular contact. Cell (2024).
2. **Shang W**, Hong G, Keller WE, Morton RA, Zeboulon P, Toma K, Duan X, Gould DB, Kim TN. A three-dimensional analytical framework for retinal microvasculature reveals layer-associated vulnerability in development and neovascular remodeling. bioRxiv (2026); under revision.
3. **Shang W**, et al. A layer-resolved graph representation of three-dimensional retinal microvasculature from two-photon microscopy in mouse models of vascular disease (RetinalVasc3D). In preparation.
4. **Shang W**, Ye A, Tong Y-K. Sub-cellular dynamic analysis of BGC823 cells after treatment with the multi-component drug CKI using Raman spectroscopy. Int J Mol Sci (2023).
5. Fang T, **Shang W**, Liu C, Liu Y, Ye A. Single-cell multimodal analytical approach by integrating Raman optical tweezers and RNA sequencing. Analytical Chemistry (2020).
6. Fang T, **Shang W**, Liu C, Xu J, Zhao D, Liu Y, Ye A. Nondestructive identification and accurate isolation of single cells through a chip with Raman optical tweezers. Analytical Chemistry (2019).
7. Two additional co-authored papers in Molecules (2018) and The Analyst (2022).

FELLOWSHIPS, GRANTS AND AWARDS

- All May See Foundation Postdoctoral Fellowship, principal investigator (2025)
- Poster presentation, ARVO Annual Meeting (2024)
- Excellent Scientific Research Award, Peking University (2020);