



# BSISB

Berkeley Synchrotron Infrared  
Structural Biology Program

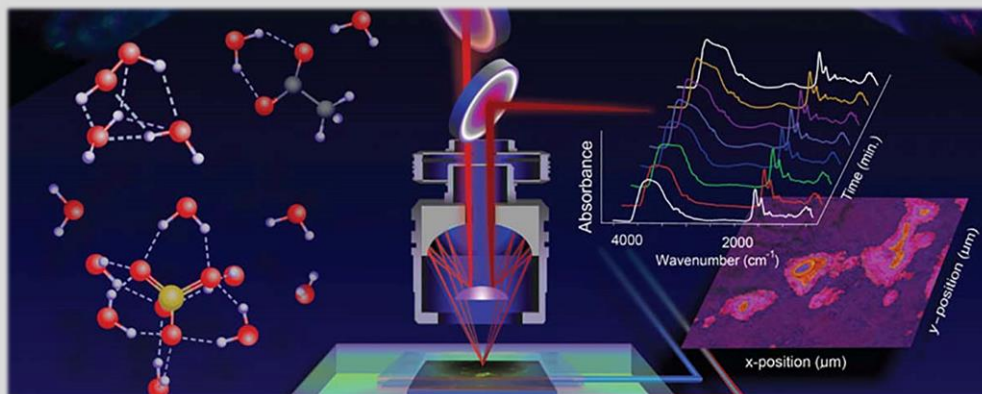
A national user program for imaging living cells, biological and biogeochemical materials

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## Contact

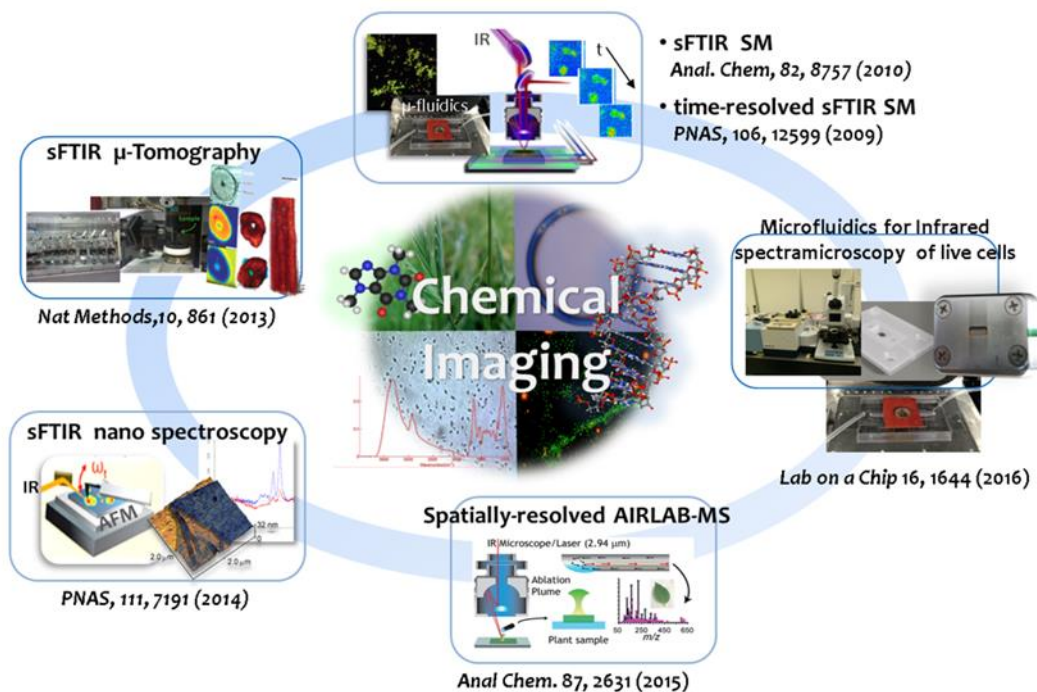
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## Imaging Capabilities and Technologies at a Glance



BSISB develops facilities, user training, and user support for researchers investigating cellular chemistry and function at infrared beamlines. Our program focuses on synchrotron radiation-based Fourier transform infrared (SR-FTIR or sFTIR) spectromicroscopy, time-resolved sFTIR spectromicroscopy, synchrotron Infrared Nano-Spectroscopy (SINS), and 3D synchrotron FTIR micro-tomography (sFTIR  $\mu$ Tomography). Other complementary microscopy and spectroscopic imaging methods include fluorescence microscopy, Raman microscopy, simultaneous optical hyperspectral sample imaging, and spatially-resolved AIRLAB mass spectrometry.

## Technology Available at the BSISB Program Facility



## Current Resolution Range

- **Label-free sFTIR microscopy** can reveal biogeochemical processes in specimens with a spatial resolution from 2 to 15  $\mu\text{m}$ .
- Broadband **Synchrotron Infrared Nano Spectroscopy (SINS)** can reveal chemical distribution in single cells with a spatial resolution of  $<20$  nm.
- **Time-resolved sFTIR imaging** can monitor the dynamics of biogeochemical processes in live microbes and biofilms over the course of seconds to hours and days.
- **sFTIR spectro-microtomography** is a technique in development for visualizing the 3D chemical distribution in samples of interest with a spatial resolution between 2 and 15  $\mu\text{m}$ .

## Selected BSISB User Publications

1. **High  $p\text{CO}_2$ -induced exopolysaccharide-rich ballasted aggregates of planktonic cyanobacteria could explain Paleoproterozoic carbon burial.** Kamennaya NA, Holman HYN et al. *Nature Communications*, accepted, 2018.
2. **Exploring biogeochemistry and microbial diversity of extant microbialites in Mexico and Cuba.** Valdespino-Castillo PM, Hu P et al. *Frontier in Microbiology*, accepted, 2018
3. **Human age and skin physiology shape diversity and abundance of Archaea on skin.** Moissl-Eichinger C, Probst AJ et al. *Nature Scientific Reports*, 7 (1) DOI: 10.1038/s41598-017-04197-4, 2017.
4. **High-spatial-resolution mapping of catalytic reactions on single particles.** Wu CY, Wolf WJ et al. *Nature*, 541 (7638), 2017.
5. **Direct observation of narrow mid-infrared plasmon linewidths of single metal oxide nanocrystals.** Johns RW, Bechtel HA et al. *Nature Communications*, 7, 2016.
6. **Belowground Response to Drought in a Tropical Forest Soil. II. Change in Microbial Function Impacts Carbon Composition.** Bouskill NJ, Wood TE et al. *Frontiers in Microbiology*, 7, 2016,
7. **IR-Live: Fabrication of a low-cost plastic microfluidic device for infrared spectromicroscopy of living cells** Birarda G, Rivasio A et al. *Lab on a Chip*, 16, 2016.
8. **Diverse uncultivated ultra-small bacterial cells in groundwater.** Luef, Birgit; Frischkorn, Kyle et al. *Nature Communications*, 6, 2015.
9. **Structural characterization of a mixed-linkage glucan deficient mutant reveals alteration in cellulose microfibril orientation in rice coleoptile mesophyll cell walls.** Smith-Moritz AM, Hao Z et al. *Frontiers in Plant Science*, 6(628), 2015
10. **Installing extra bicarbonate transporters in the cyanobacterium *Synechocystis* sp. PCC6803 enhances biomass production.** Kamennaya NA, Ahn SE et al. *Metabolic Engineering*, 29, 2015.
11. **Metabolic phenotyping of the cyanobacterium *Synechocystis* 6803 engineered for production of alkanes and free fatty acids.** Hu P, Borglin S et al. *Applied Energy*, 102, 2013.
12. **Trackling the minority: sulfate-reducing bacteria in an archaea-dominated subsurface biofilm.** Probst AJ, Holman HYN et al. *ISEM*, 7(3), 2013.
13. **Metagenome, metatranscriptome and single cell genomics reveal functional response of active Oceanospirillales to the Gulf of Mexico oil spill.** Mason OU, Hazen TC et al. *ISEM*, 6, 2012.
14. **Deep-sea oil plume enriches psychrophilic oil-degrading bacteria.** Hazen TC, Dubinsky EA et al. *Science*, 330, 2010.

## Contacts

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SINS, AIRLAB MS**  
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