

Raman microscope

Features

Molecular structure

via vibrational spectrum

Low-invasiveness

no requirement for sample treatment

Dry and Wet condition

visible light is used for observation

Label-free

applicable to difficult-to-stain sample

Wavelength tunability

405 nm

532 nm

780 nm

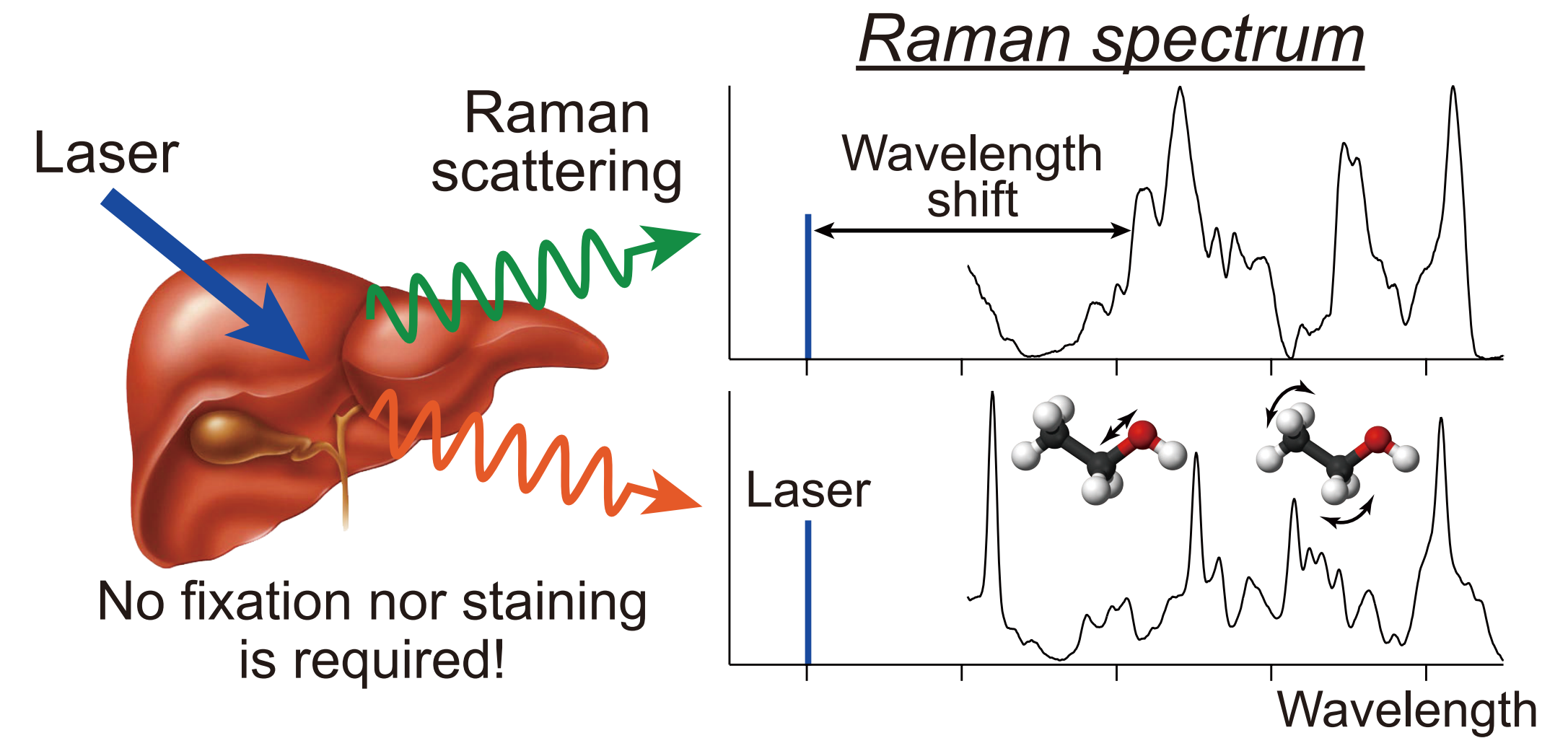
High Intensity/Resolution **Low**

High Invasiveness **Low**

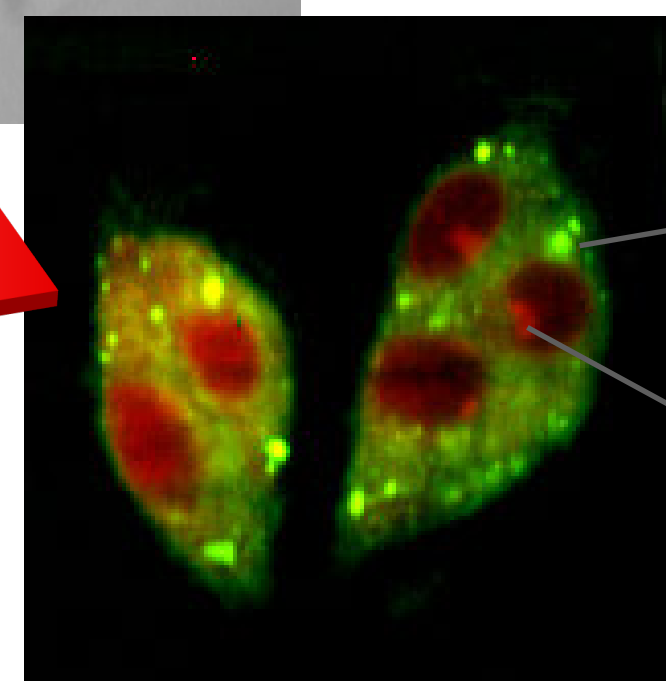
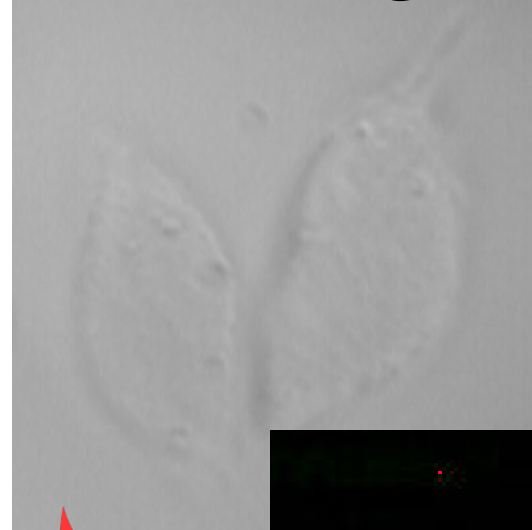
Resonant Raman scattering

Principle of Raman scattering

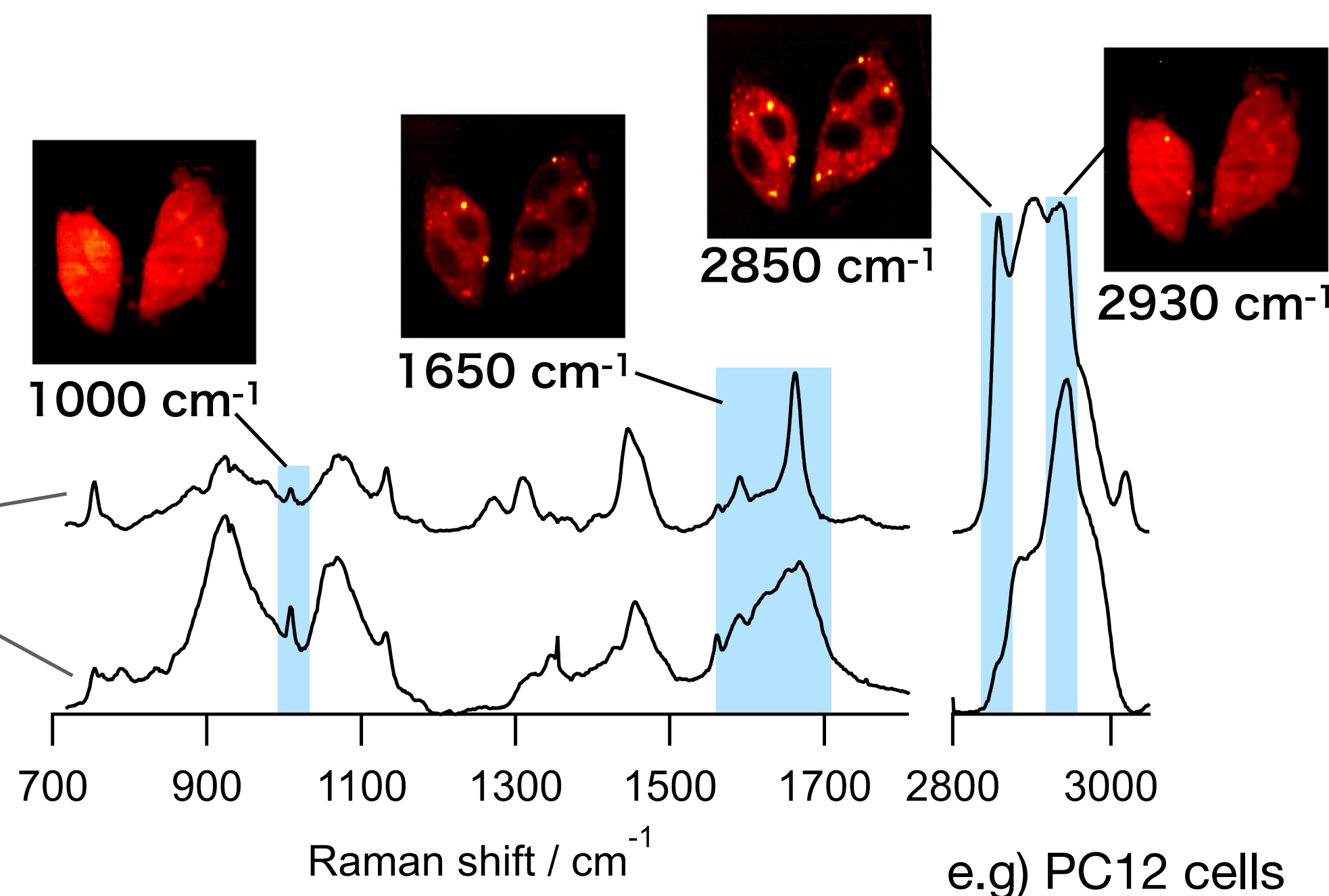
Observation of wavelength shift originated from the interaction between light and molecular vibration



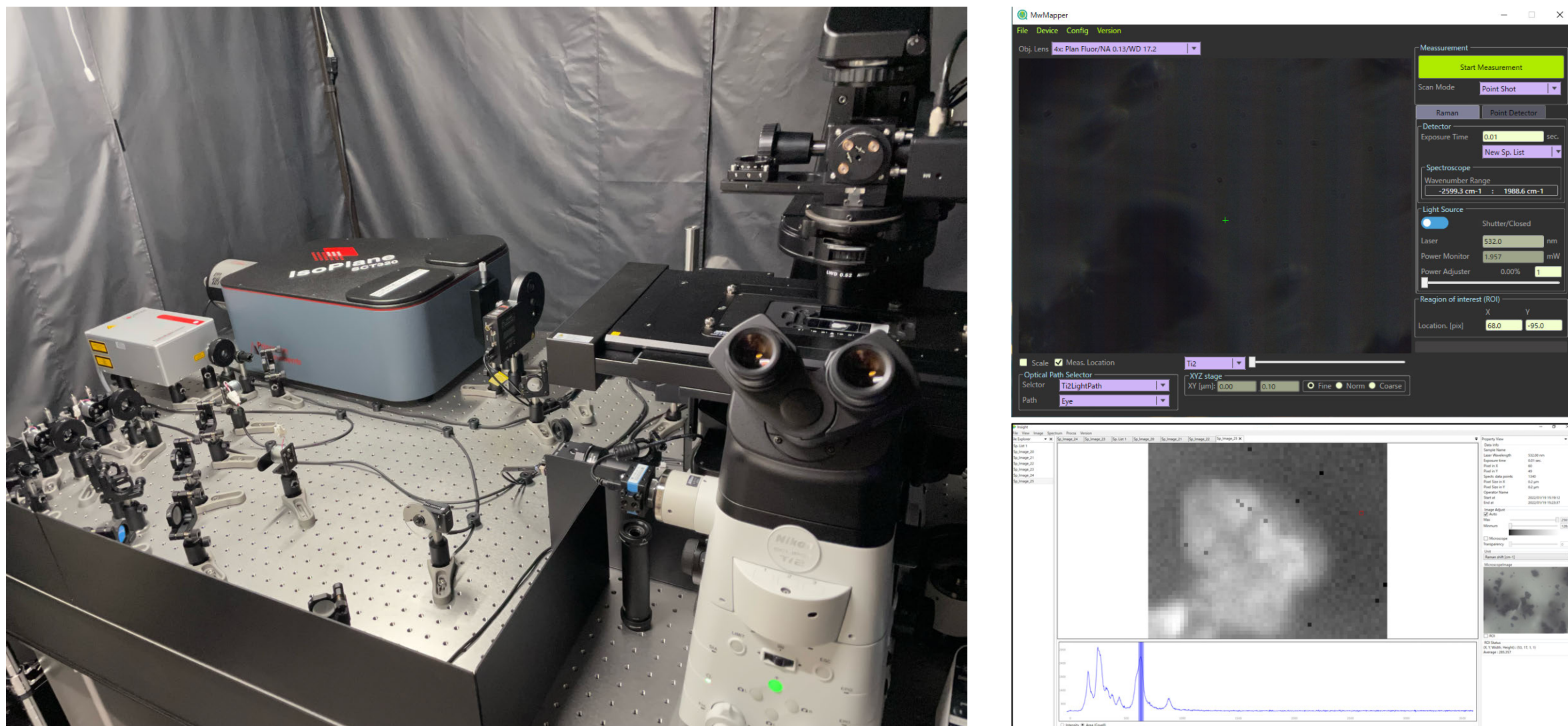
White light



Raman



Home-built multimodal microscope



What can do?

- **Raman spectroscopic imaging**
 - Label-free analysis of molecular distribution and molecular structure
 - Measurement with a spectrometer (reflection arrangement)
 - Imaging duration: 5–30 min/image, 1–10 s/point
- **Second-harmonic generation (SHG) imaging**
 - Collagen orientation and maturity, the crystallinity of molecules, etc.
 - Measurement with spectrometer (reflection configuration) or PMT (transmission configuration)
 - Imaging duration: 10 s–1 min
- **Fluorescence imaging with LED light source**
 - Fluorescence observation of stained tissue/cells
 - Measurement with sCMOS camera (reflection configuration)
 - Light source: UV, B, G excitation
 - Imaging duration: 0.1–10 s
- **Laser scanning fluorescence spectroscopic imaging**
 - Fluorescence observation of stained tissue/cells
 - Measurement with a spectrometer (reflection configuration)
 - Imaging duration: 1–10 s
- **Multiphoton fluorescence spectroscopic imaging**
 - Fluorescence observation of stained tissues/cells in the deep part of the living body, etc.
 - Measurement with a spectrometer (reflectance configuration)
 - Imaging time: 10 s–1 min

Concept: Multifunctional spectroscopic microscope that can be "modified" to meet your needs

Fundamental specifications

- Microscope:** Inverted microscope-based system with laser-scan / stage-scan system
LED light (UV, B, G), Phase contrast
- Ex. Light:** CW 532 nm (473, 633, 785 nm will be available in the future)
Pulsed femtosecond laser 785 nm
- Functions:** Spectrometer (Reflection configuration)
Photomultiplier tube (Transmission configuration)
Spot detection / Spot scanning imaging
- Resolution:** ca. 500 nm (XY), 1,000 nm (Z)
- Other:** Can be modified as request

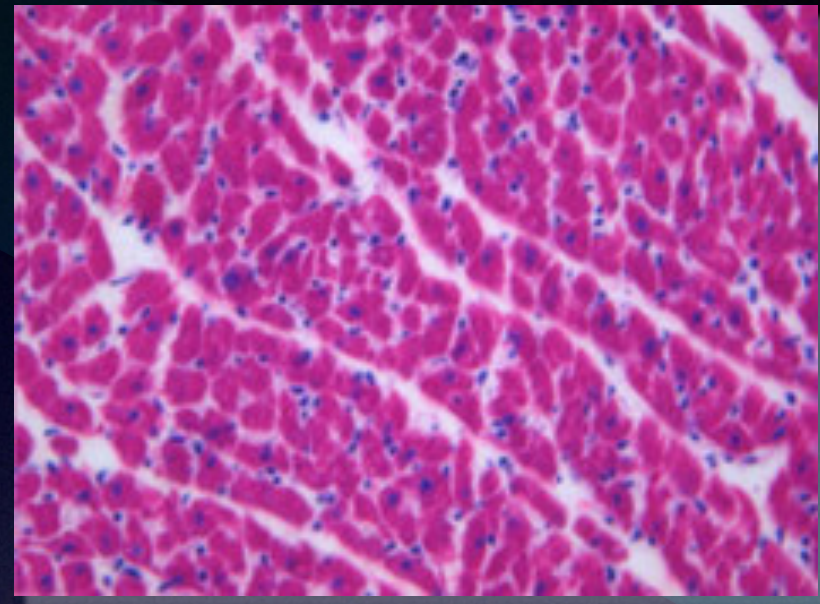
What Raman microscopes can do

Label-free imaging of functional molecules and tissues

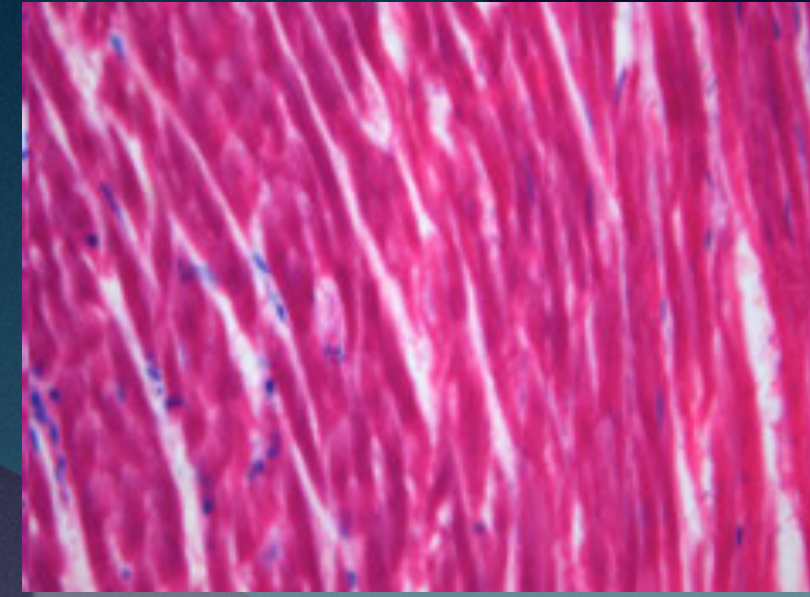
e.g. myocardial infarction diagnosis by Raman spectroscopy

Acute response

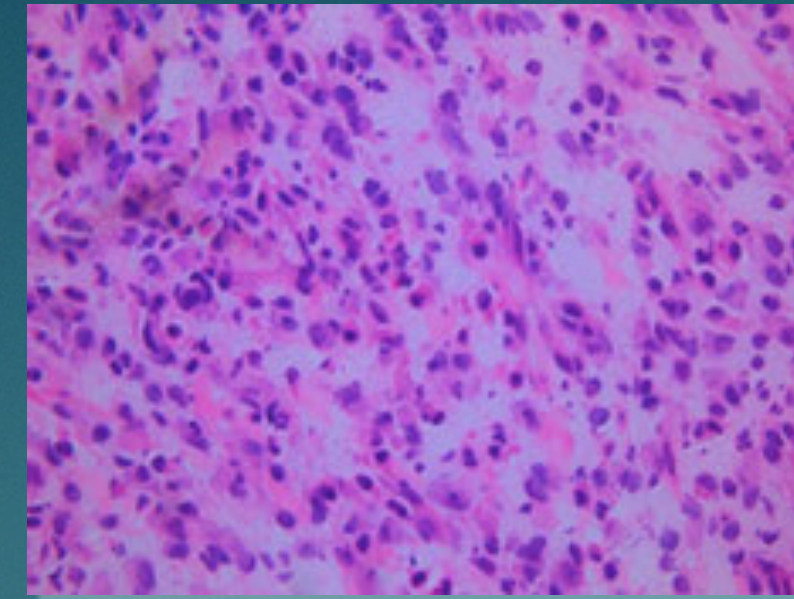
S. Ohira, T. Minamikawa et al.,
Sci. Rep. (2017).



Normal

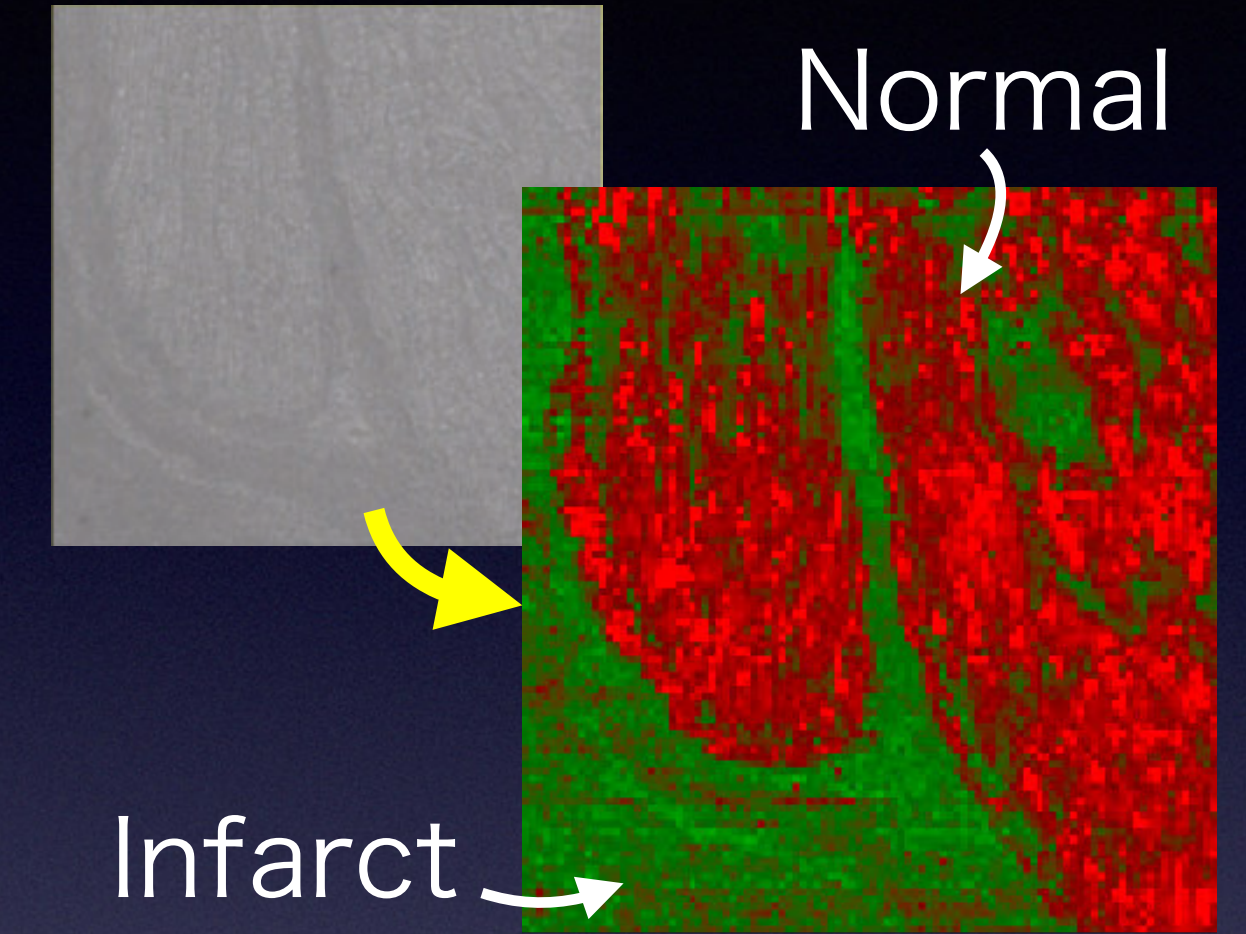


Necrosis



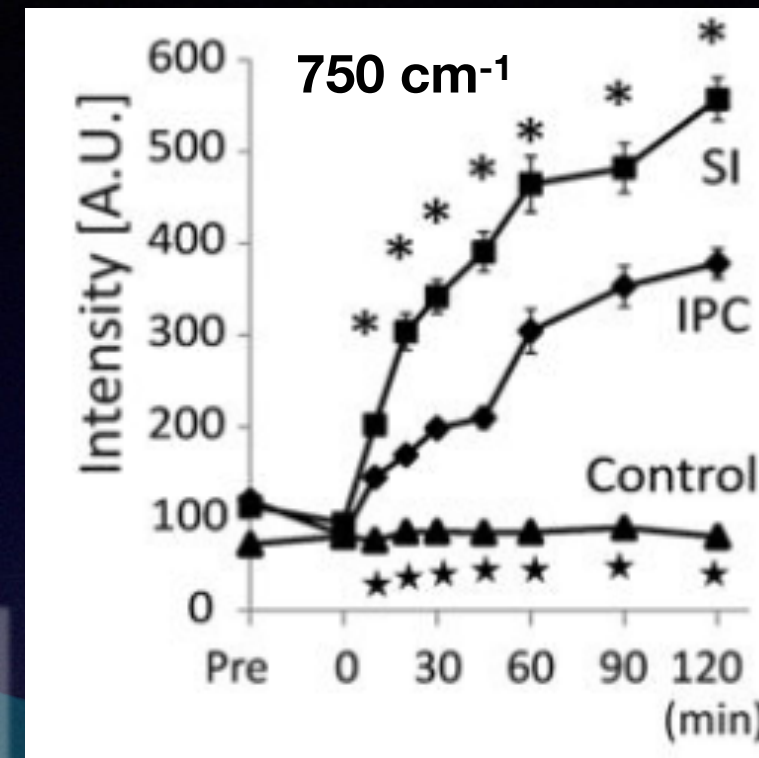
Granulation

Human heart tissue



Normal

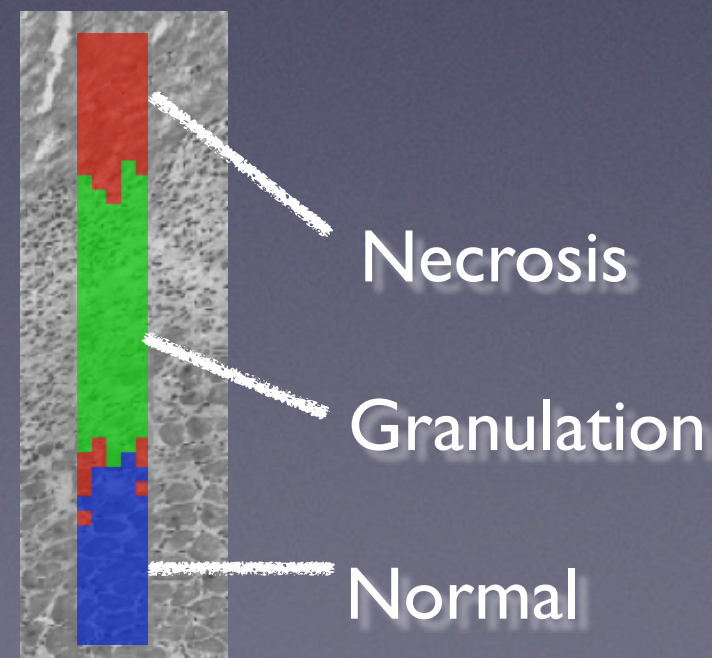
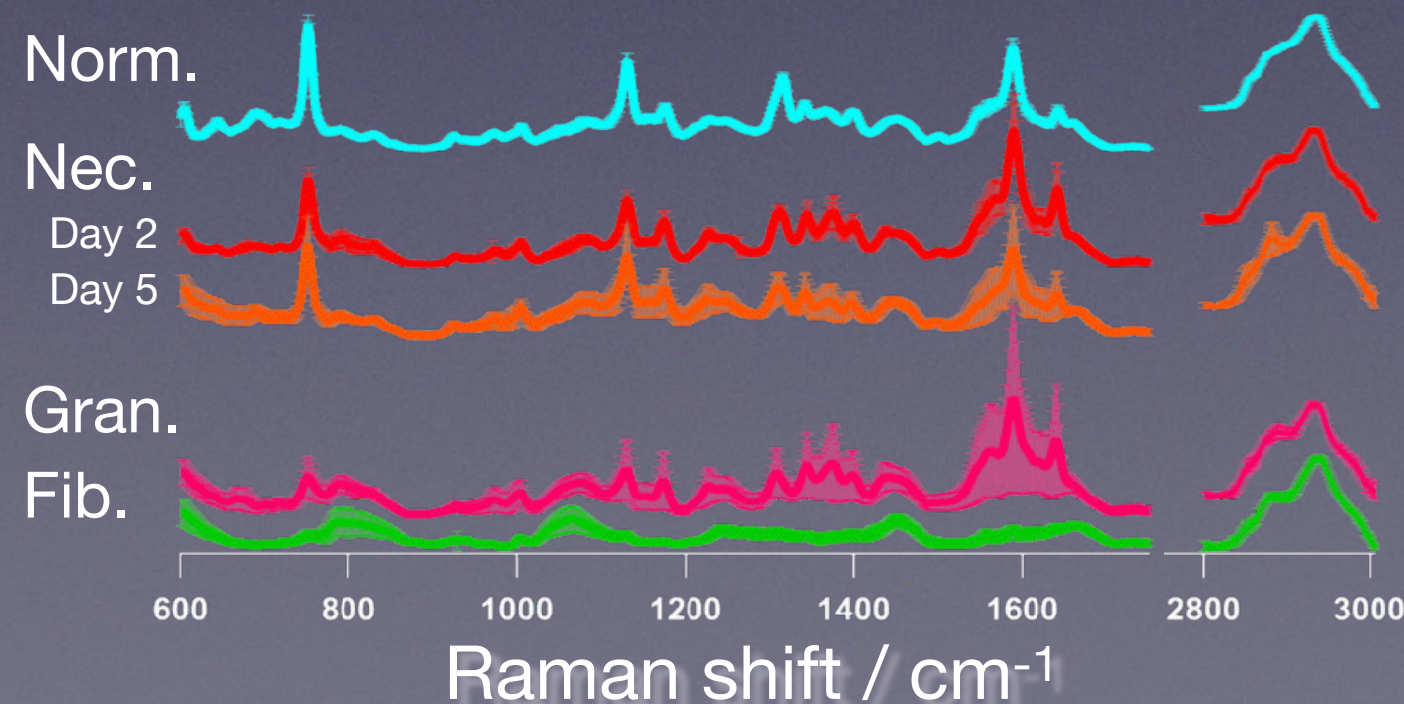
Infarct



Redox state of cytochrome c

Process of MI

N. Muranishi, T. Minamikawa et al.,
Anal. Chem, (2014). JP Pat. 6103700



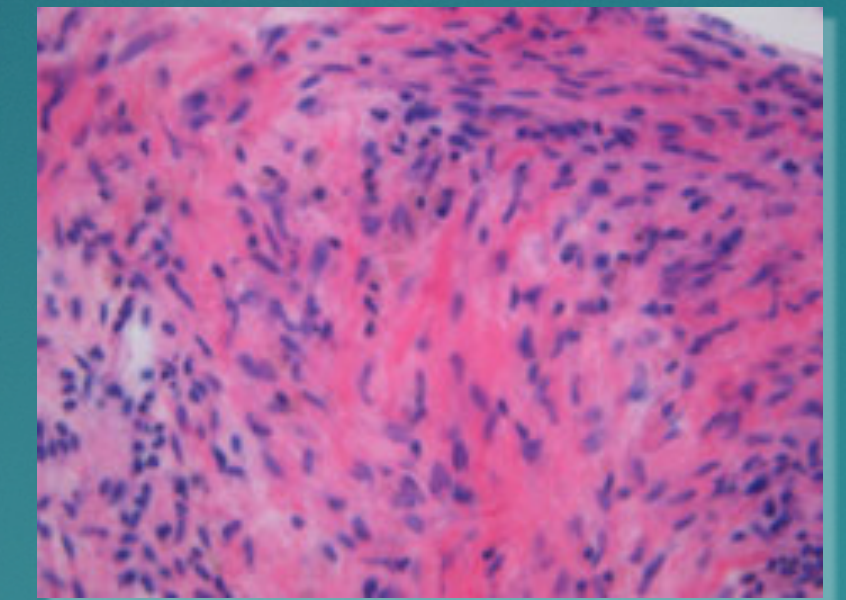
Necrosis

Granulation

Normal

Old MI

T. Yamamoto, T. Minamikawa et al.,
Sci. Rep. (2018)



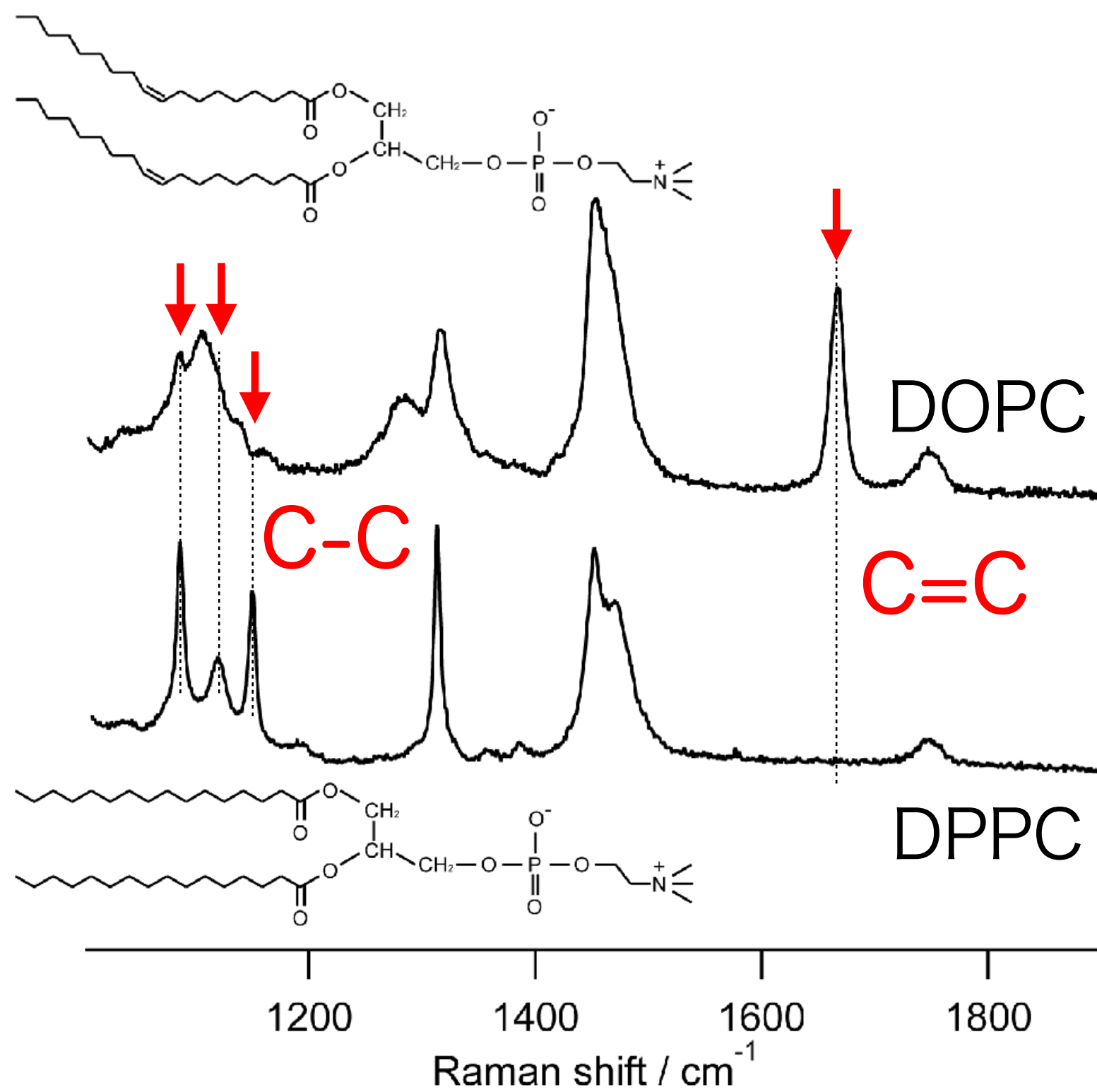
Fibrosis

Molecular structural analysis of difficult-to-stain molecules

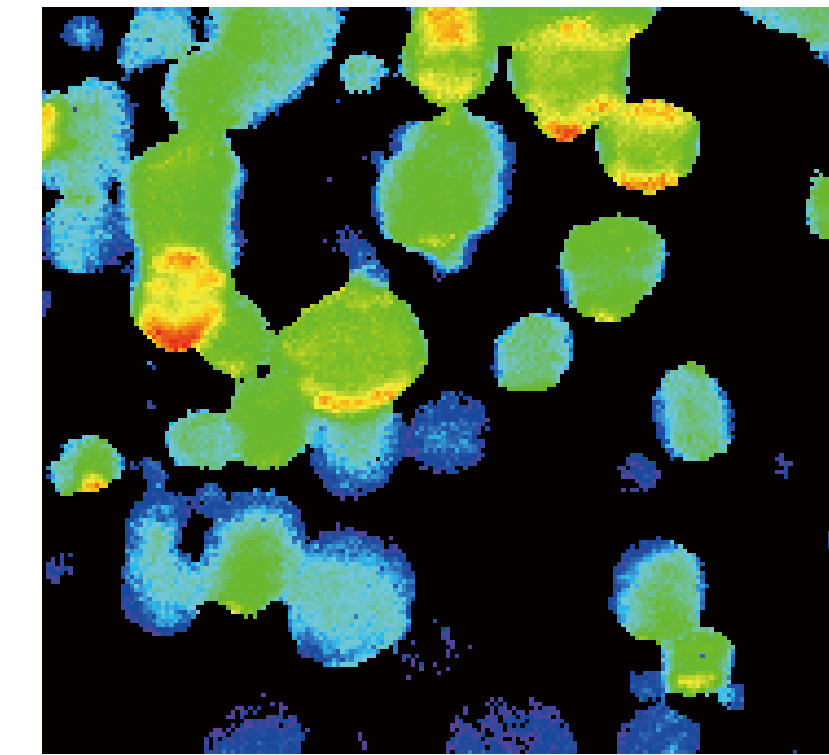
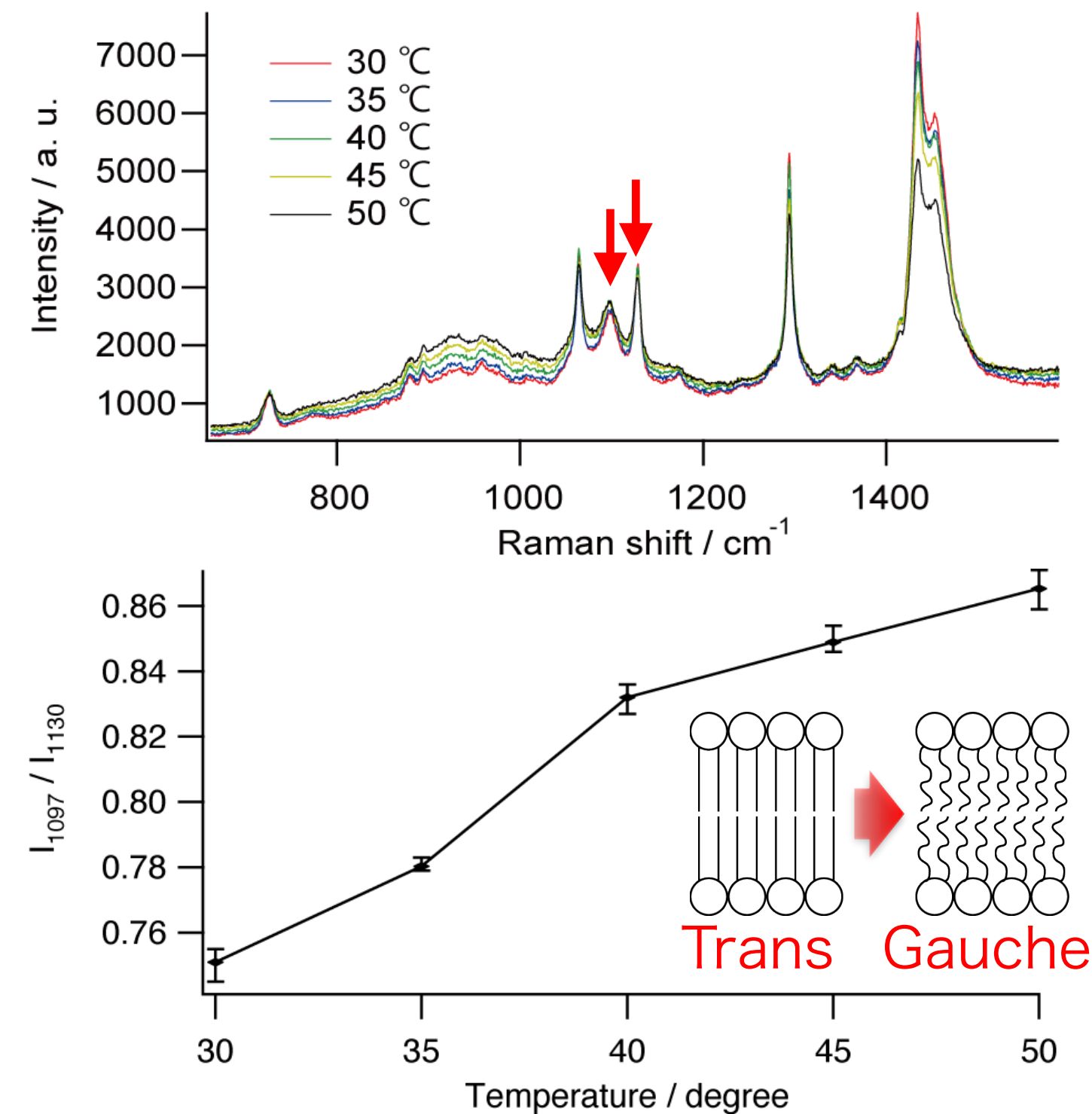
e.g. Lipid Molecular Structure Analysis

e.g. NASH diagnosis

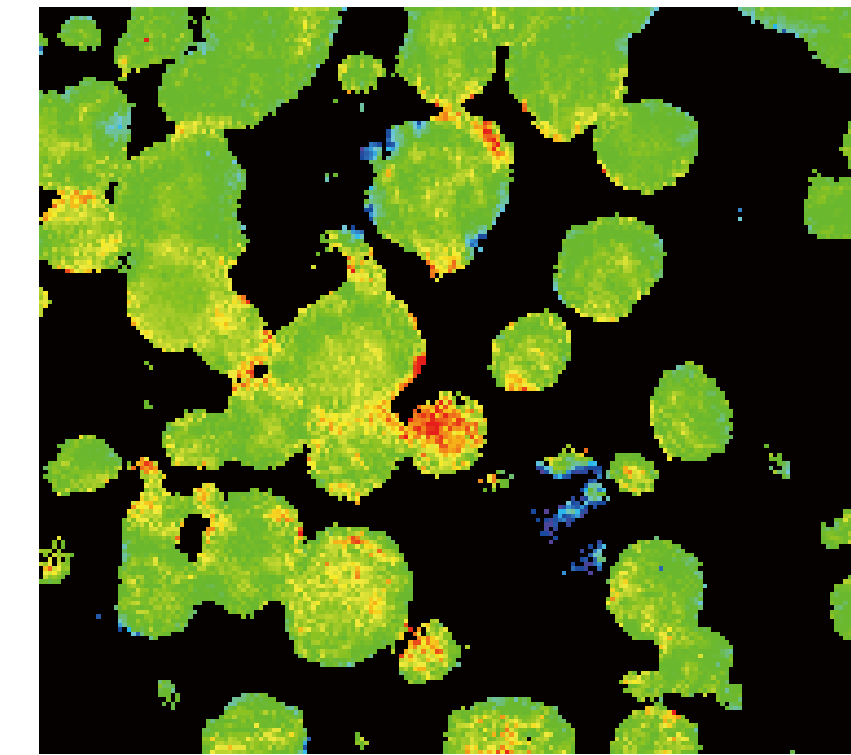
Species/structures



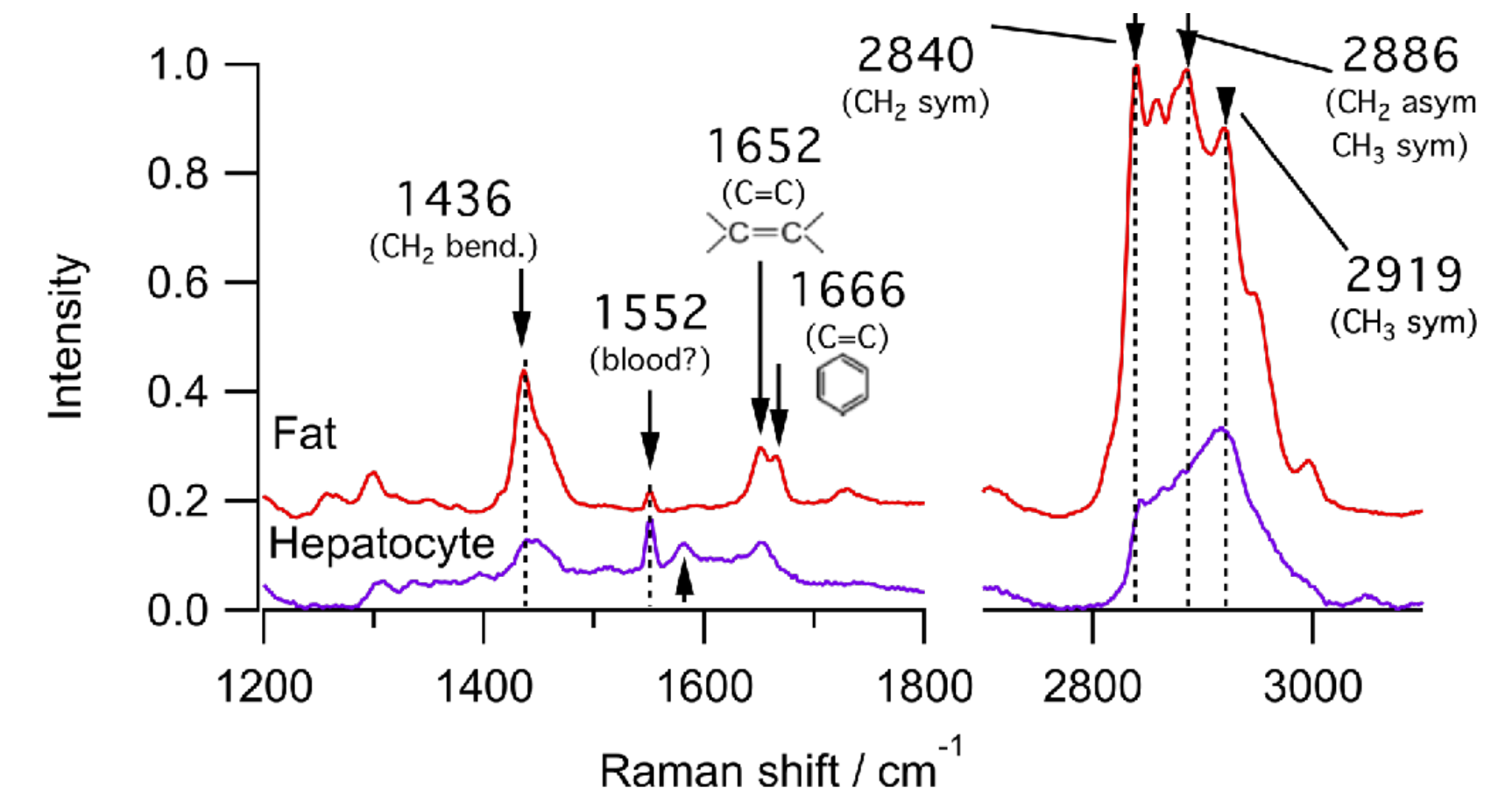
Conformation



Lipid species
(e.g. cholesterol/TAG)



Structures
(Unsaturation)



Molecular Spectral Analysis