



**National Institute of Standards and Technology**

Technology Administration, U.S. Department of Commerce

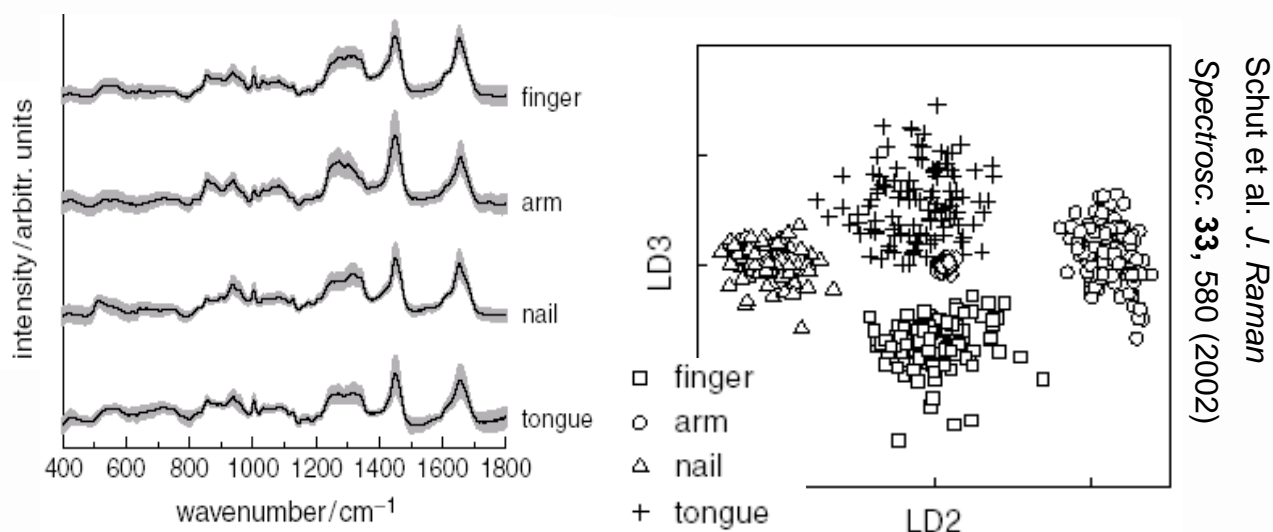
*Label-Free Chemical Imaging of  
Biological and Medical Samples  
Using Broadband Coherent Anti-Stokes Raman  
Scattering Microscopy ( $\mu$ CARS)*

Marcus T. Cicerone

## Technology

### Label-Free Chemical Imaging of Cells and Tissues

- All phenotypic changes in cells and tissues are accompanied by changes in chemical profile

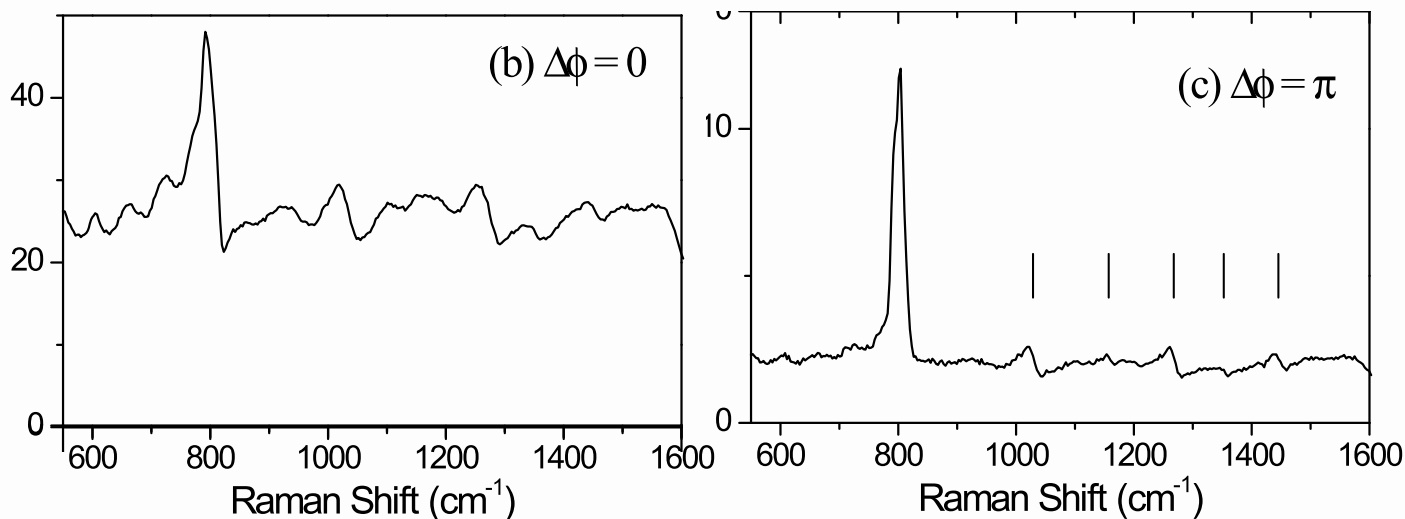


150 mW 488 nm, 5 s / spectrum - slow and damaging to cells

## Technology

### Label-Free Chemical Imaging of Cells and Tissues

- Technology based on nonlinear Raman spectroscopy, uses interferometric method to extract pure Raman spectrum



Low Power  
10 mW, 830 nm

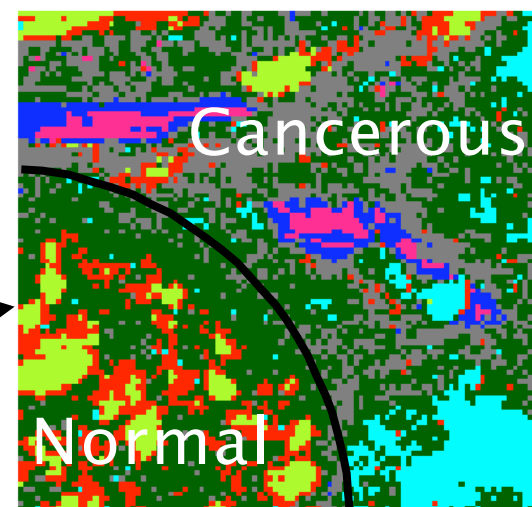
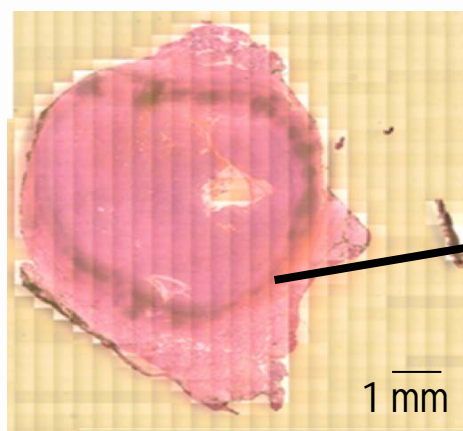
Fast  
10-100 ms

Non-invasive

## Technology Applications

Use intrinsic contrast from chemical changes to rapidly and quantitatively detect phenotype changes and disease states

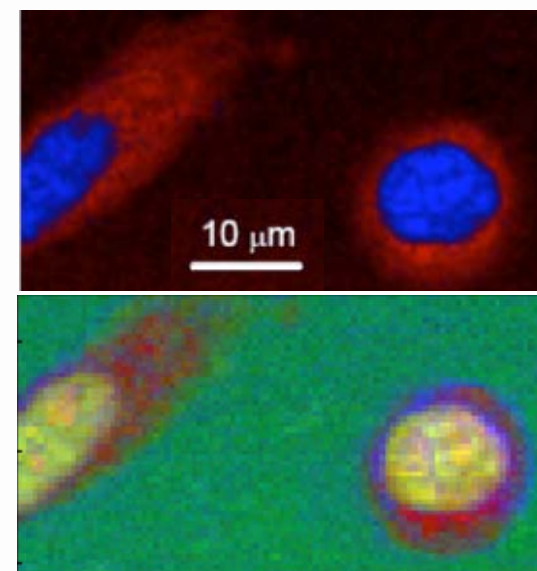
- Cancer
- Stem Cells



7 clusters

## *Commercial Applications*

- ⊕ Rapid Cancer Screening
  - ⊞ Potential for objective, reliable diagnosis
- ⊕ Noninvasive 100% inspection of stem cell culture
  - ⊞ Ensure phenotype maintenance
  - ⊞ Detect development of differentiating structures within cell culture



CARS Pseudo-Color Images



**National Institute of Standards and Technology**  
Technology Administration, U.S. Department of Commerce

## *Collaboration Opportunities*

- ❖ List licensing opportunities
  - ❖ Development of commercial broadband CARS microscope using interferometric background suppression
  - ❖ Development of broadband CARS endoscope



**National Institute of Standards and Technology**  
Technology Administration, U.S. Department of Commerce

## *Contact Information*

✚ For further information contact:

✚ Marcus T. Cicerone

NIST / Polymers Division

100 Bureau Drive MS 8543

Gaithersburg, MD 20899-8543

301.975.8104

[cicerone@nist.gov](mailto:cicerone@nist.gov)