

# Imaging Science: Electrons to Galaxies

**Paul S. Weiss**

California NanoSystems Institute, UCLA | [www.nano.ucla.edu](http://www.nano.ucla.edu)  
Departments of Chemistry & Biochemistry and Materials Science & Engineering

## Research Teams (straw men)

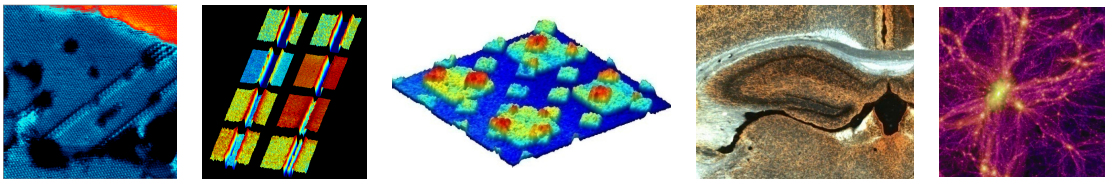
Advance the state-of-the art in imaging  
Analytical and statistical tools for imaging science  
Fusion of modalities  
Visualization/animation  
+?

## Education and Outreach

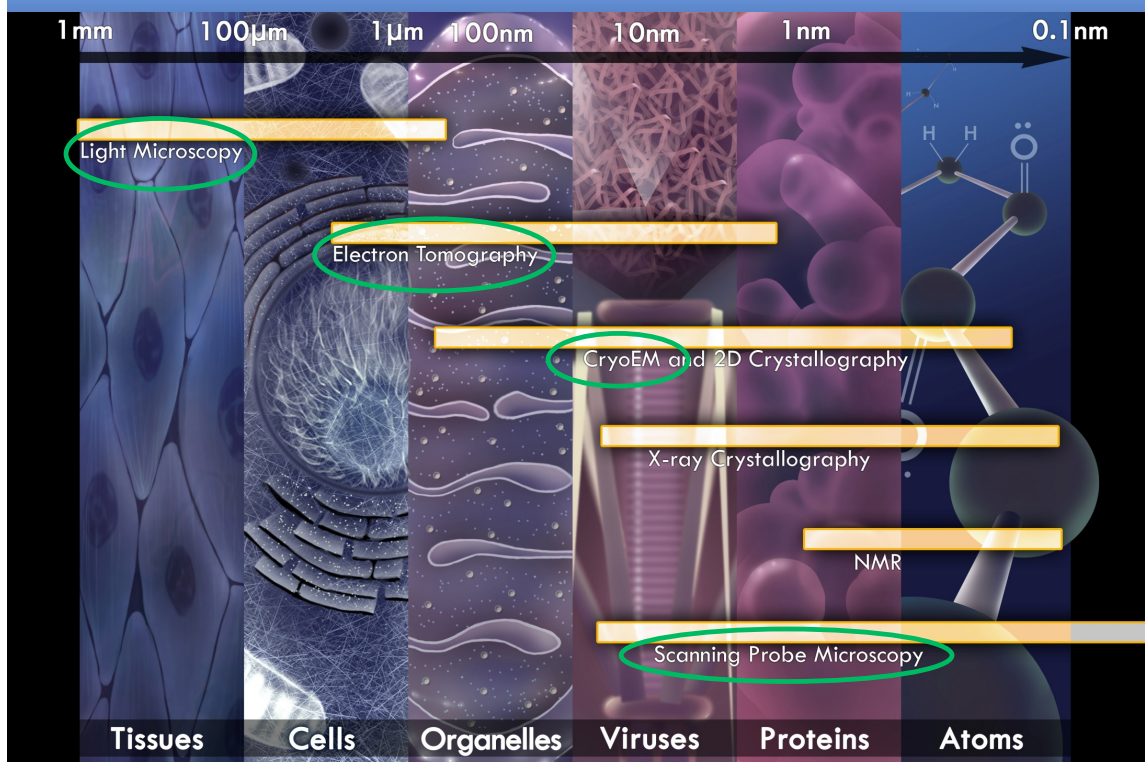
## International Engagement

## Administration

## Industrial Partners and Advisors



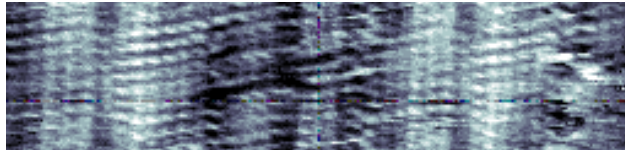
## Single Biomolecules/Assemblies in Real Space



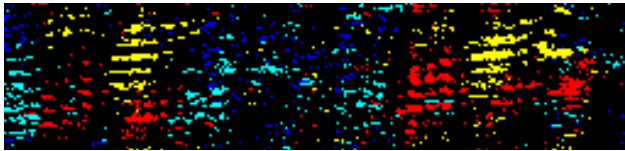
# New Information in New Imaging Methods

e.g., Microwave ACSTM: **Textural differences correspond to different amino acids. Image contact (electronic coupling) between peptide chains and to substrate.**

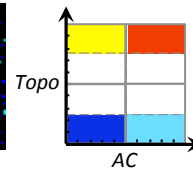
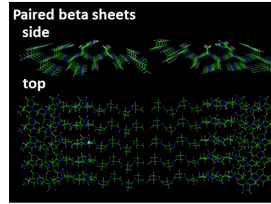
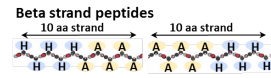
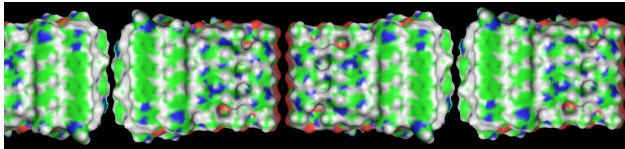
Topography



Combined topography and microwave



Peptide model



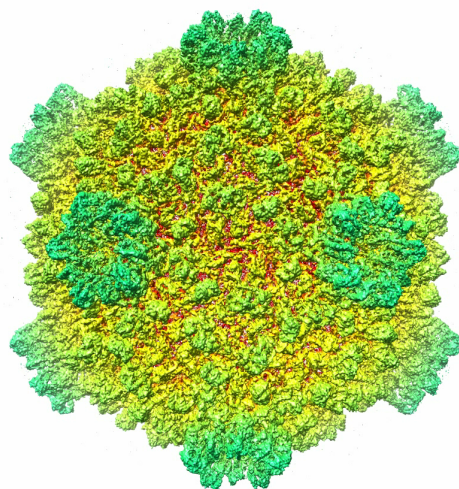
**NB- New theory is needed for new modalities**

**CAS**

Claridge, Schwartz, Eisenberg, **Liu, Wang, & Weiss**

# Measurements of Single Molecules, Particles

**Migrating from diffraction-based techniques to real-space** speeds structural determinations, enables increased structural complexity, and eliminates bottlenecks and barriers (crystallization)



CPV (cytoplasmic polyhedrosis virus)

Universal packaging domain

Controlled release via pH

Stable single-shell dsDNA



**World record resolution for biomolecules – 3.2 Å**

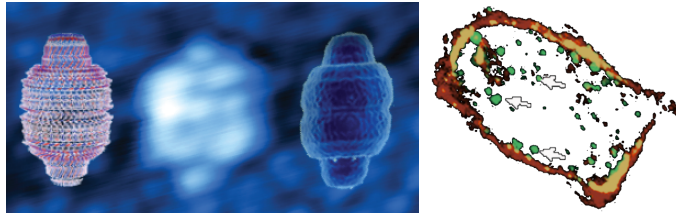
Zhou, Eisenberg, Andrews, Rome, & Weiss

Yu, Jin, & Zhou, *Nature* **453**, 415 (2008)

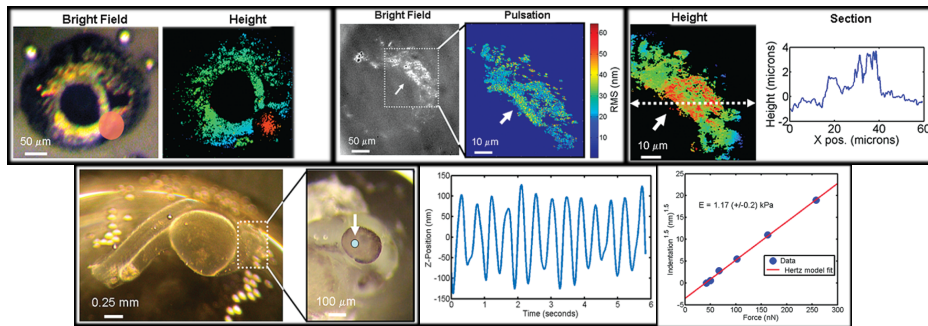
Ge, Tsou, Schein, Green, Luo, & Zhou, *Science* **327**, 689 (2010)

# Correlative and Fusion Microscopies

Exploit unique proximate *collection of tools at and pushing the state of the art*



Vaults nanoparticles by TEM, AFM, and Confocal Fluorescence Imaging



Living zebrafish embryos by optical microscopy, interferometry, and force spectroscopy  
Gimzewski, PWeiss, SWeiss, Zhou, Bensimon