

NUANCE BioCryo

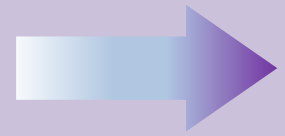
More than Bio, More than Cryo

Eric W. Roth

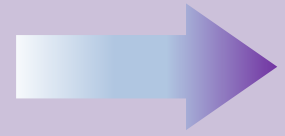
Core Scientist

NUANCE, BioCryo Facility

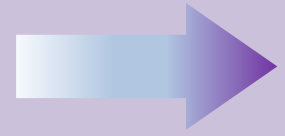
2026.10.21



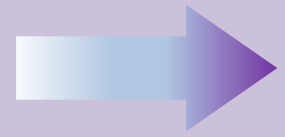
Who we are



What we do



What we can do for you



Research Highlights

More than Bio, More than Cryo



Eric W. Roth

Core Scientist

Northwestern University

NUANCE, BioCryo Facility

eric-roth@northwestern.edu

847.467.4164

NYU Skirball Institute of Biomolecular
Medicine, Microscopy Facility
2007 – 2011

Mouse models, cell lines, drosophila,
c. elegans, etc.

TEM ultrastructure studies, immuno gold,
chemical processing, tokuyasu,
cryo-ultramicrotomy, cryoTEM
Microscope and sample prep training

Northwestern University
NUANCE BioCryo Facility
2011 - Present

Mouse models, cell lines, soft materials
(polymers), hybrid materials,
hard-soft interfaces, MOF's,
nano particles, drug discovery
TEM, SEM, HAADF STEM, microanalysis
cryo-ultramicrotomy, cryo plunge-freezing, high
pressure freezing
Microscope and sample prep training



BioCryo Facility

Soft Materials/Bio, cryoTEM,
ultramicrotomy, sample prep,
STEM, EDS, training



JEOL 3200FS TEM



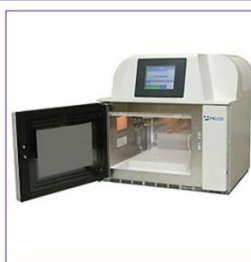
JEOL 1400 FLASH TEM



Hitachi HD-2300A Dual EDS Cryo S/
TEM



Leica EM AFS2 Freeze Substitution
& Low Temperature Embedding
System



PELCO BioWave Microwave Tissue
Processor



Leica EM ACE600 High Vacuum
Coater



FEI Vitrobot Mark IV - Plunge
Freezer



Leica High-Pressure Freezer
HPM100



Leica UC7/FC7 Cryo-
Ultramicrotome



Leica VT1200 S Vibrating-blade
Microtome ("Vibratome")



Tousimis Critical Point Dryer



ASP-1000 mPrep Automated
Specimen Processor



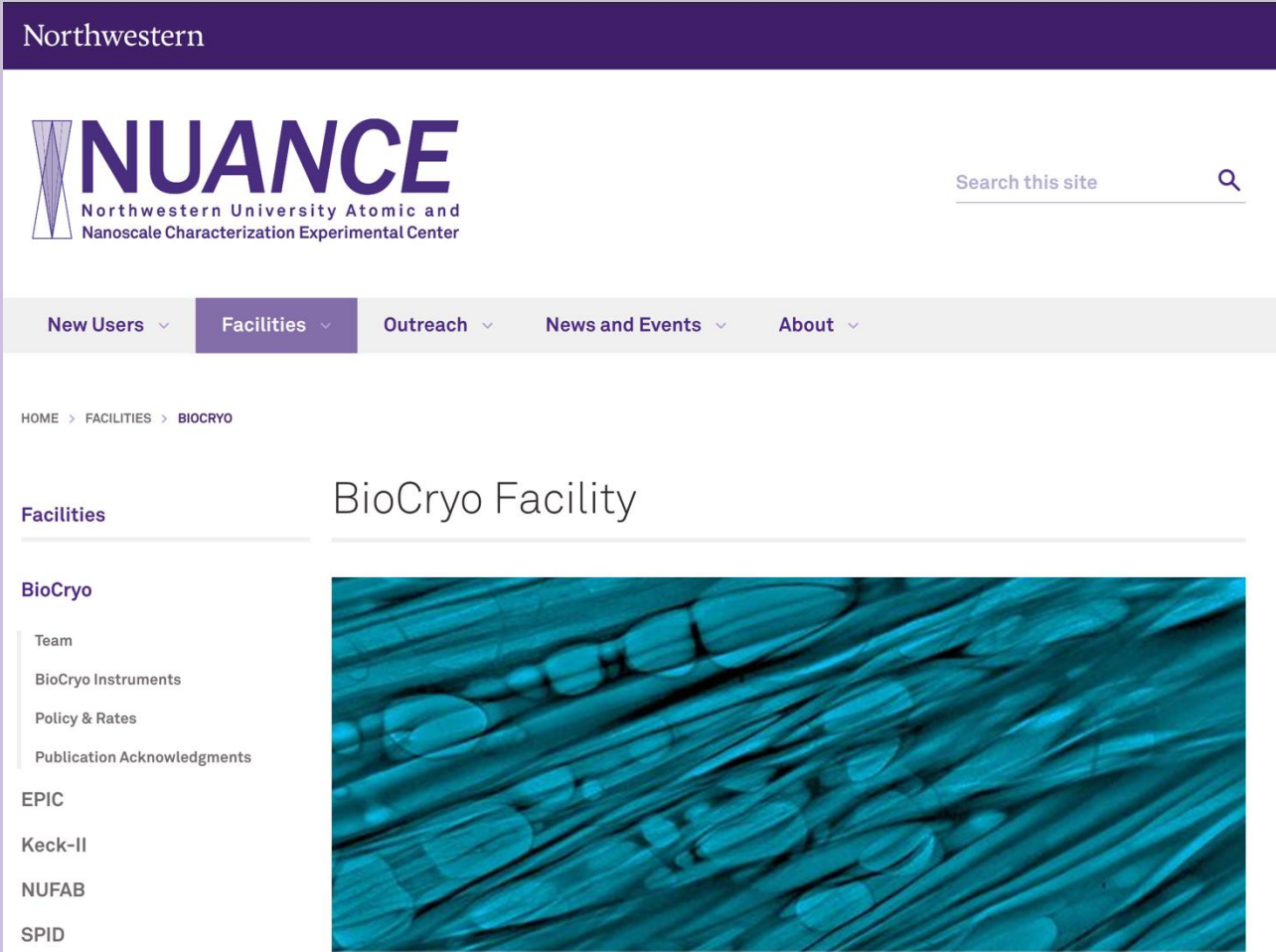
Dr. Reiner Bleher
BioCryo Manager
Research Associate
Professor



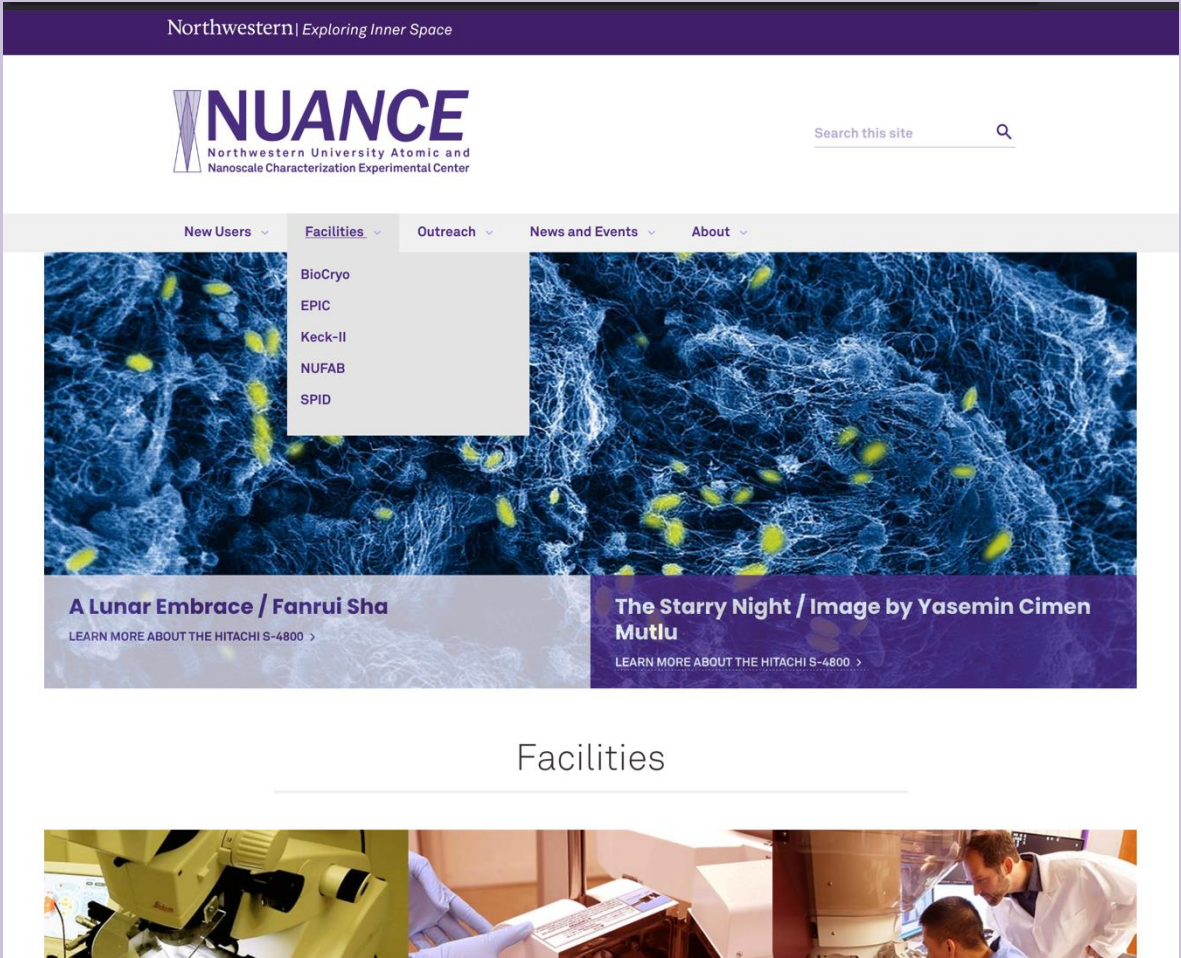
Eric W. Roth
BioCryo
Core Scientist



Chris Sharpe, PhD
BioCryo Postdoctoral
Research Associate

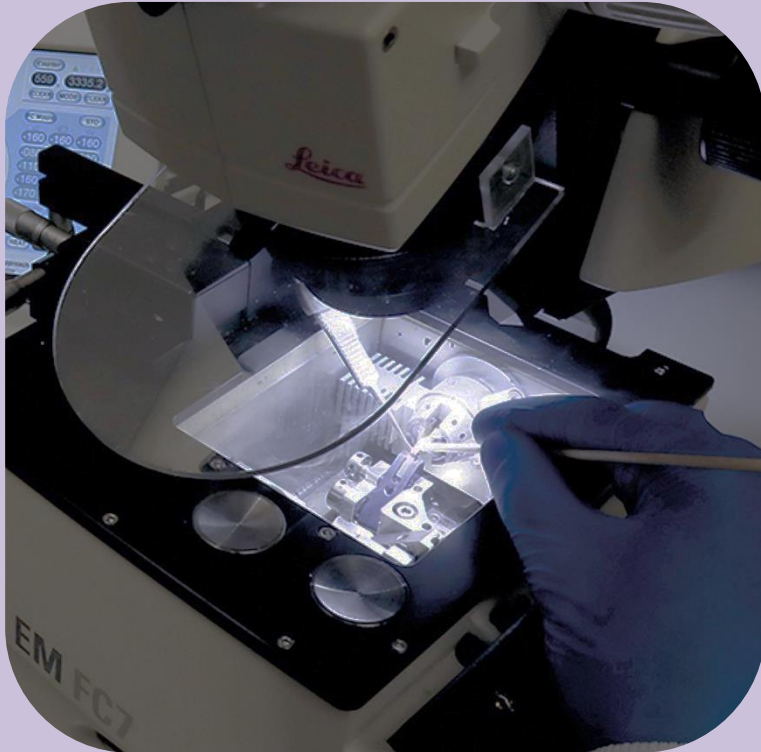


<https://nuance.northwestern.edu/facilities/biocryo/index.html>



<https://nuance.northwestern.edu>

Service



Training



Collaboration



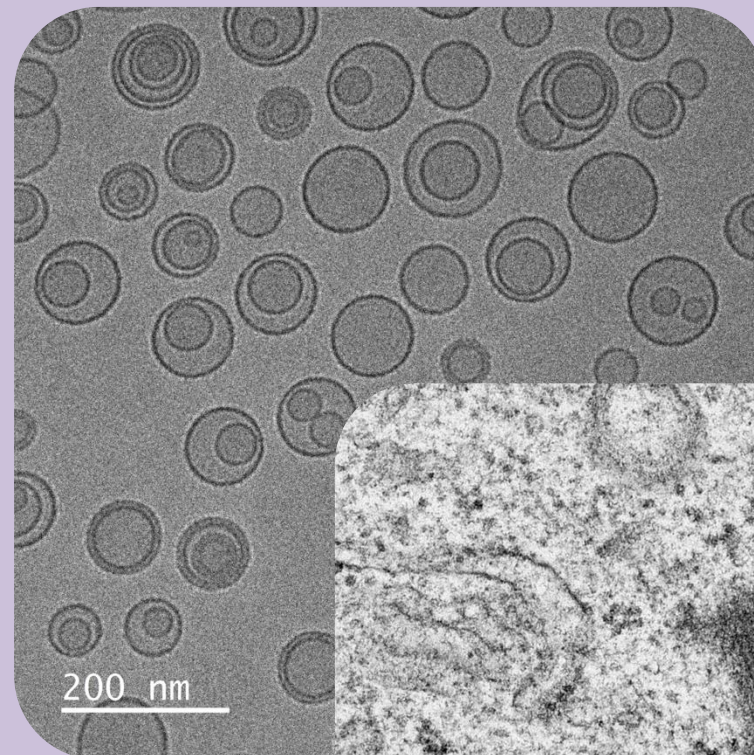
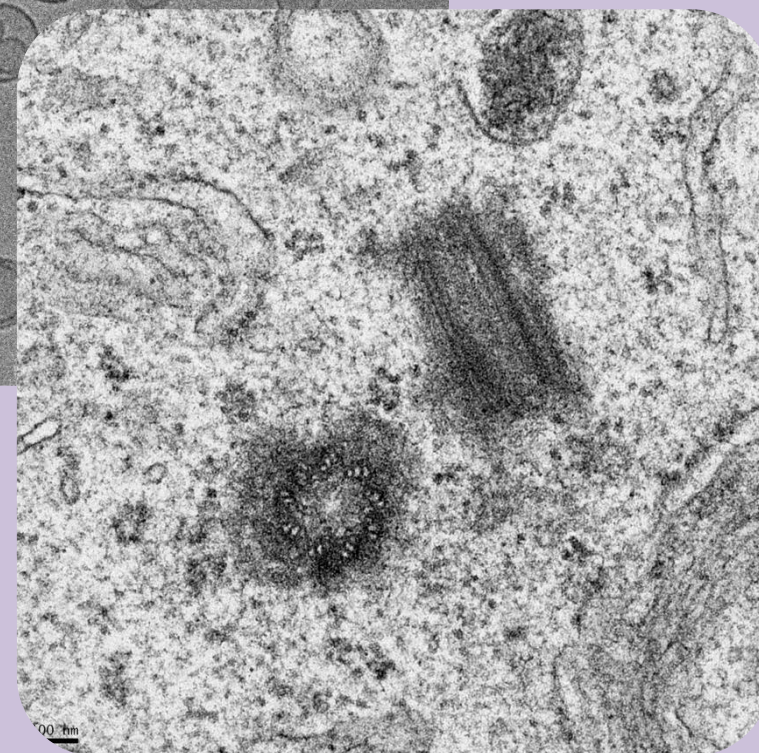
JEOL 1400 Flash TEM



- ☐ 120kV LaB6
- ☐ user-friendly interface
- ☐ Gatan OneView 4K camera with Drift Correction
- ☐ cryogenic capabilities
- ☐ in-person staff support
- ☐ alignment tutorial clips to be installed on desktop

- plan ahead -
microscope books up quickly*

**NOW AVAILABLE TO RESERVE
UP TO 21 DAYS IN ADVANCE!*



- All TEM training begins at BioCryo -

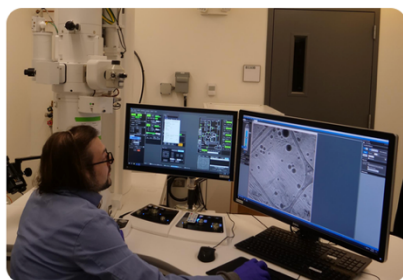
Prerequisite for using higher end TEMs
(JEOL 3200, ARM300, ARM200)

10 hours independent use gains

- 24/7 access
- May register for training on higher end TEM's
- May register for cryoTEM training



Northwestern | myHR Learn Browse



NUANCE - TEM 101

Course | ID: NUANCE-TEM101-JEOL1400 | V 2

Successful

Completed on: 14-SEP-2026

SEE CLASSES TO ENROLL



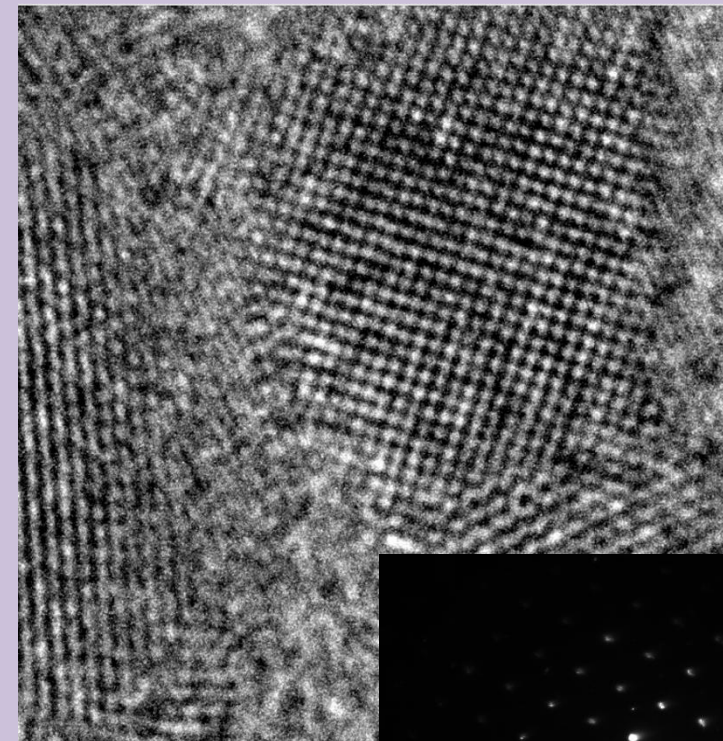
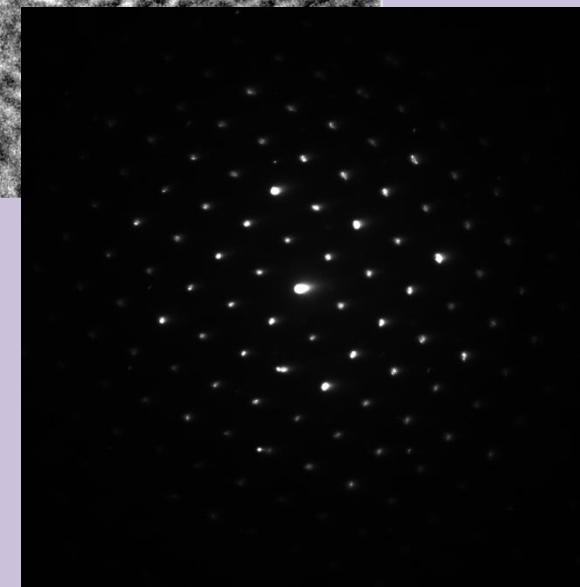
JEOL 3200 (S)TEM



WALK-UP MICROSCOPE

**pre-aligned and baked out by staff*

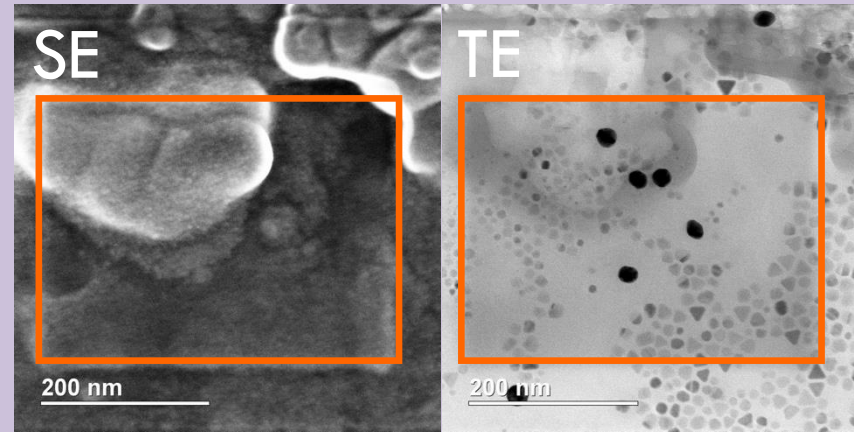
- ☐ 300kV Schottky FEG
(comparable to ARM300 resolution)
- ☐ Rio and K2 cameras
- ☐ cryoTEM experiments
- ☐ Liquid cell in-situ experiments
- ☐ STEM mode
- ☐ Diffraction work
- ☐ *EASY* lattice work
- ☐ Features energy filter to produce high contrast data



Prescreen samples prior to ARMs

****USUALLY AVAILABLE SAME DAY!***

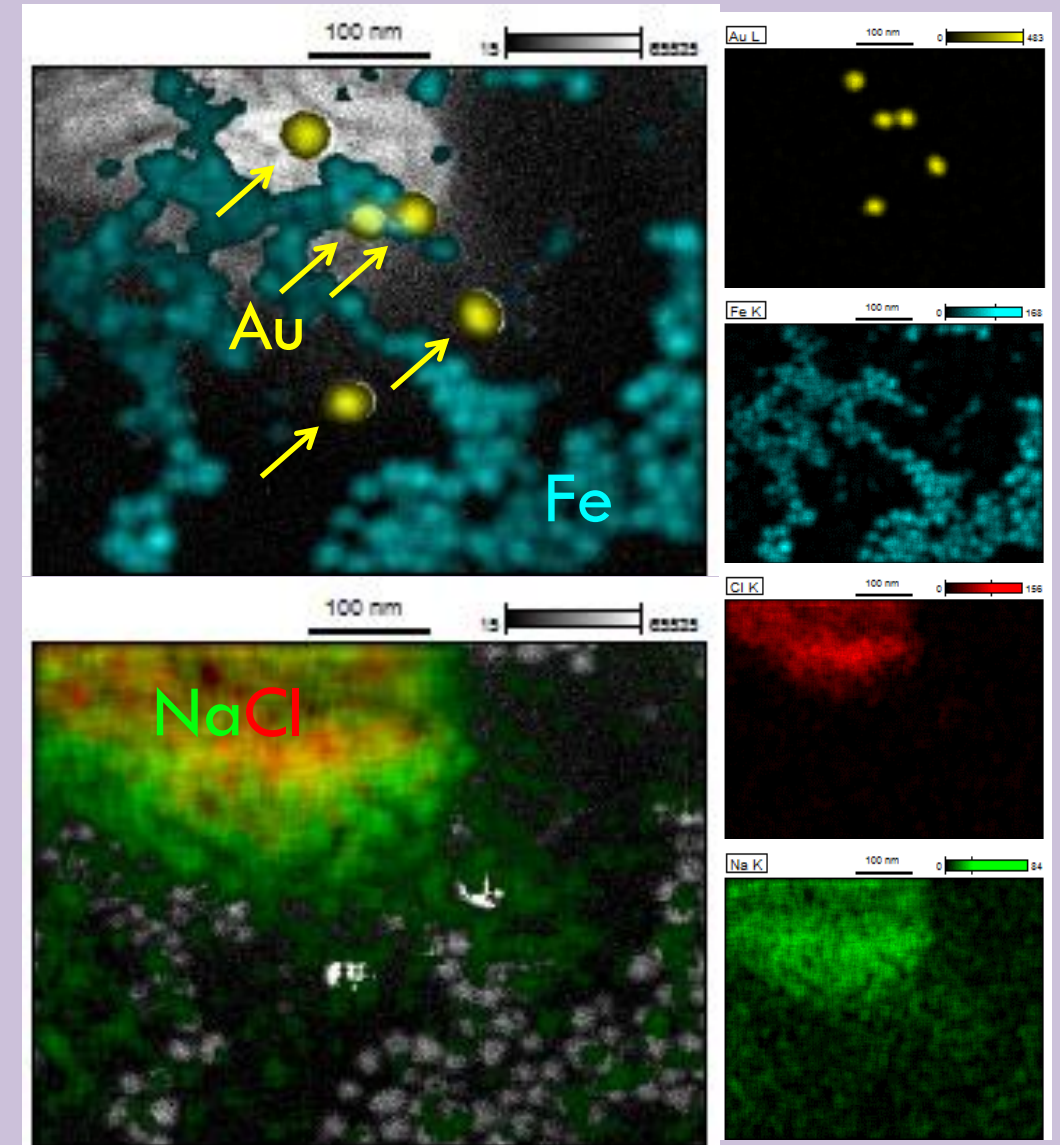
Hitachi HD 2300 STEM

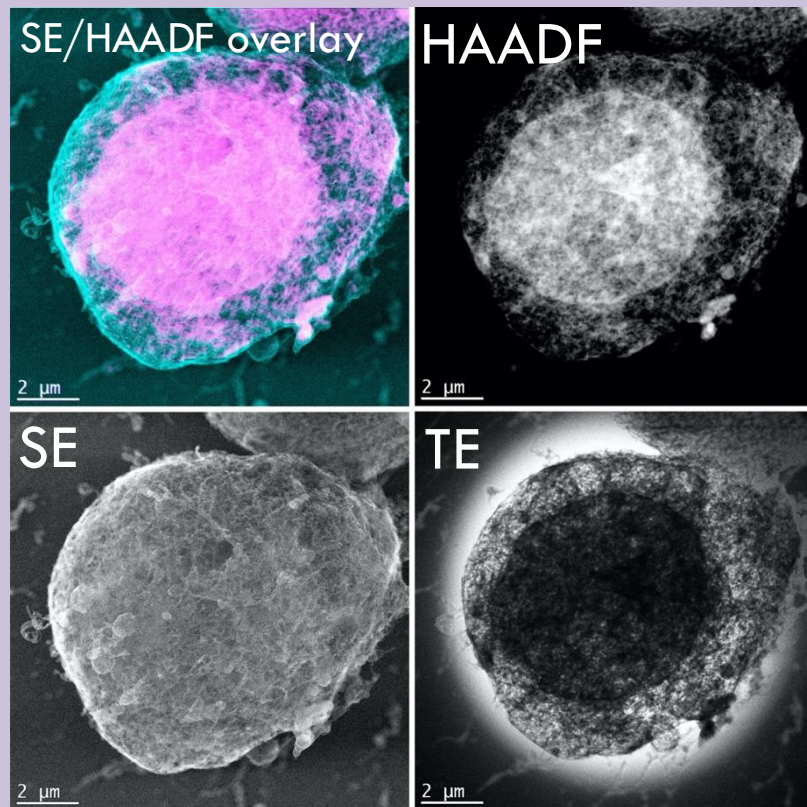


- ☐ 200kV Schottky FEG
- ☐ Secondary electrons - Surface
- ☐ Transmission bright field
- ☐ High angle annular dark field (HAADF)
- ☐ Dual - X-ray detectors
- ☐ Cryogenic capabilities

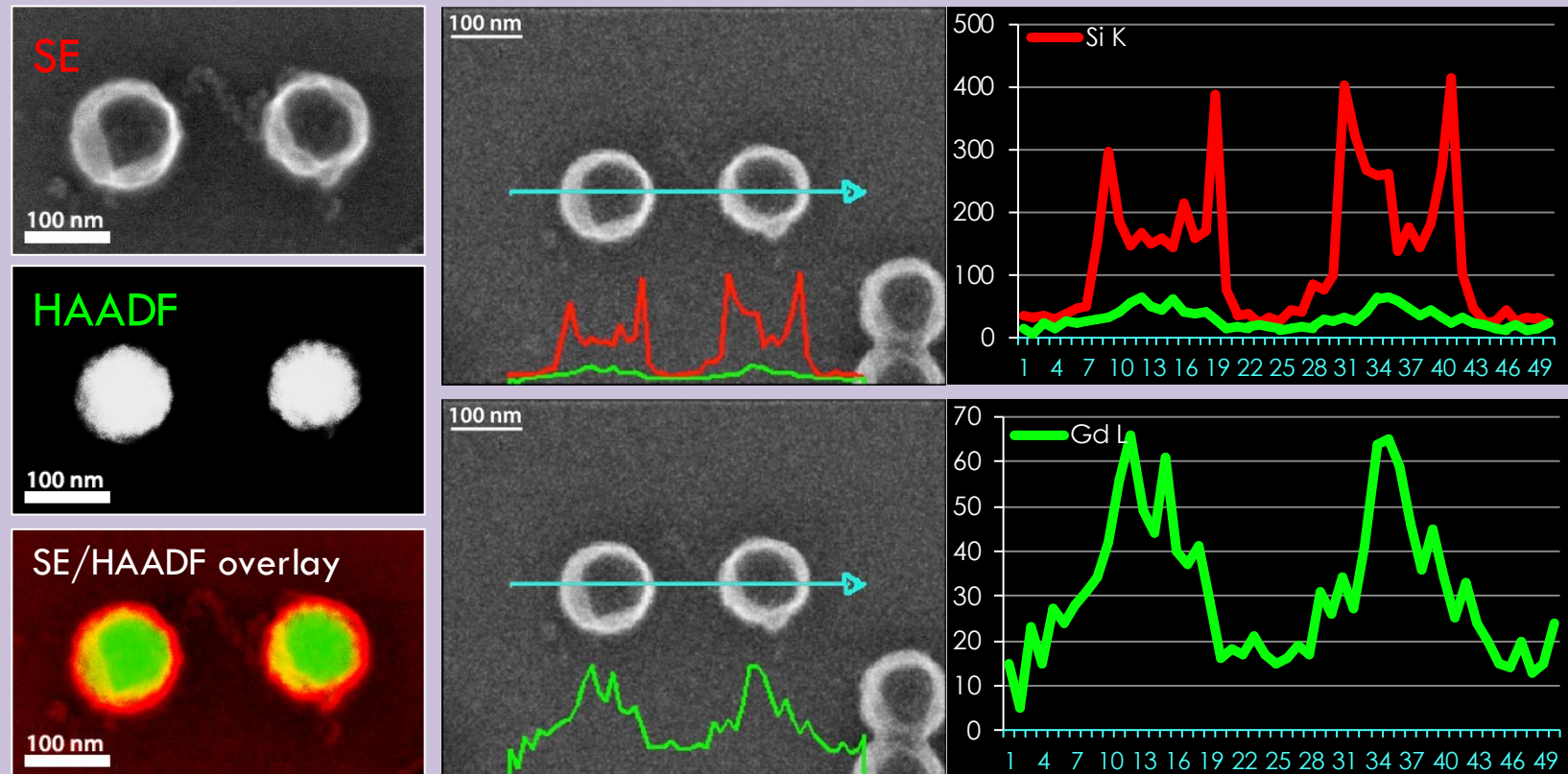
Shines in the 50kX to 500kX ranges
(not for atomic lattice work)

**EXTREMELY USER-FRIENDLY*



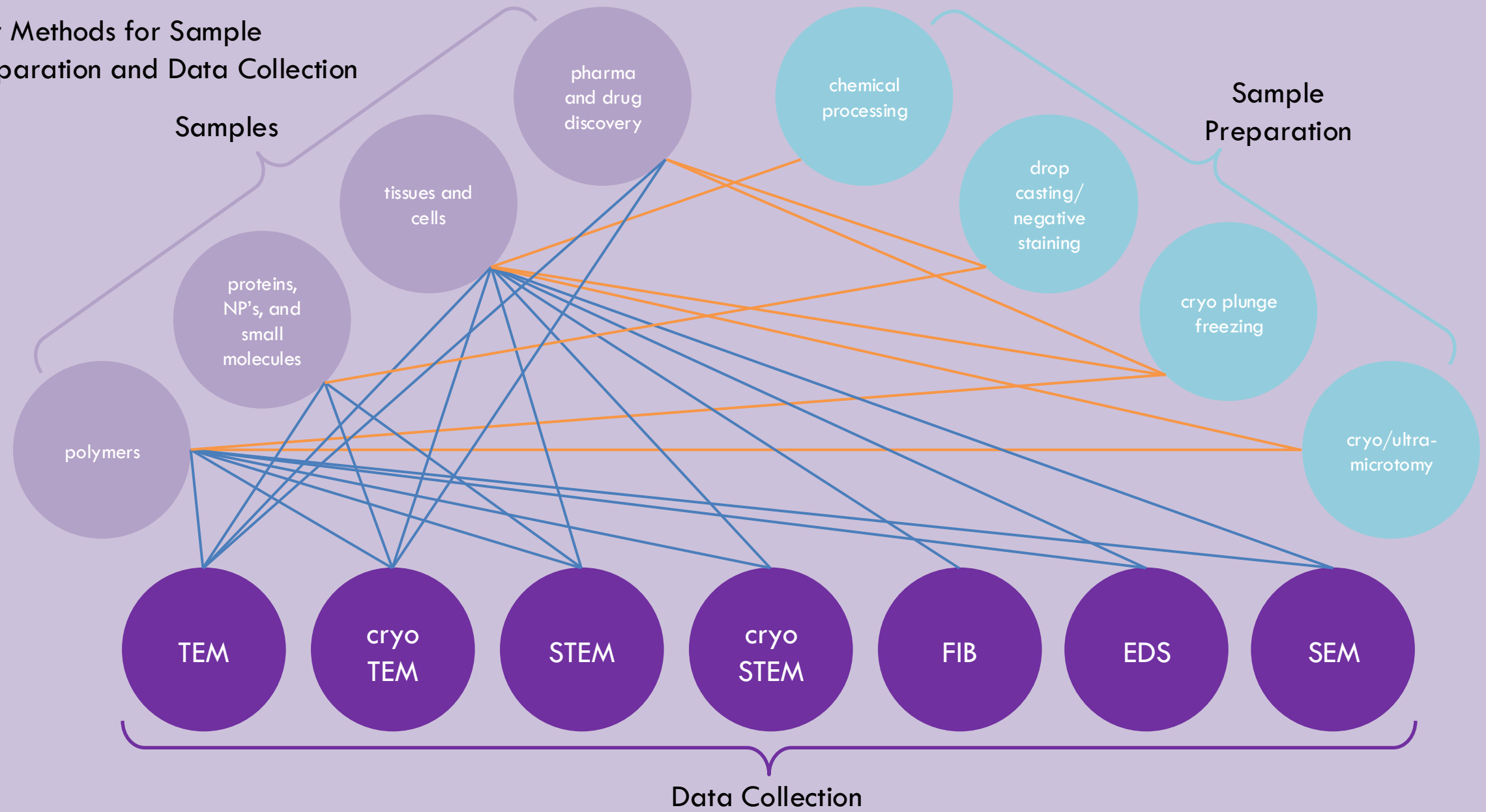


Jurkat Cell

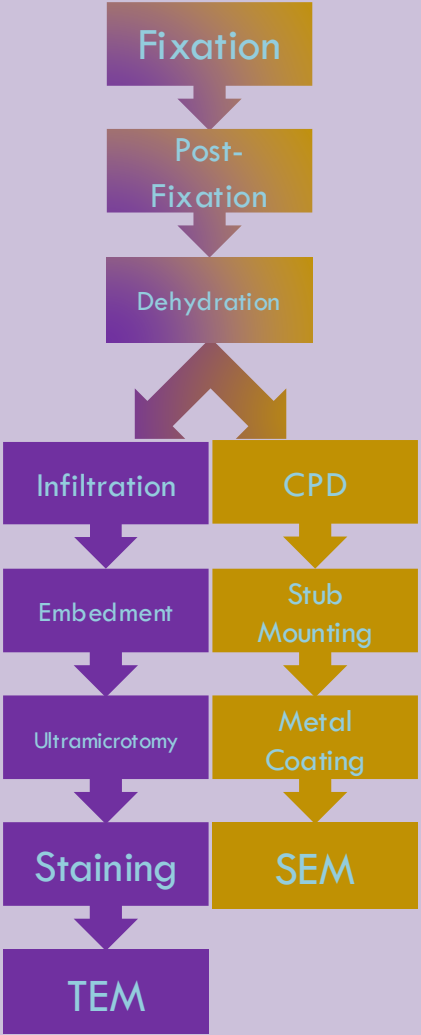
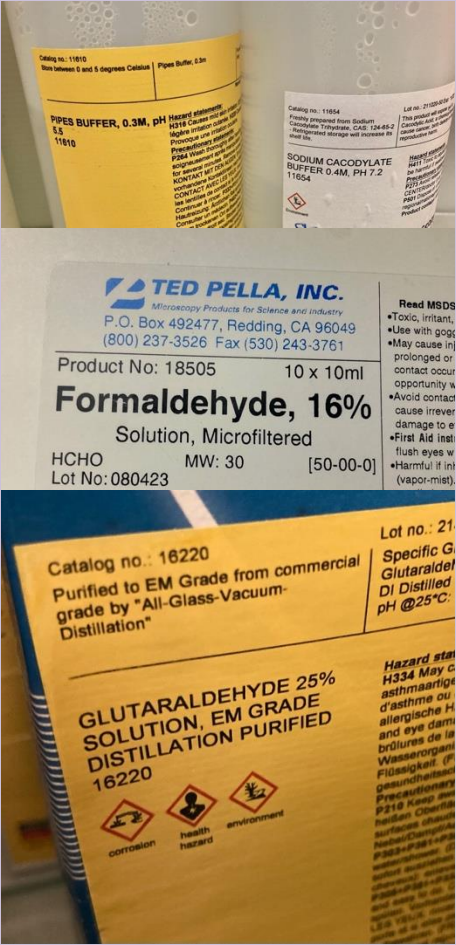


STEM/Dual EDS of Core/Shell Gd/Si NP's EDS line Scan

Our Methods for Sample Preparation and Data Collection



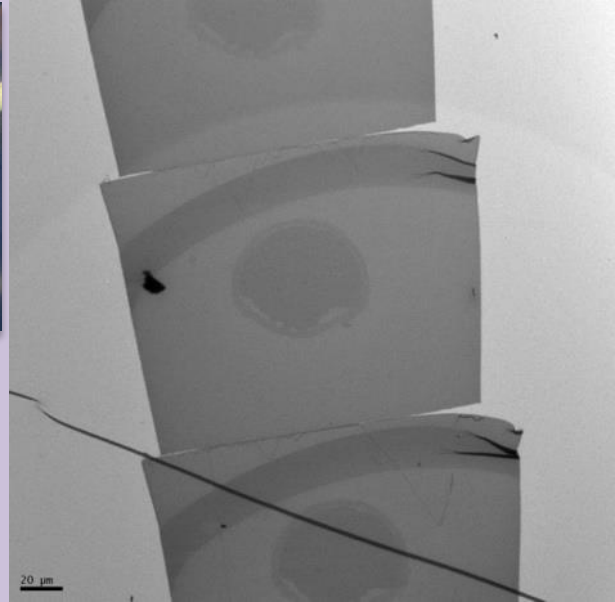
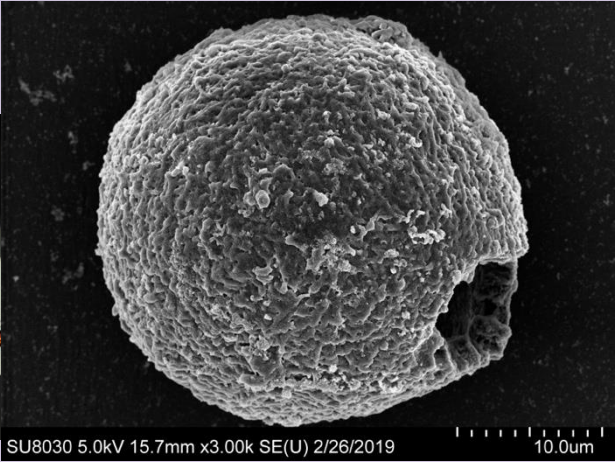
Chemical Processing



TEM prep

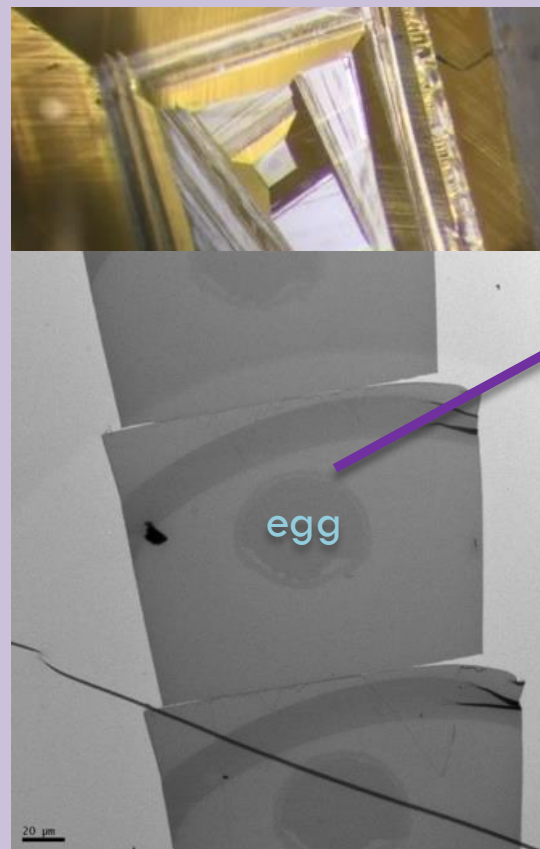
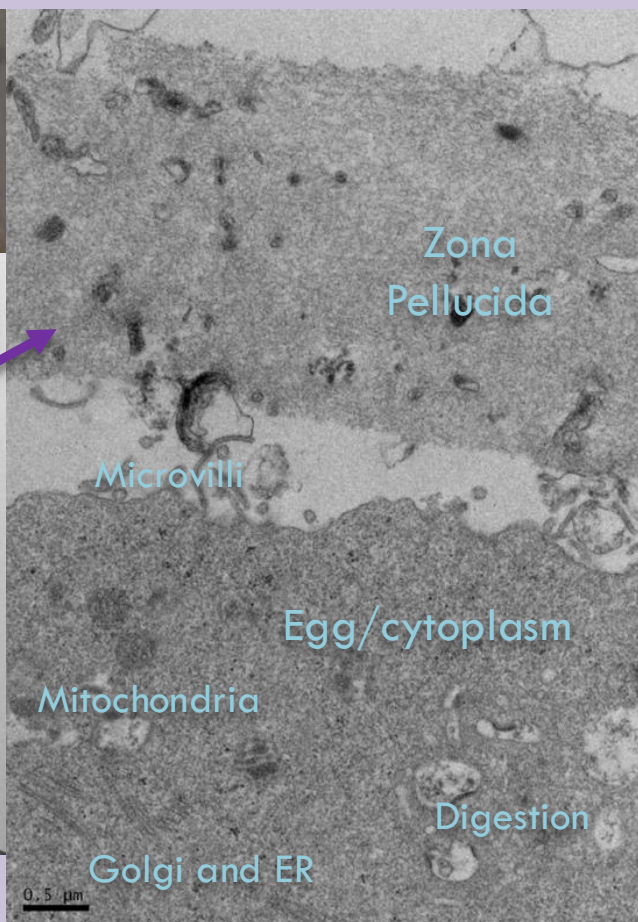
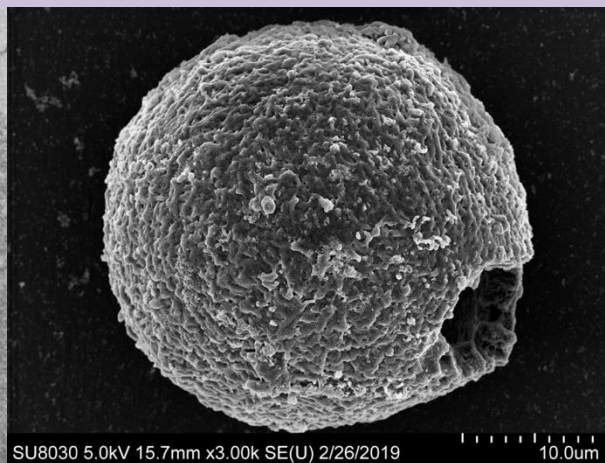
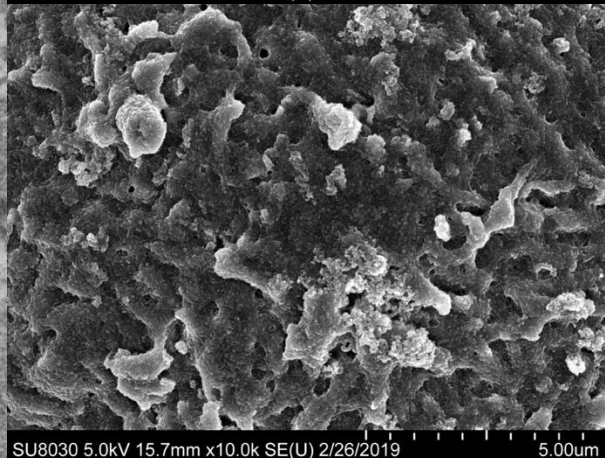
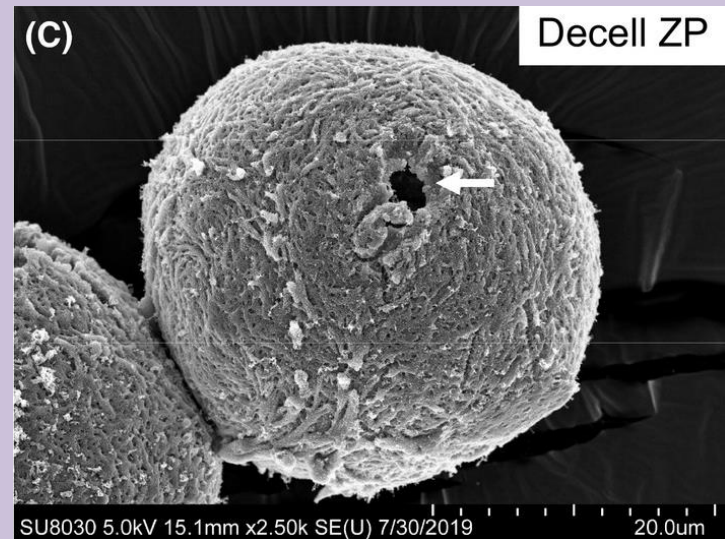
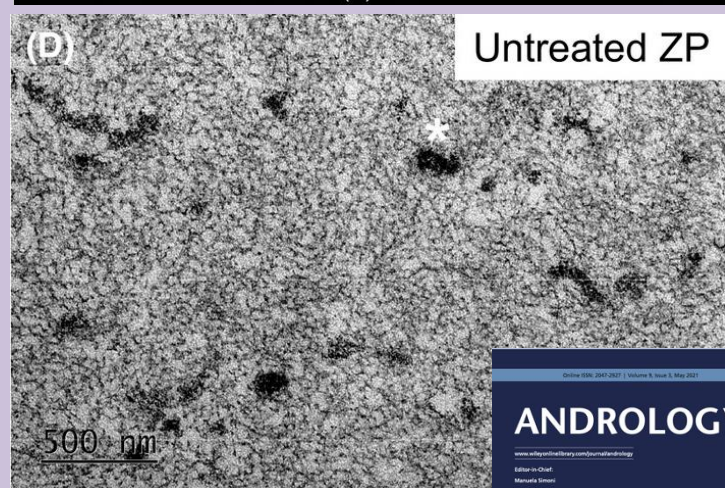


SEM prep



TEM

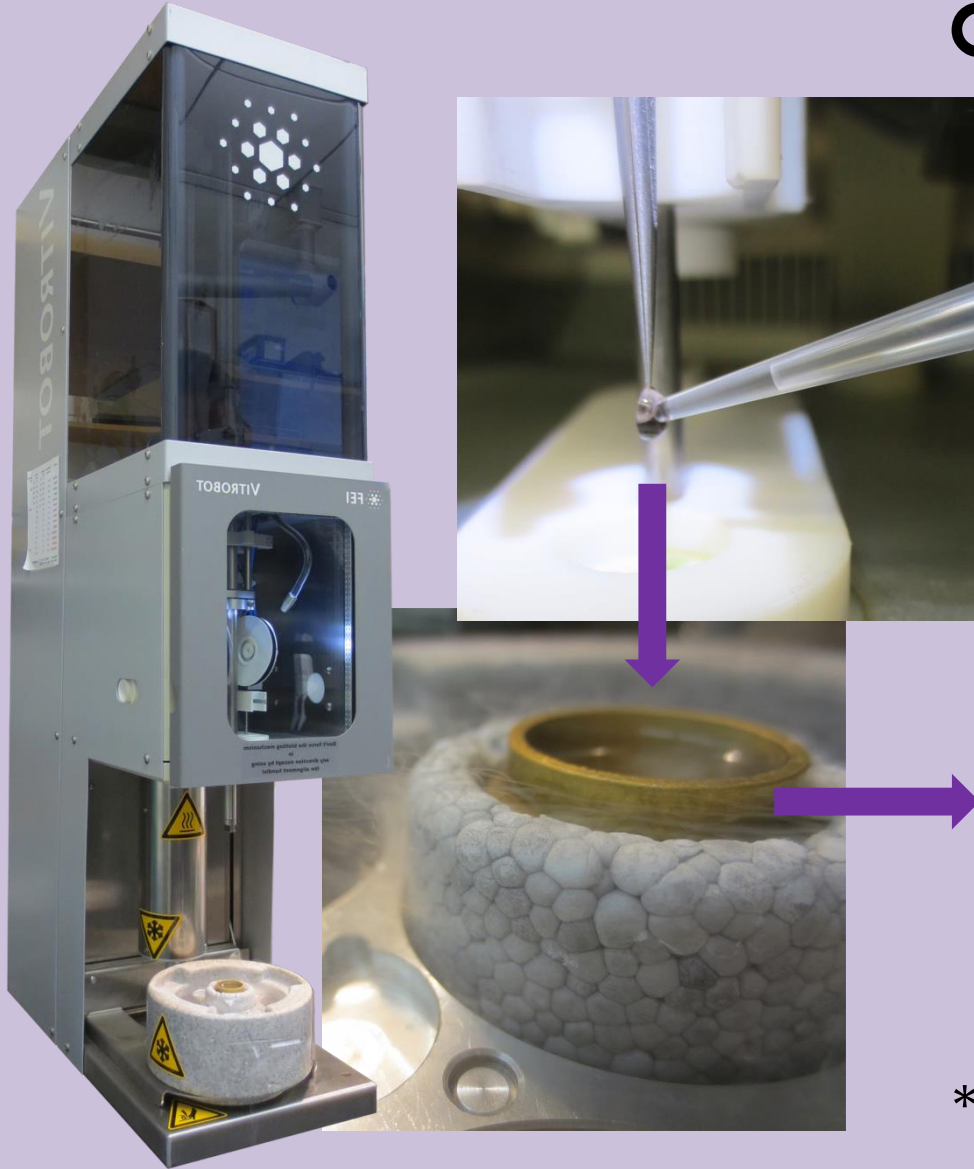
SEM



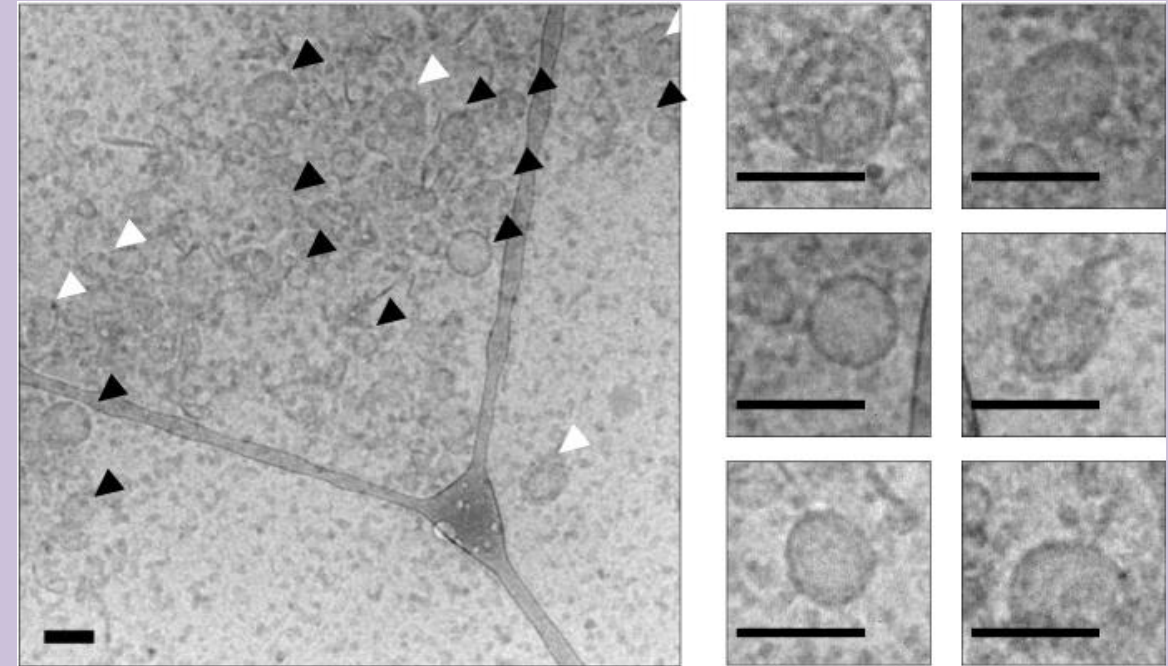
Lee, H. C., J. L. Balough, E. W. Roth, S. Vaccari, and F. E. Duncan. "A Decellularized Oocyte-Derived Scaffold Provides a "Sperm Safe" to Preserve Mammalian Spermatozoa." *Andrology* (Feb 9 2021).
<https://dx.doi.org/10.1111/andr.12986>



cryoTEM



- ☐ Sample grid stored in LN
- ☐ Loaded into cryoTEM holder and kept vitreously frozen ($\sim -180^{\circ}\text{C}$)
- ☐ Imaged while still frozen

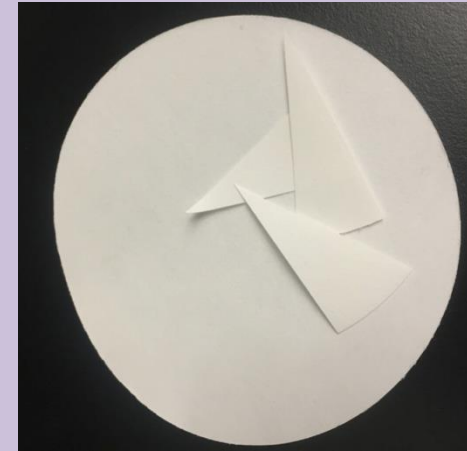


Hershewe, Jasmine M, Katherine F Warfel, Shaelyn M Iyer, Justin A Peruzzi, Claretta J Sullivan, Eric W Roth, Matthew P DeLisa, Neha P Kamat, and Michael C Jewett. "Improving Cell-Free Glycoprotein Synthesis by Characterizing and Enriching Native Membrane Vesicles." *Nature Communications* 12, no. 1 (2021): 1-12.

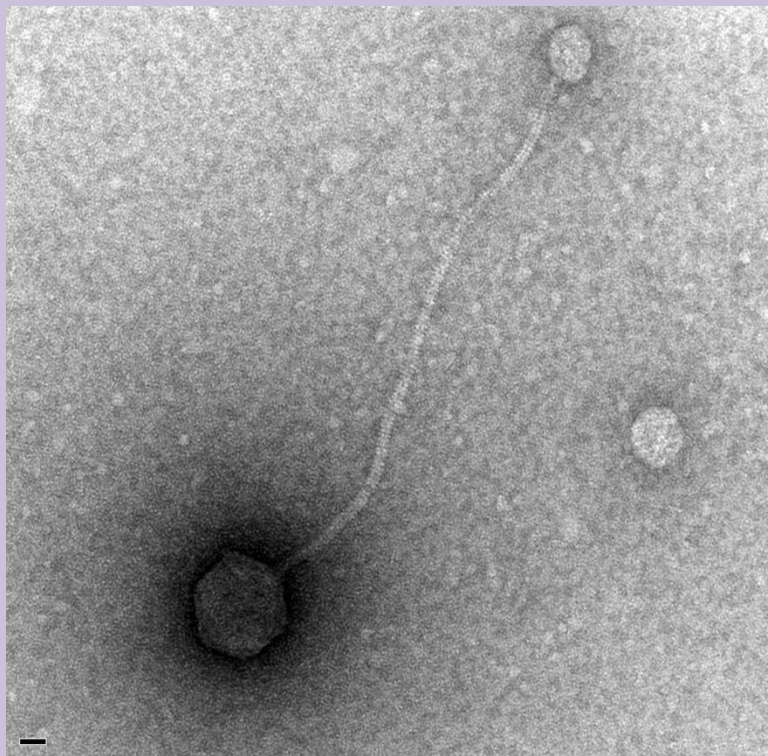
**FROM SAMPLE TO DATA IN - ONE DAY - !*

Negative staining

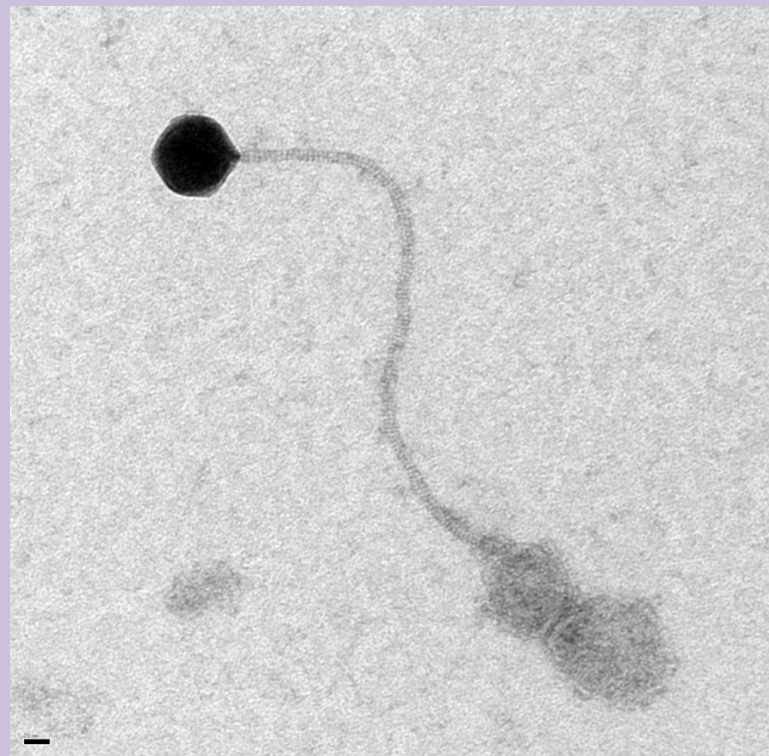
- very fast and easy sample prep
- screen samples prior to cryoTEM
- structures may collapse too much upon drying



Phages

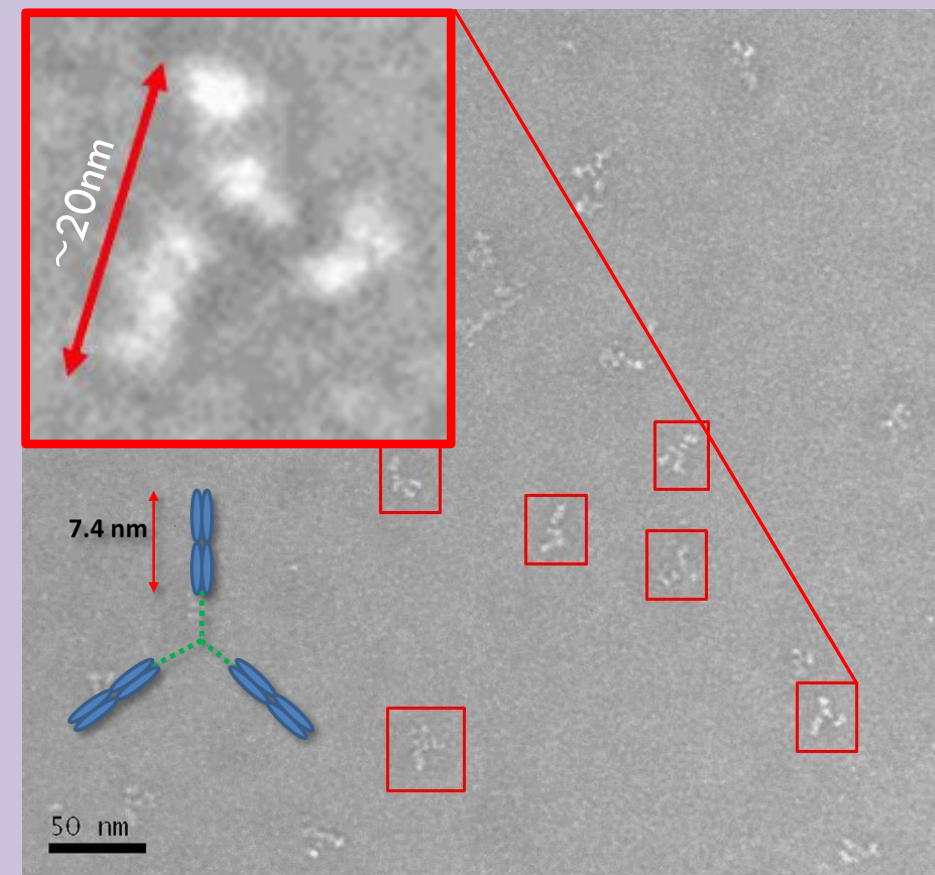


uranyl acetate negative staining



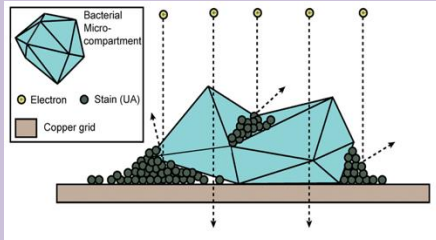
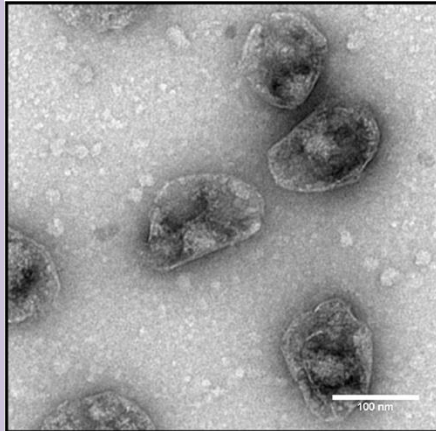
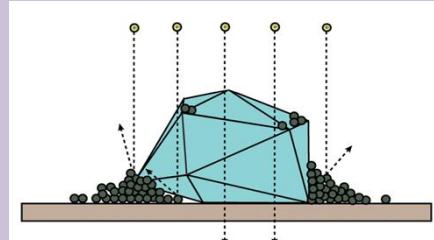
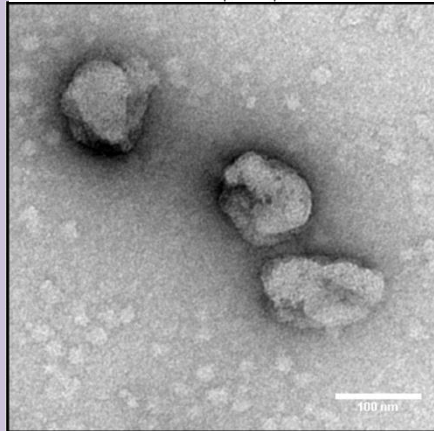
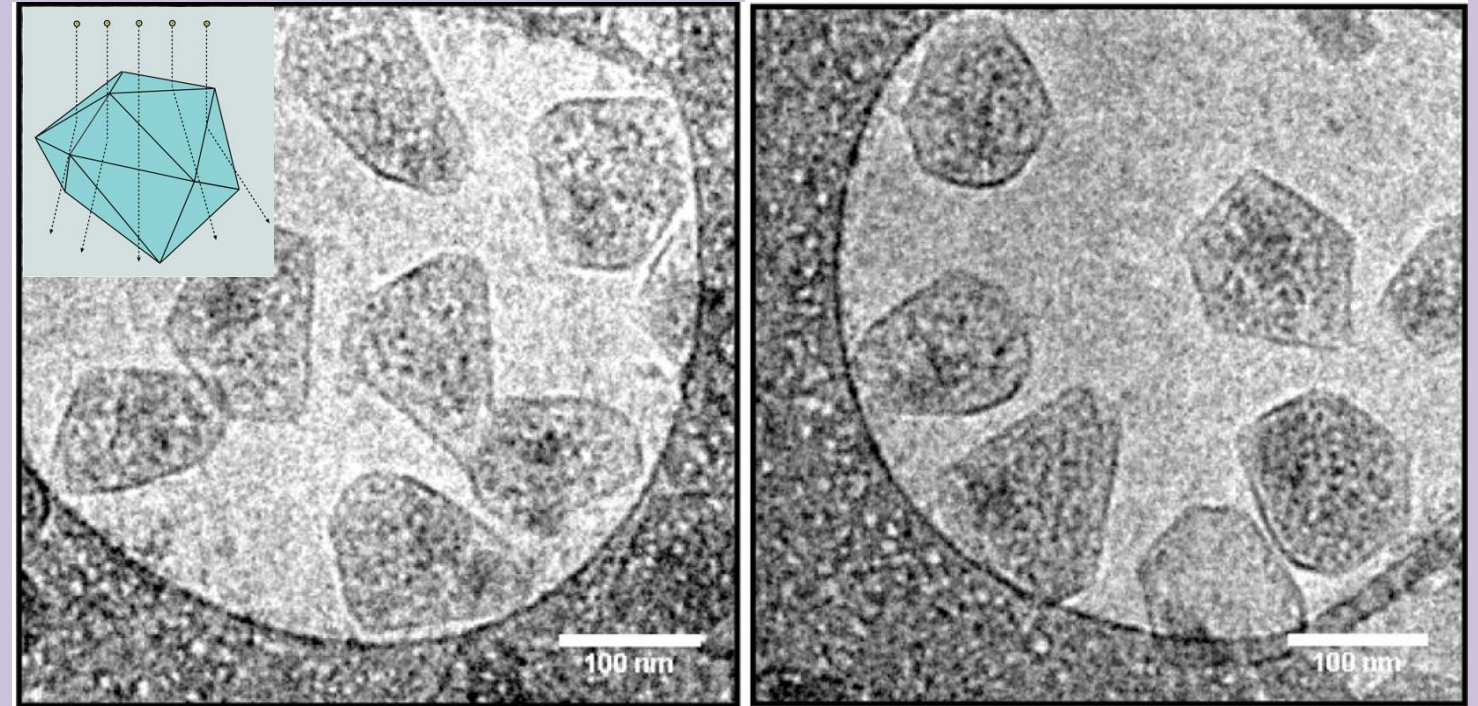
phosphotungstic acid positive staining

Macro-molecules



uranyl formate negative staining

negative staining Vs. cryoTEM



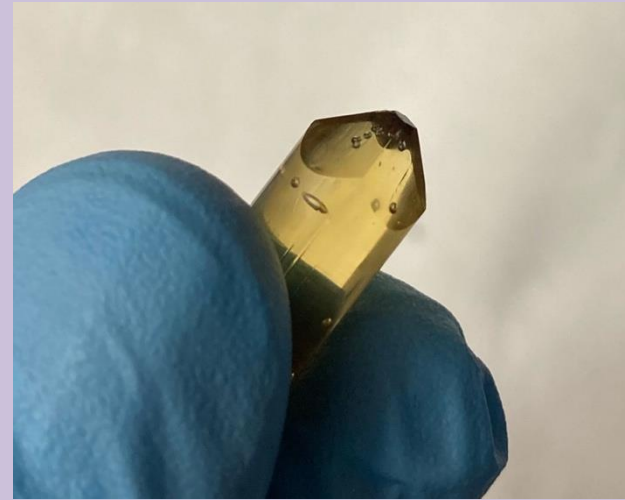
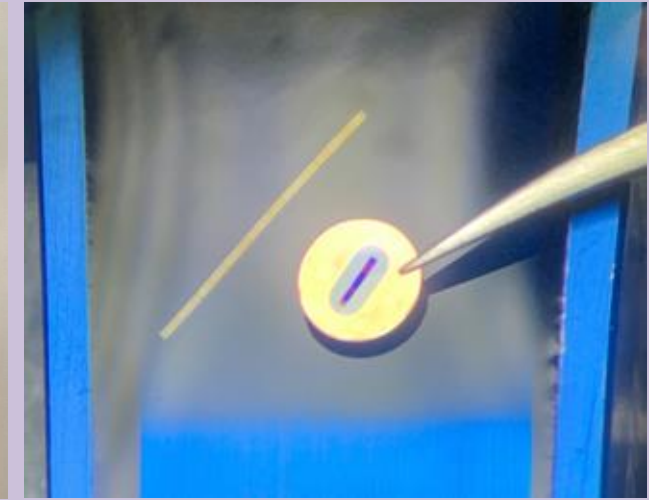
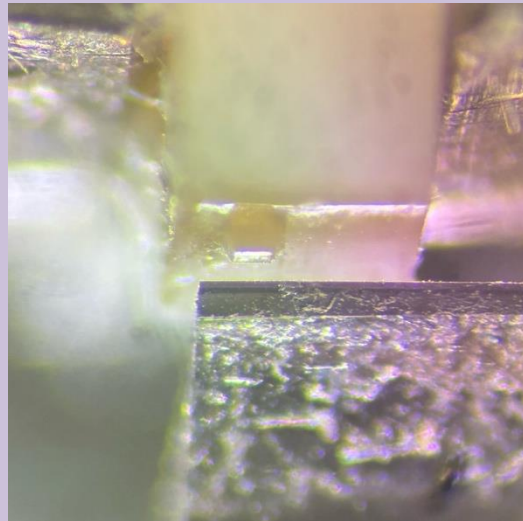
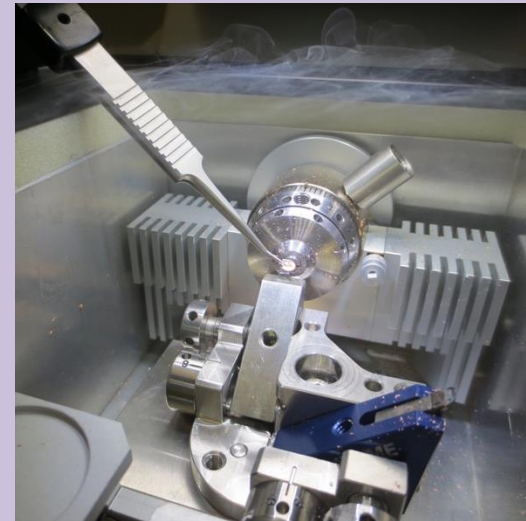
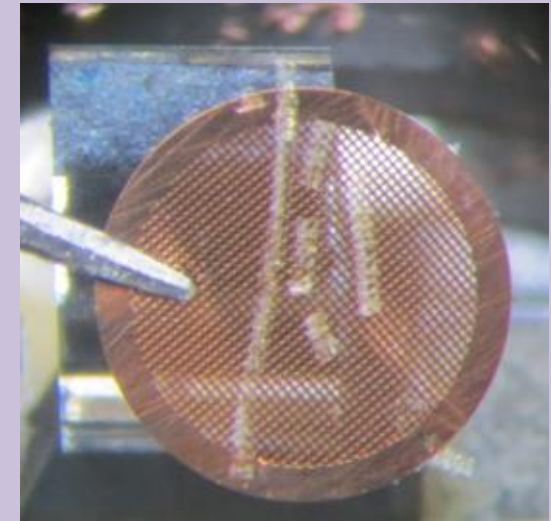
Kennedy, Nolan W, Jasmine M Hershewe, Taylor M Nichols, Eric W Roth, Charlene D Wilke, Carolyn E Mills, Michael C Jewett, and Danielle Tullman-Ercek. "Apparent Size and Morphology of Bacterial Microcompartments Varies with Technique." *PLoS one* 15, no. 3 (2020): e0226395.

Ultramicrotomy and Cryo-Ultramicrotomy

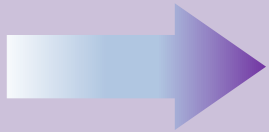
- ☐ Ultramicrotomy of embedded tissues or particles
- ☐ cryo-ultramicrotomy of low-T_g materials for
- ☐ Useful prep for
- ☐ TEM, AFM, or super-resolution fluorescence

**REQUIRES DEDICATION TO MASTER*

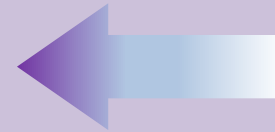
Leica UC7 / FC7



Research Highlights



More than Bio, More than Cryo



Kaitlin Landy / Mirkin Lab

Sample:

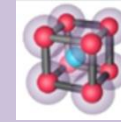
- embedded colloidal crystal analogs made with DNA tagged to Au and Fe NP's

Research Goals:

synthesize substitutional alloy colloidal crystals with either ordered or random arrangements of Au and Fe_3O_4 nanoparticles within identical parent lattice and crystal habit

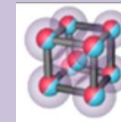
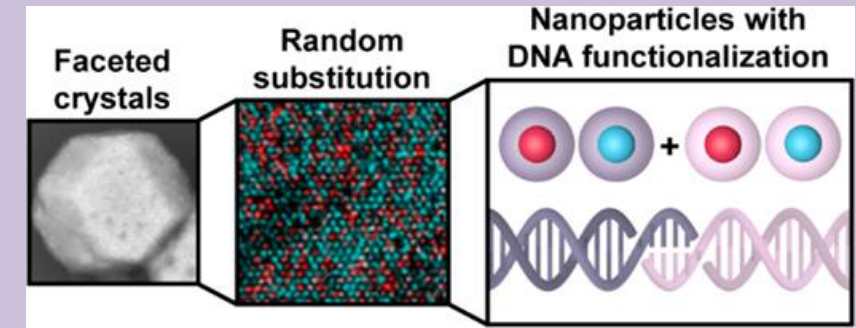
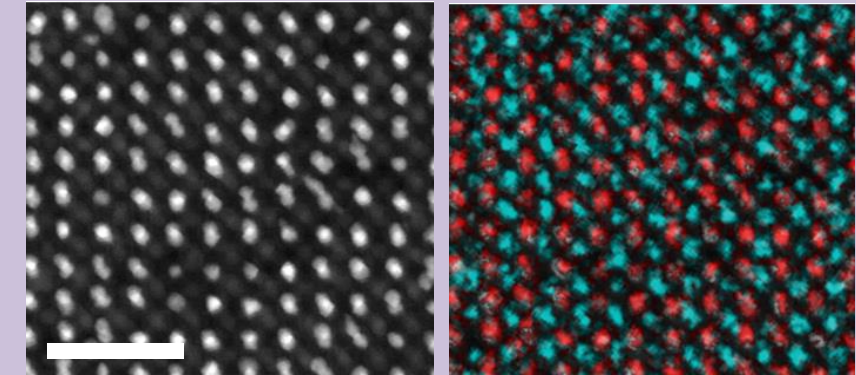
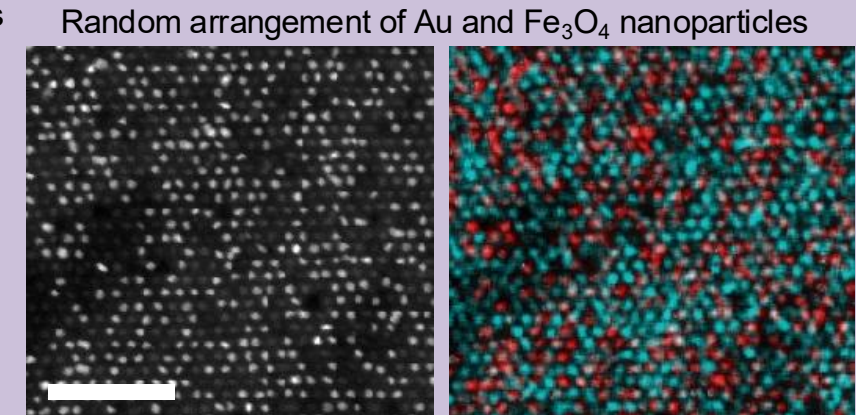
Techniques used

- ultramicrotomy (Leica UC7)
- SEM (JEOL 7900)
- STEM/EDS (Hitachi HD2300)
- SAXS



HD2300 STEM/EDS
Red: Au L, Cyan: Fe K.
Scale bars: 250 nm.

~80 nm thick resin-embedded sections of colloidal crystals
Au and Fe_3O_4 nanoparticles (20 nm diameter).



slides removed for proprietary reasons

Q&A