M3D2:Purify active material

1. BE Communication lab workshop: Research Proposals!
2. Prelab discussion
3. Demo of $FePO_4$-phage reaction
4. Collect and wash active material: AuNP-Fe(III)-phage nanowires
5. Prepare TEM samples
6. Prepare active material for 80°C vacuum oven

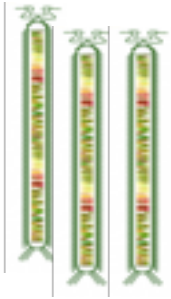
Module 3: biomaterials engineering

How do nanoparticle size and quantity affect battery capacity?

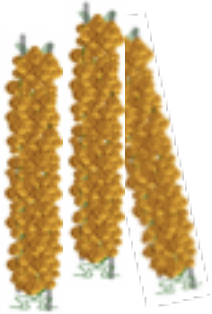
Purify M13 phage
Add AuNP

DAY 1

PEG

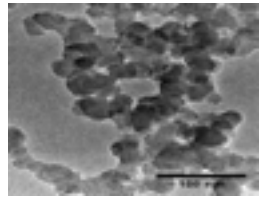


Biomineralize Fe(III)-phage-AuNP



Visualize nanowires on TEM

DAY 4



Purify active material

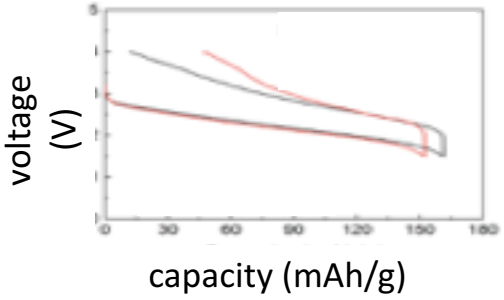
DAY 2

Construct cathode (and battery)

DAY 3

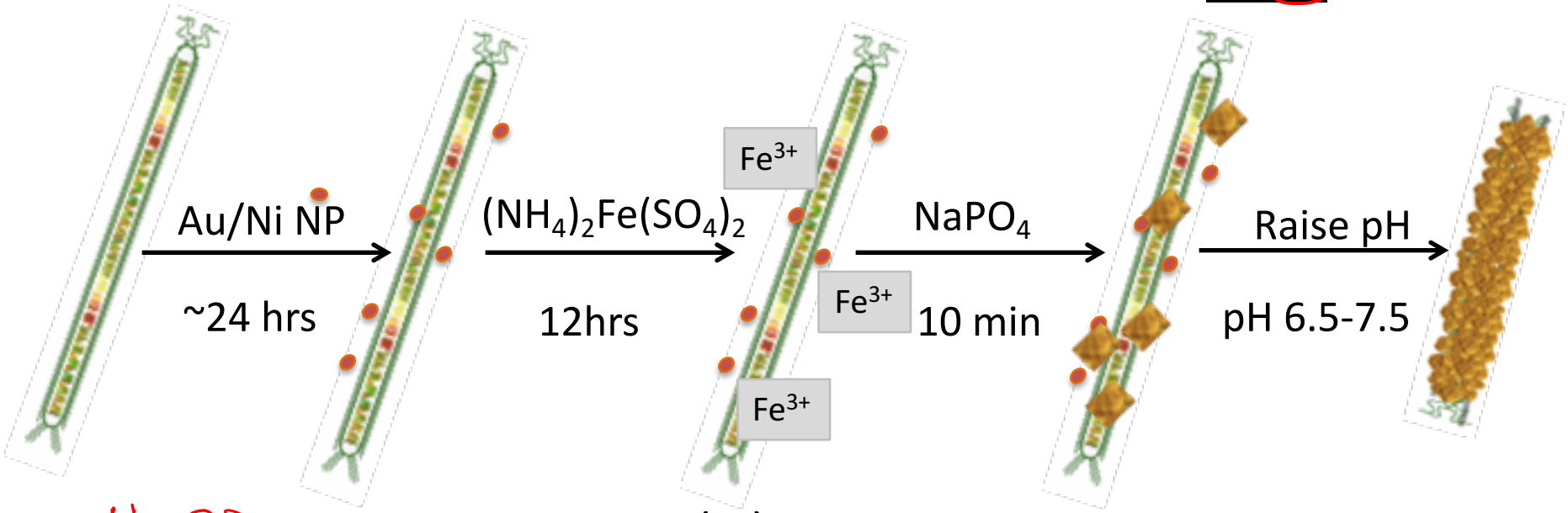
Measure battery capacity

DAY 5



Phage Biomineralized with Iron and NPs

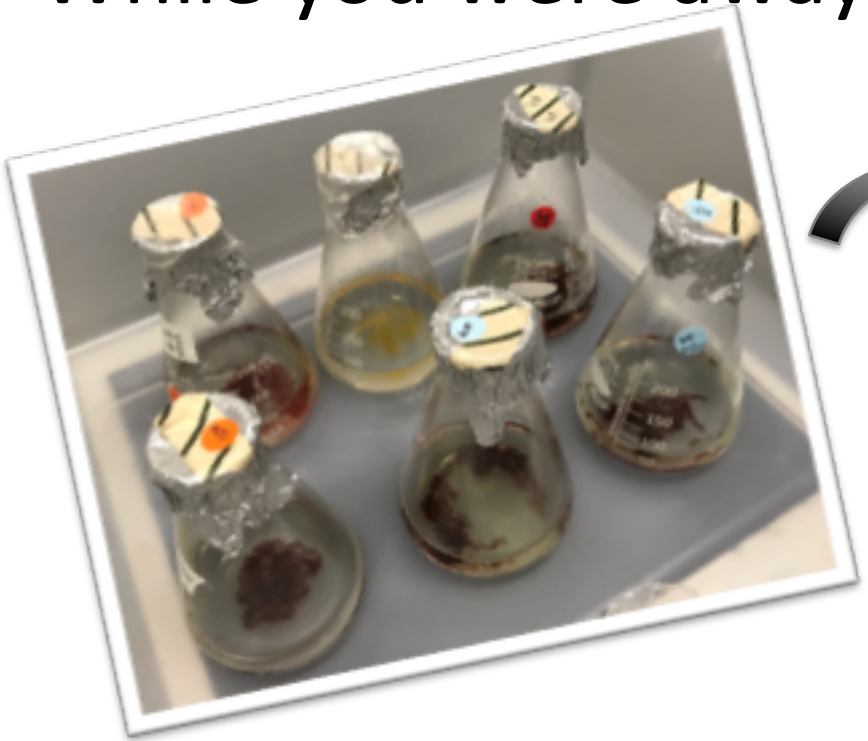
pVIII coat protein modified to include DSPHTELP (+ / —) peptide)



$NaPO_4$ precipitates Fe(III)

amorphous iron facilitates ion insertion into cathode material

While you were away…



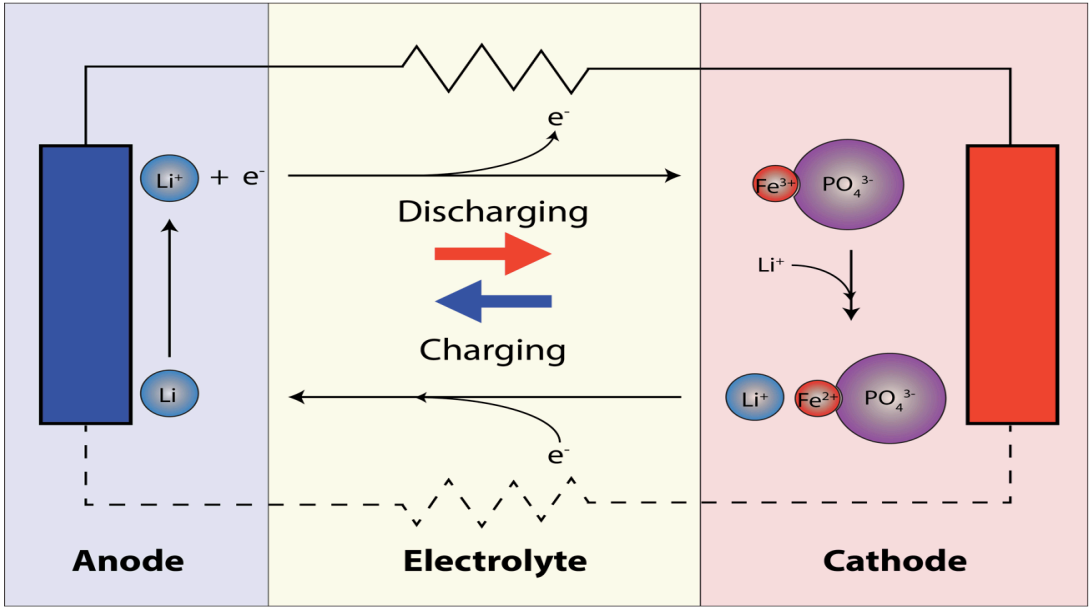
Last night: $(NH_4)_2Fe(SO_4)$
This morning: $NaPO_4$ &
pH to 6.5-7.5

Diagram of Mod3 battery

M13 phage: scaffold

AuNP (& SuperP): electrical conductor

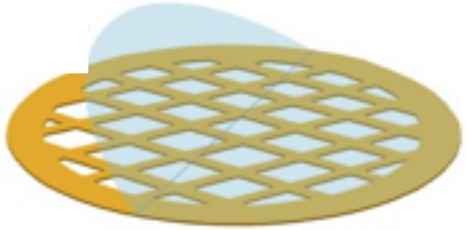
Fe(III) PO4: ionic conductor



Set aside Fe(III)-phage-NP for TEM inspection

- The Fe(III)-phage-NP active material is in its purest form
  - No impurities, binder, etc.

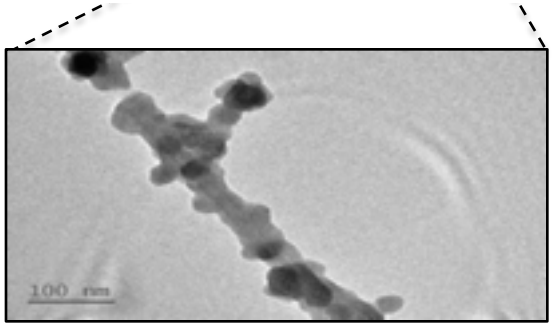
- Cu-grid, carbon mesh
  - Copper-orange side
  - ✓ Silver/black side where droplet deposited



➢ Practice handling it with tweezers

side view

sample
Carbon mesh
Cu-grid



In lab today…

1. Do Part 3 First (Collect active material)
2. Demo of $FePO_4$-phage reaction during spin
3. Practice then prepare TEM samples
4. Prepare active material for 80°C vacuum oven

- During the downtime you should discuss and choose a topic for M3D3 homework (and potentially beyond!) submitted as a pair/team
- Quiz on Friday
- **Class time Tues. 5/1 Prof. Belcher would like to hear elevator pitches from all groups.**
- No Lab next Wednesday! Work on research proposals!