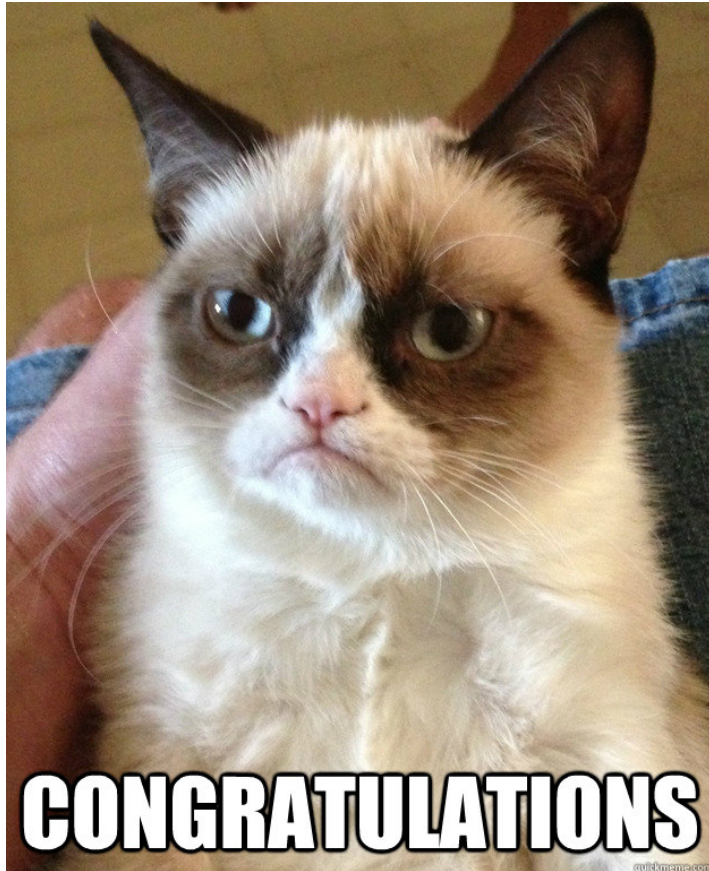


M3D2:Purify active material

11/16/2016

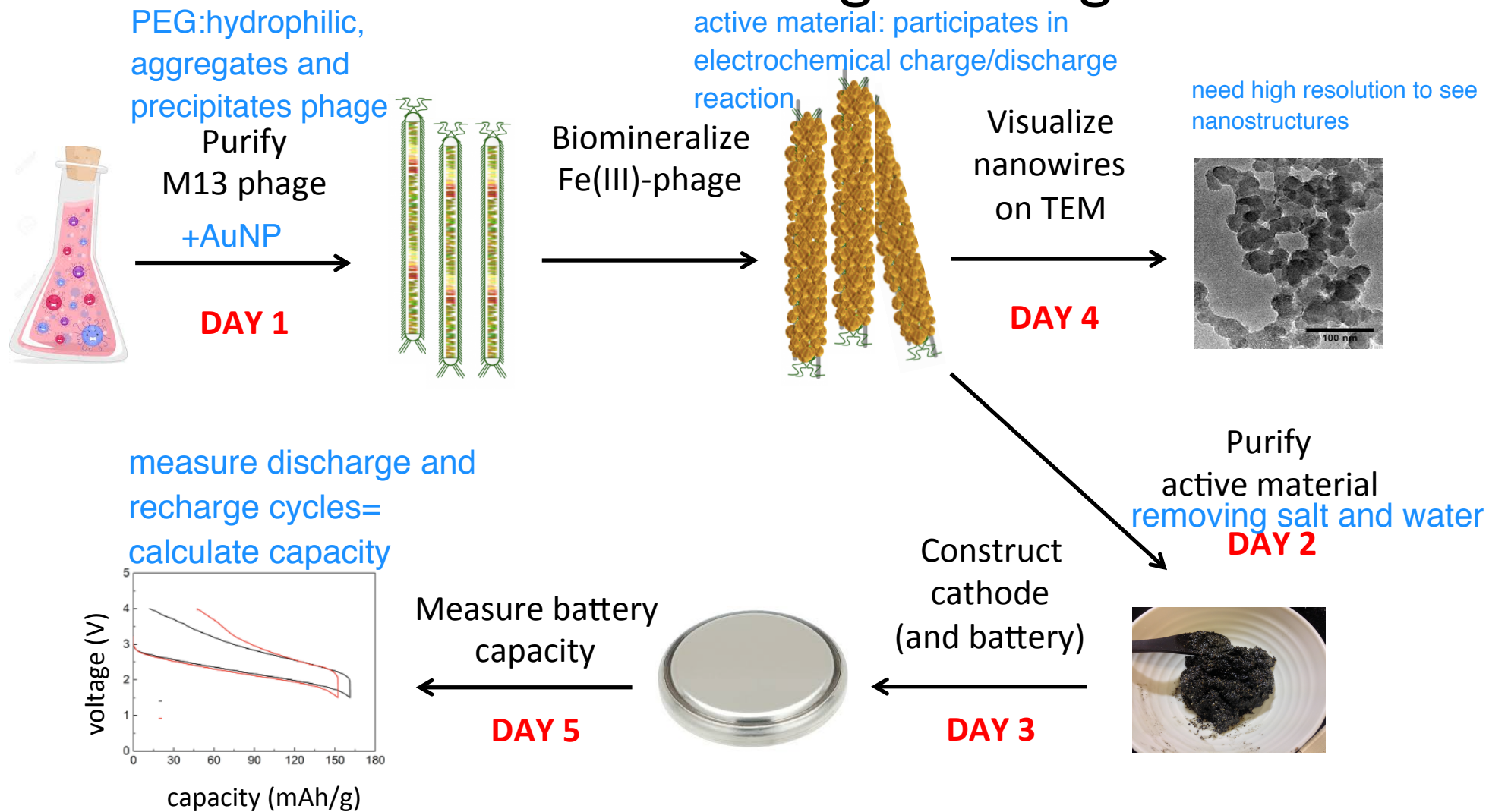
1. BE Communication lab workshop: Research Proposals!
2. Prelab
3. Demo of FePO₄-phage reaction
4. Collect and wash active material: AuNP-Fe(III)-phage nanowires
5. Prepare TEM samples
6. Prepare active material for 80°C vacuum oven

Congratulations! You're almost done with Mod2



- ✓ Office hours Saturday 11/19 10am-5pm
- ✓ Research report: Due **SUNDAY** 11/20 at 5pm
- ✓ Blog by Monday 11/21 at 5pm
- **M3 research proposal**
 - HW due M3D3 in teams: refine your topic and approach, doesn't have to be your final proposal, **get feedback during downtime(s)**
 - During lecture Tuesday 11/22 team elevator pitches
- Quiz on M3D3

Module 3: biomaterials engineering



Phage Biomining

- P8 coat protein modified to include DSPHTELP, neg charged peptide
- Gold nanoparticles (AuNP ●) incubated with phage for 24 hours after M3D1.
- Next phage/AuNP incubated in $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2$ as a source of Fe^{3+}
 - 90% efficiency!
 - Fe^{3+} back into solution if wait > 12 h
- PO_4^{3-} from NaPO_4 precipitates Fe(III)
- nucleation / accumulation / mineralization ensues
 - amorphous ($\alpha\text{-FePO}_4$), not crystal
 - promising cathode material

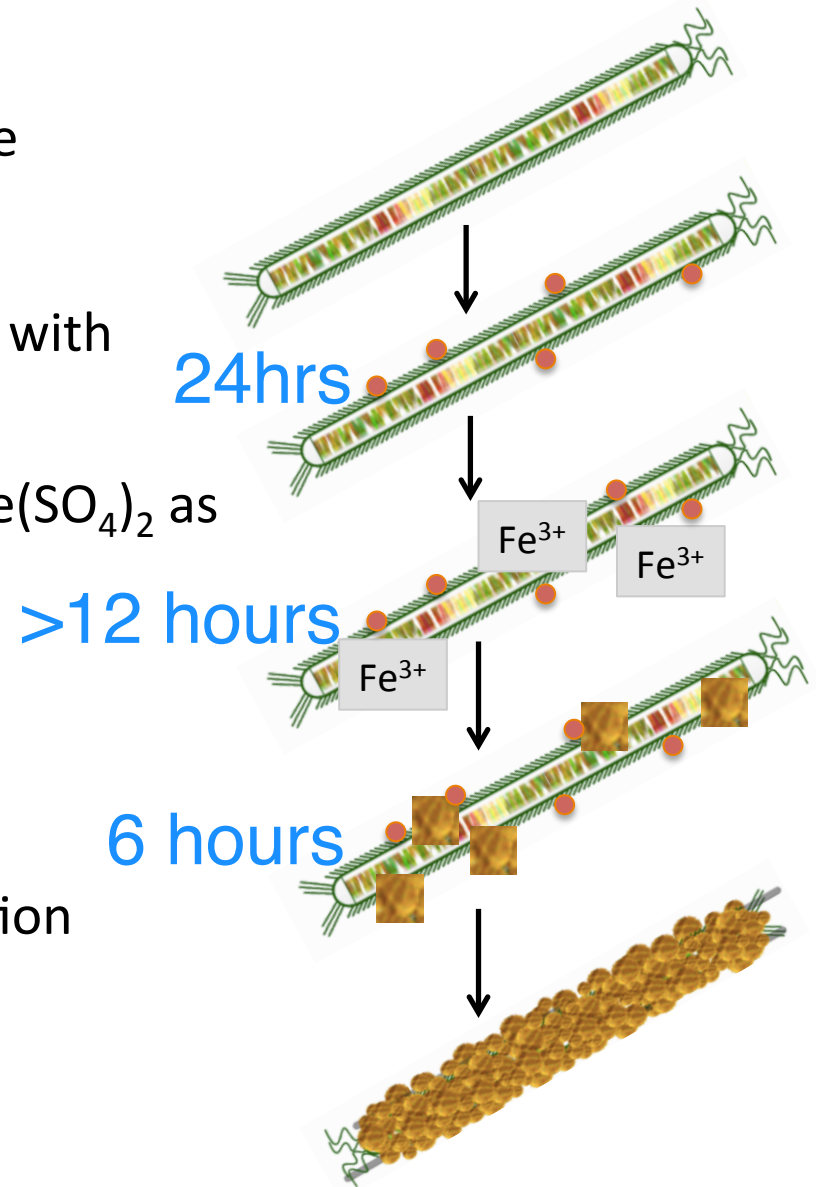
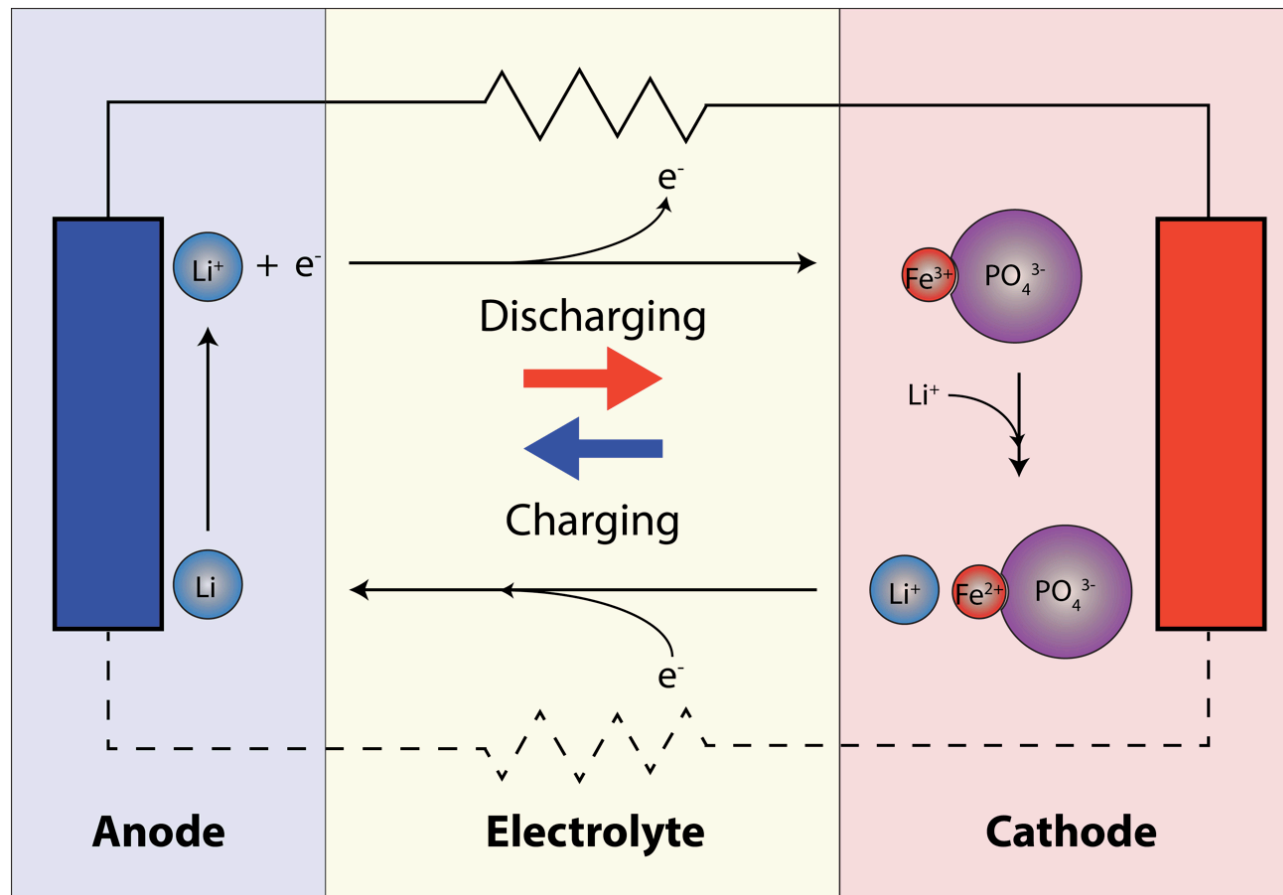


Diagram of Mod3 battery

M13 phage: [scaffold](#)

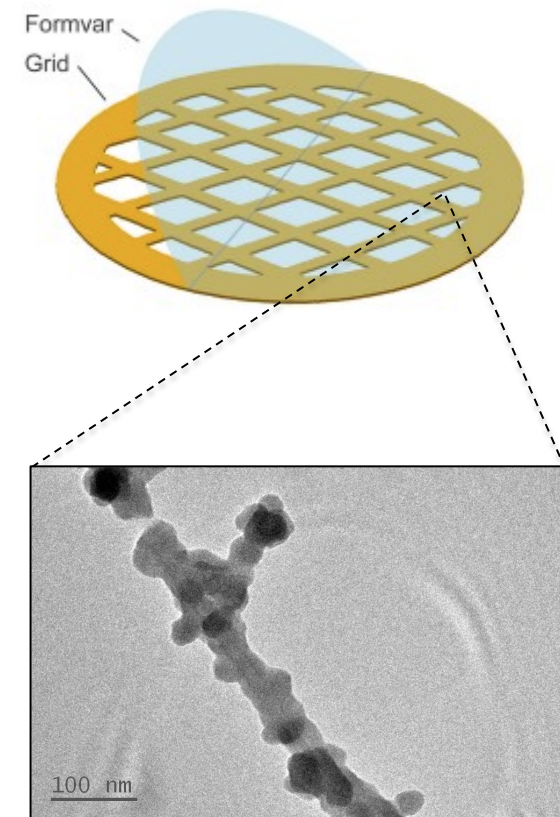
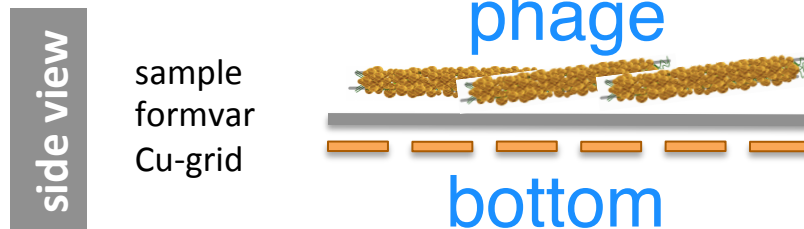
AuNP: [electrical conductor](#)

Fe(III) PO₄: [ion storage](#)



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

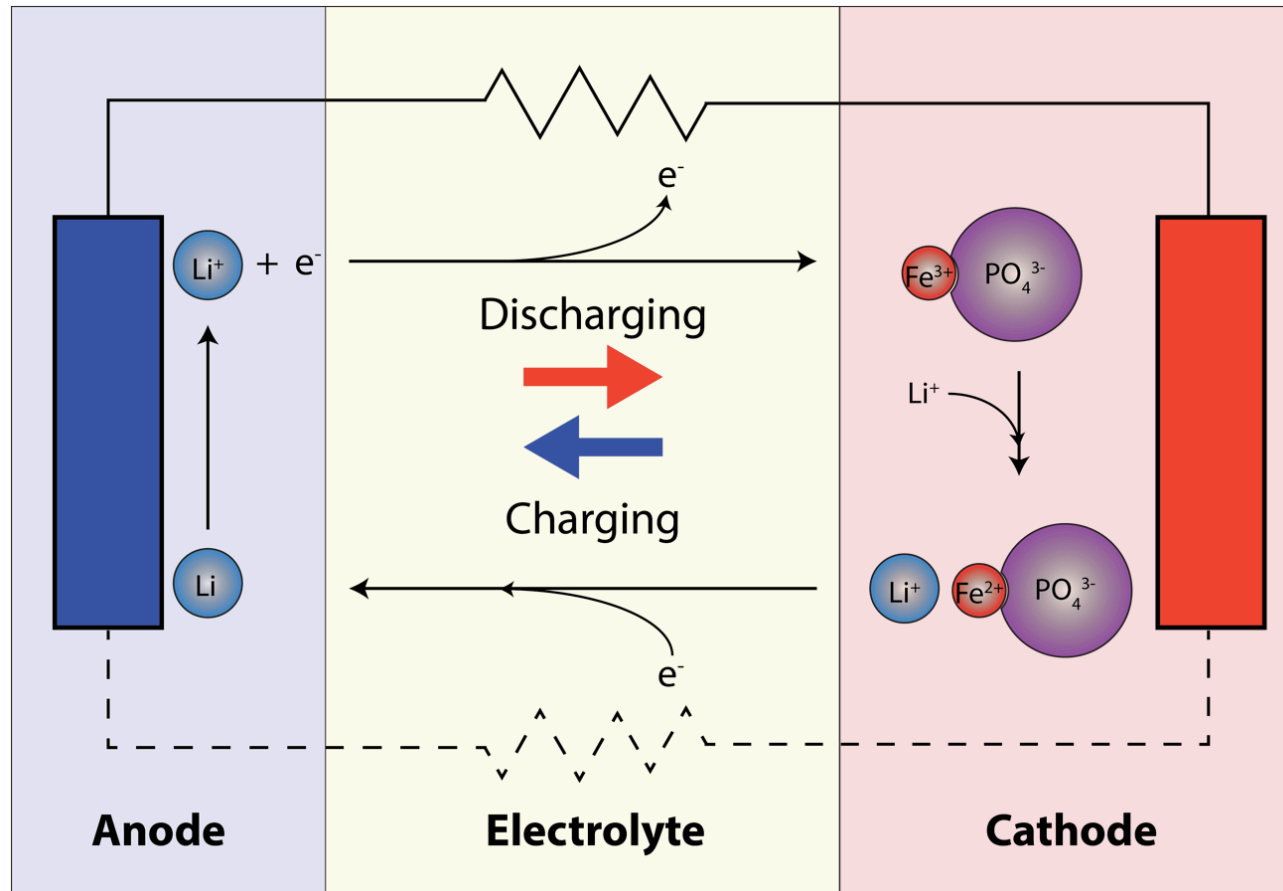
- The Fe(III)-phage-AuNP active material is in its purest form
 - no impurities, binder, etc.
- Formvar coated Cu-grid
 - copper-orange side
 - ✓ silver/black side where droplet deposited
- Practice handling it with tweezers



2 samples: undiluted and 1:10 dilution

What is your experimental question/ hypothesis?

Does gold nanoparticle size (4nm or 9nm incorporated into the cathode active material) affect battery capacity?



In lab today...

1. Demo of FePO₄-phage reaction **write observations!**
 2. Collect and wash active material (lots of long spins!)
 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
 - Remember class time 11/22 Prof. Belcher would like to hear elevator pitches from as many of you as possible.