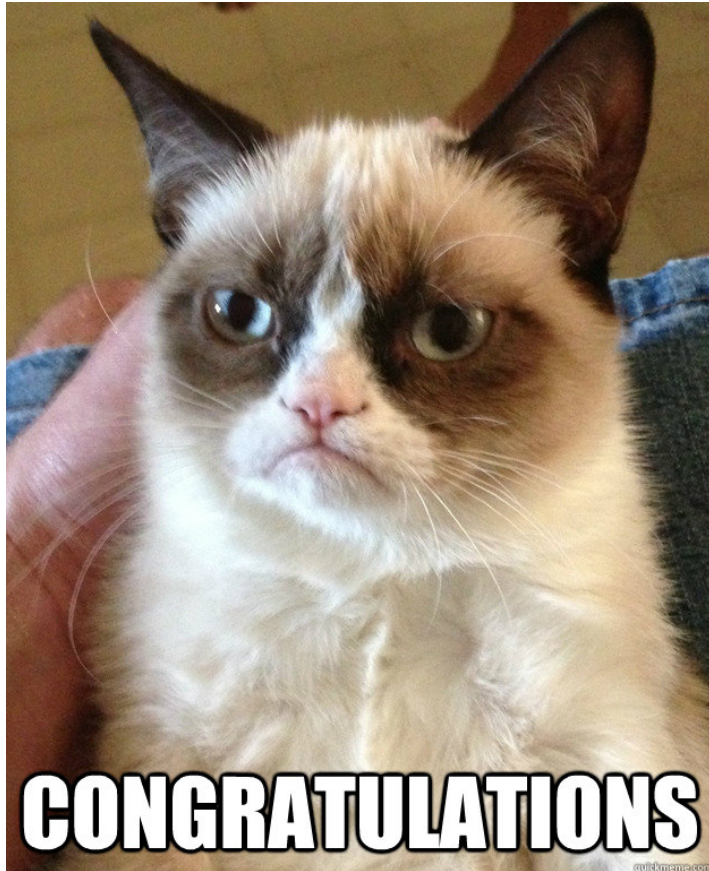


M3D2: Purify active material

4/26/2016

- ✓ 1. Quiz + BE Communication lab workshop:
Research Proposals!
2. Prelab discussion
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 done with Mod2

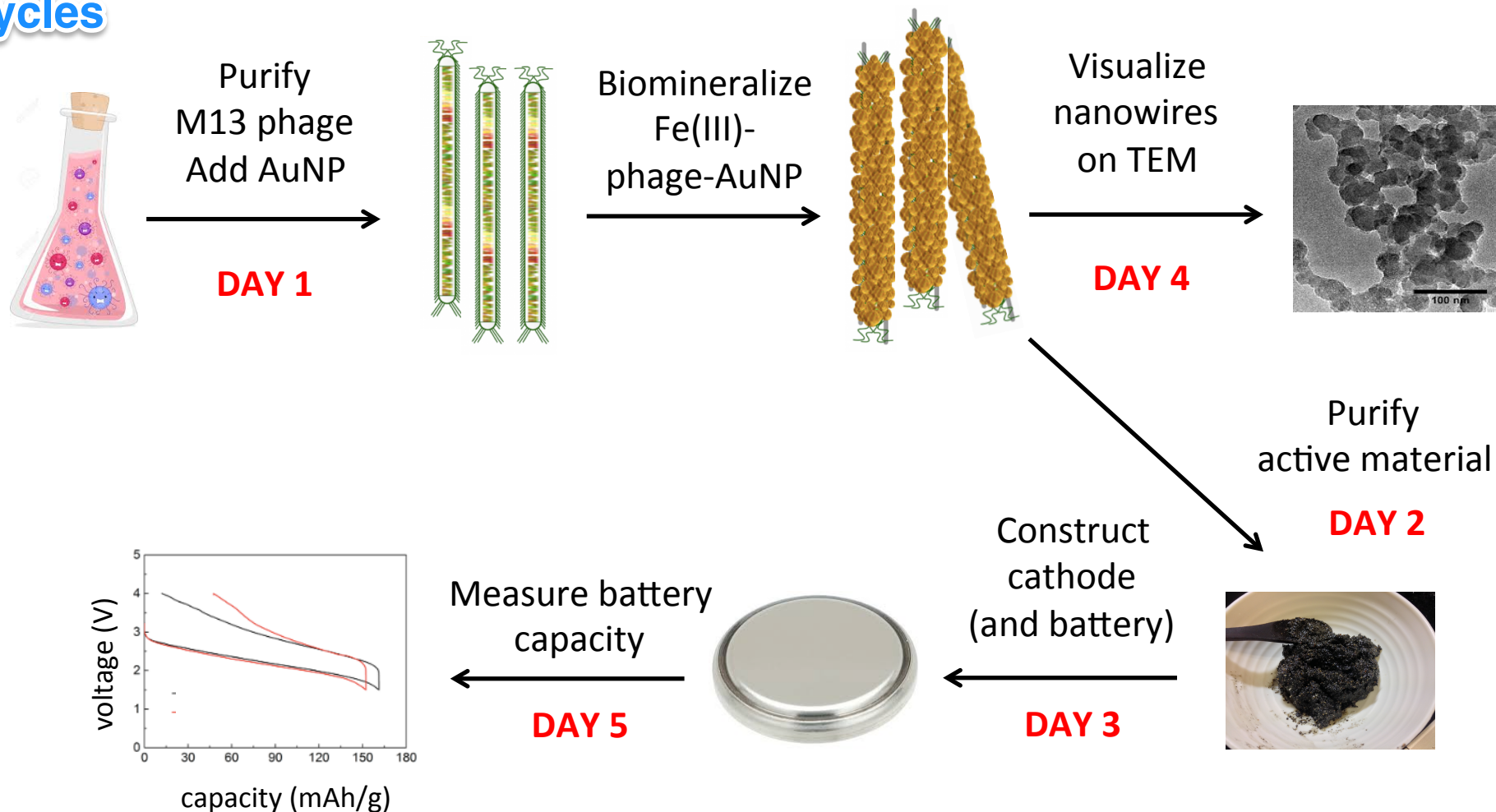


- **M3 research proposal**
 - HW due M3D3 [in teams](#): refine your topic and approach, doesn't have to be your final proposal, **get feedback during downtime(s)**
 - During lecture Tuesday 5/2 team elevator pitches
 - Finalize idea by M3D4HW (May 5th), one week in advance of presentation

Module 3: biomaterials engineering

How does gold quantity affect battery capacity?

active material: components in electrochemical rxn=charge/discharge cycles



Phage Biomining

- **P8** coat protein modified to include DSPHTELP, **neg** charged peptide
- Gold nanoparticles (AuNP ●) incubated with phage for ~~24 hours~~ **4.5 days** 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

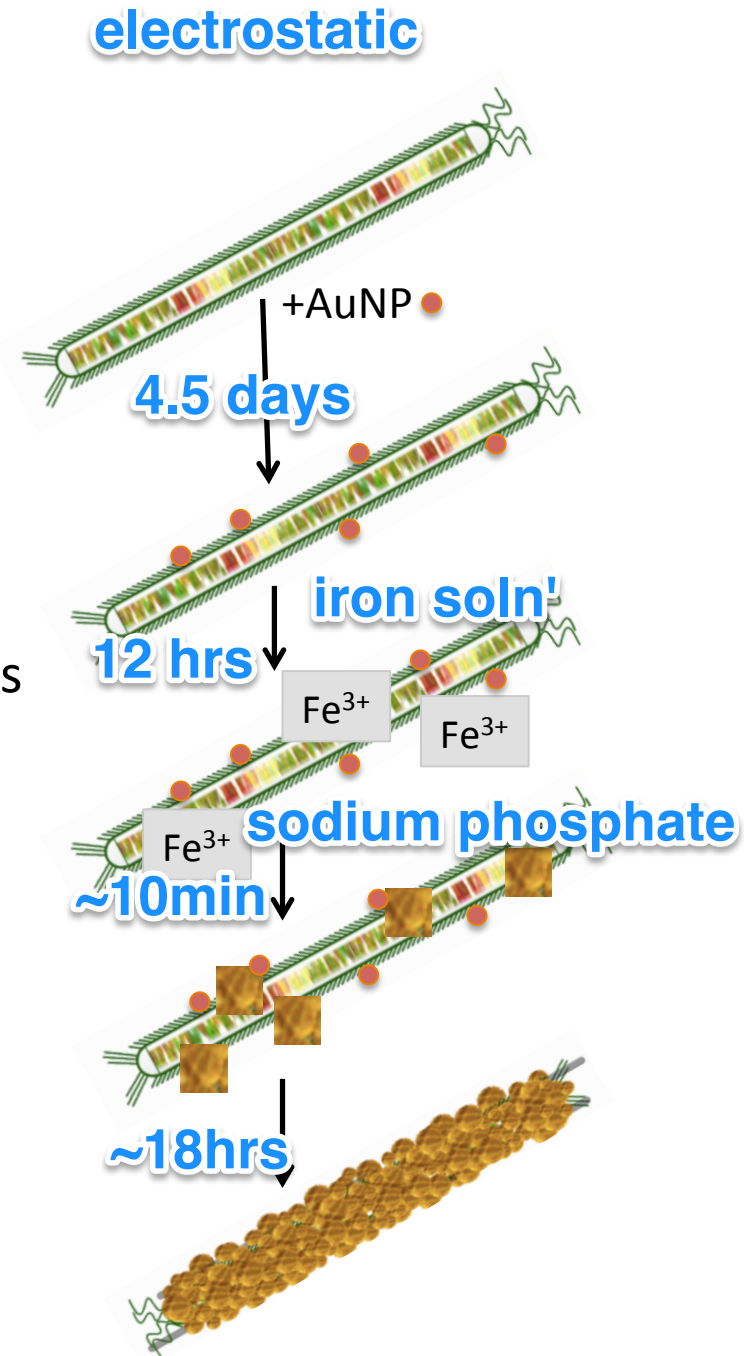
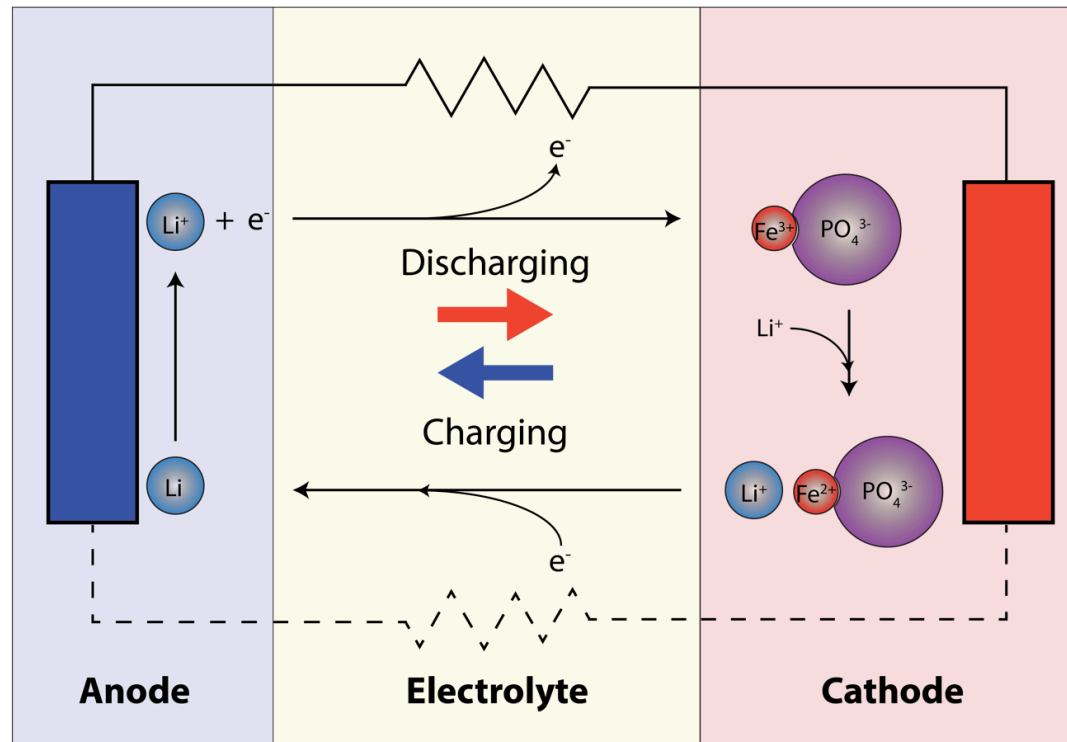


Diagram of Mod3 battery

M13 phage: scaffold

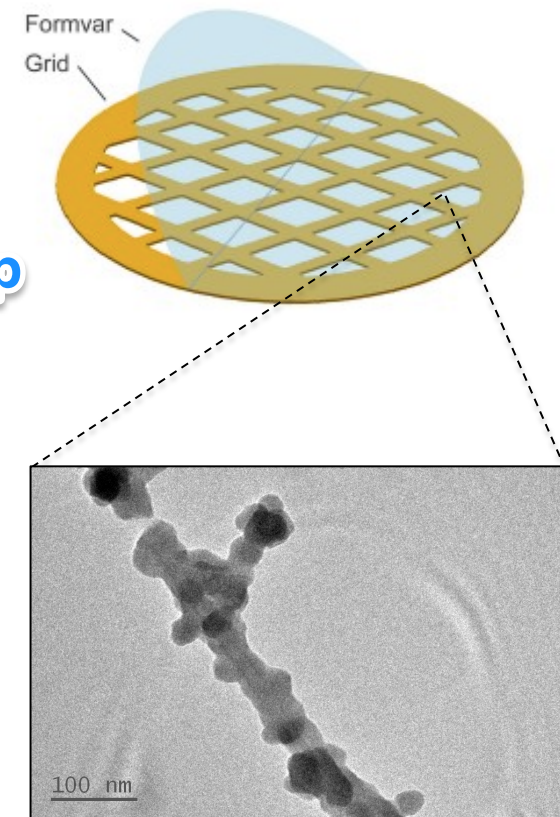
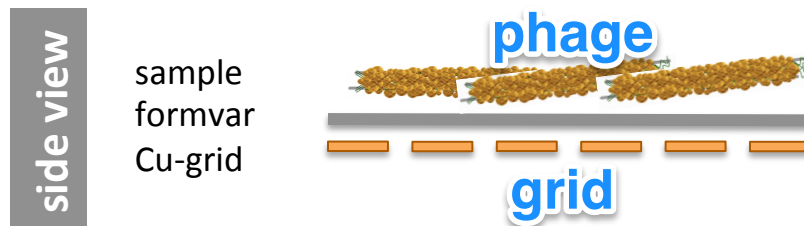
AuNP: electrical conductor

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 **bottom**
 - ✓ silver/black side where droplet deposited **top**
 - Practice handling it with tweezers



In lab today...

take photos, writing your observations

1. Demo of FePO₄-phage reaction
 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 5/2 Prof. Belcher would like to hear elevator pitches from all groups.

****NO LAB NEXT WEDNESDAY****