M3D2:
Purify active material

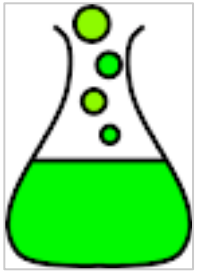
11/17/2015

note: **lecture**, but no lab on 11/24 – 11/25

In lab today… and beyond

MIT BE
BIOLOGICAL ENGINEERING | Communication Lab

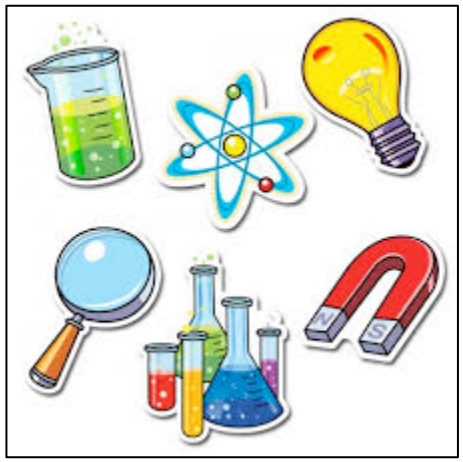
How to write your
M3 research proposal



- Demo by George Sun
  - $FePO_4$-phage reaction

- Collect and wash active material
  - Refine your M3 proposal ideas during downtime
- Spot active material onto TEM grid
- Dry active material in 80°C vacuum oven

Congratulations! You made it through M2.



- ✓ Research report
  - returned on December 1st
- ✓ And also journal club and blog!

- M3 research proposal
  - due M3D3: refine your topic and approach
    doesn't have to be your final proposal
    get feedback during downtime(s)

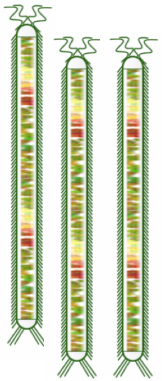
- Quiz on M3D3

Module 3: biomaterials engineering

Purify
M13 phage

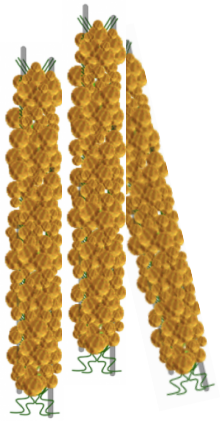
DAY 1

using PEG



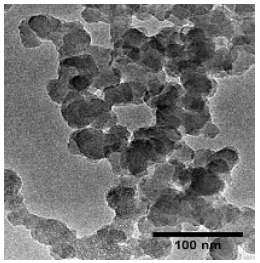
Biomineralize
Fe(III)-phage

active material



Visualize
nanowires
on TEM

DAY 4



Purify
active material

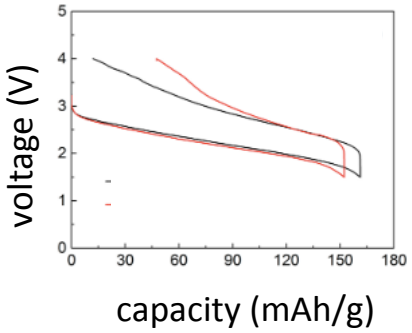
DAY 2

Construct
cathode
(and battery)

DAY 3

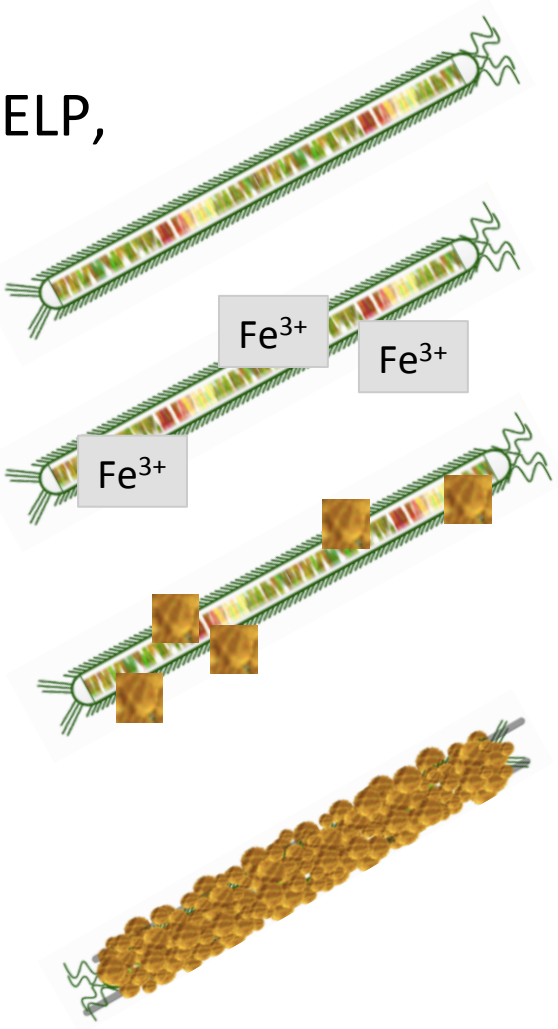
Measure battery
capacity

DAY 5



Biomineralization happened this weekend

- p8 coat protein modified to include DSPHTELP, negatively charged peptide
- Electrostatic affinity between p8 and Fe^{3+} … from $(NH_4)_2Fe(SO_4)_2$
  - 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 a-$FePO_4$ ≠ crystal

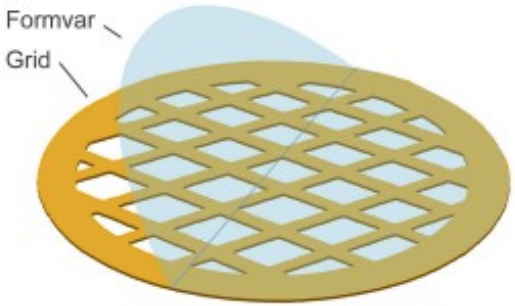


Set aside Fe(III)-phage for TEM inspection

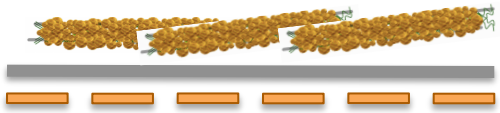
- The Fe(III)-phage active material is in its purest form today
  - no impurities, binder, etc.

- Formvar coated Cu-grid
  - copper-orange side
  - ✓ <u>silver/black side</u> where droplet deposited

  ➢ Practice handling it!



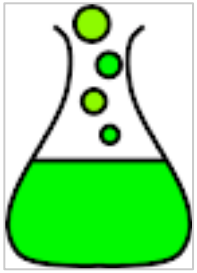
side view



In lab today… and beyond

MIT BE
BIOLOGICAL ENGINEERING | Communication Lab

How to write your
M3 research proposal



- Demo by George Sun
  - $FePO_4$-phage reaction

- Collect and wash active material
  - Refine your M3 proposal ideas during downtime
- Spot active material onto TEM formvar copper grid
- Dry active material in 80°C vacuum oven