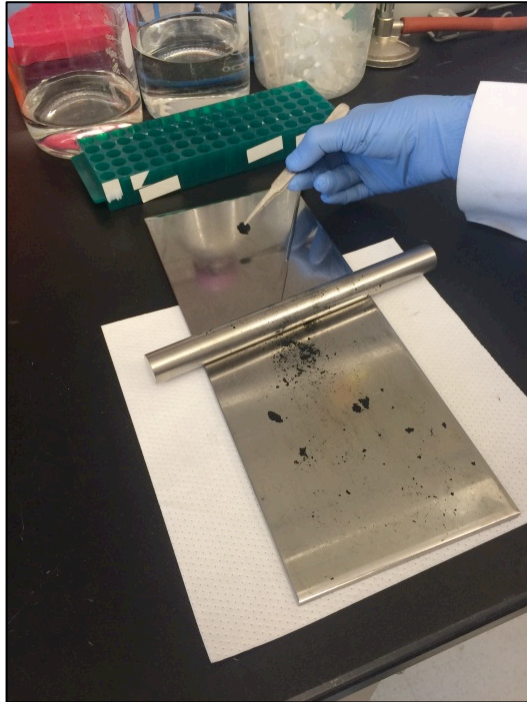


M3D3: Cathode construction

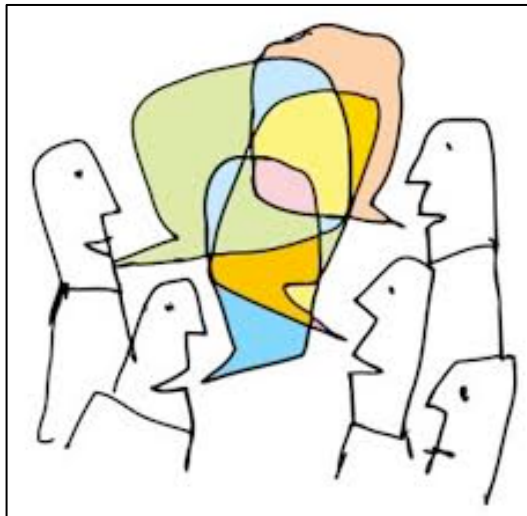
04/27/2016

Happy birthday, Leslie!



Today in lab

- Prelab discussion
- In 76-591: prepare material and roll & punch the cathodes
- In 56-322: research proposal peer review exercise
- ❖ Prepare for elevator pitch to Prof. Belcher

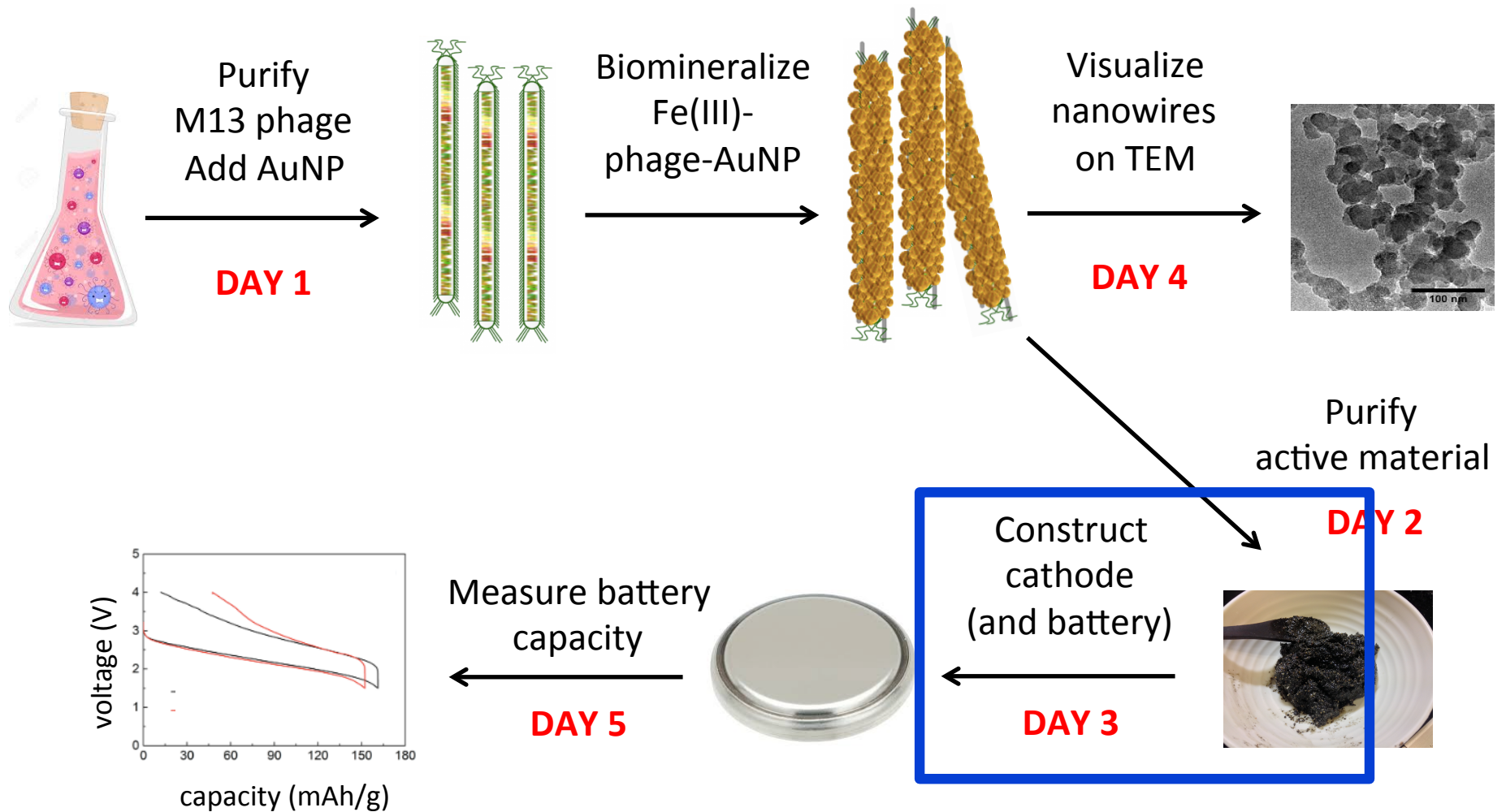


On the horizon for M3

- Major assignments
 - Research proposal oral presentation (20%); Thursday, May 11, 1pm
 - Mini-report (5%); Tuesday, May 16, 10pm
- Homework due M3D4
 - Submit both parts as a **team**
 - 1. Refine presentation outline, incorporate peer review feedback
 - 2. Background and Approach, with references
<http://belcherlab.mit.edu/publications/>

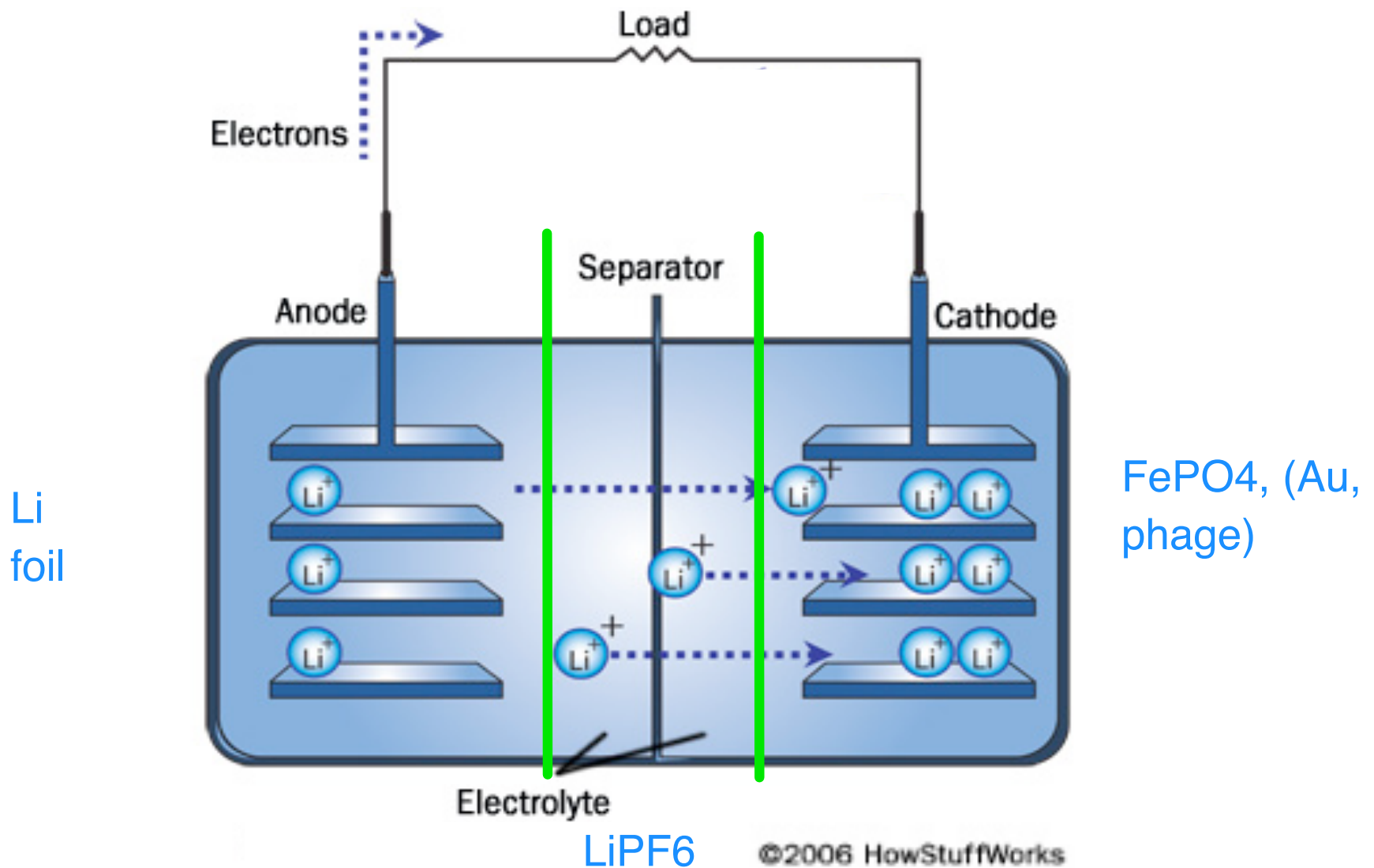
You must have a finalized topic in one week, on 05/04/2017.

Module 3: biomaterials engineering overview



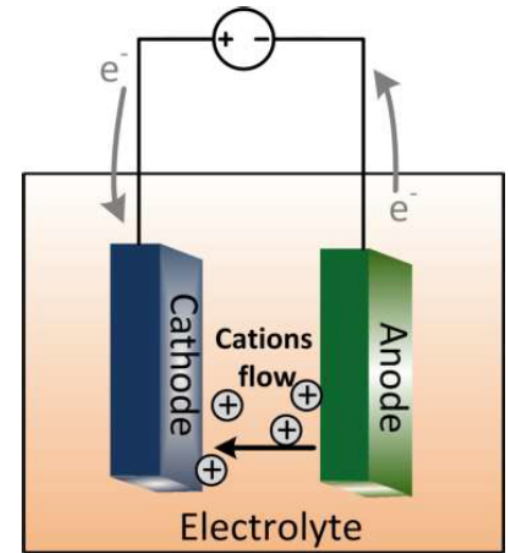
Dr. Jifa Qi will assemble your batteries.

Is this battery discharging or charging?



Main components of a battery

- During **discharge**,
 - cathode accepts electrons e^- and lithium ions Li^+
- Battery consists of two electrodes:
 - cathode = positive electrode, **accepts** electrons
 - anode = negative electrode, **gives** electrons
 - In rechargeable battery, when is electrode polarity defined? **during discharge**
 - **electrolyte** allows for flow of ions
- What is **capacity**?
 - quantity of electricity (charge) involved for the electro-chemical reaction within the battery
 - for our Fe(III)-phage batteries, the theoretical capacity is $178 \text{ mA}\cdot\text{h/g}$



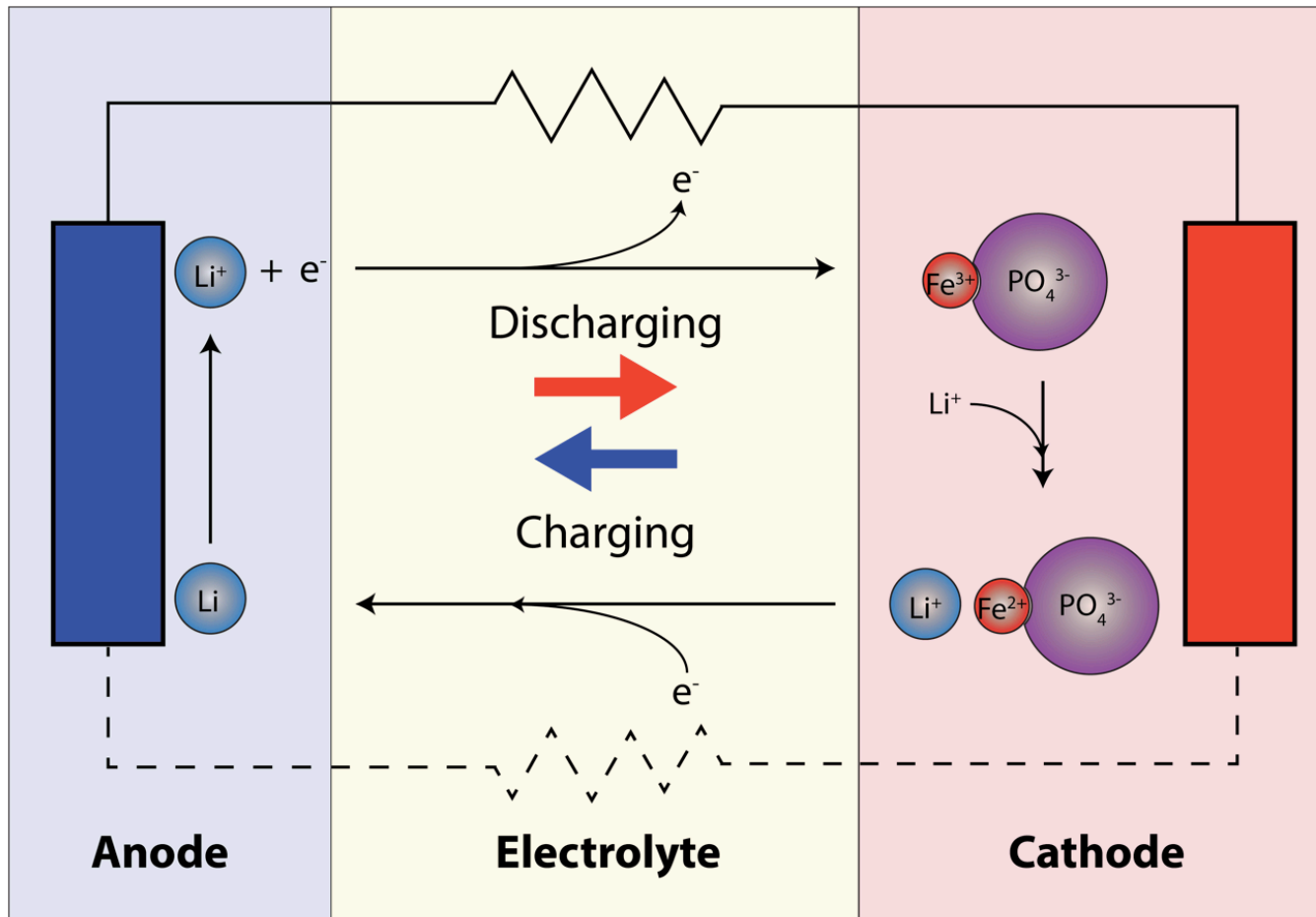
from Dr. Maryam Moradi

Diagram of M3 battery

M13 phage

AuNP

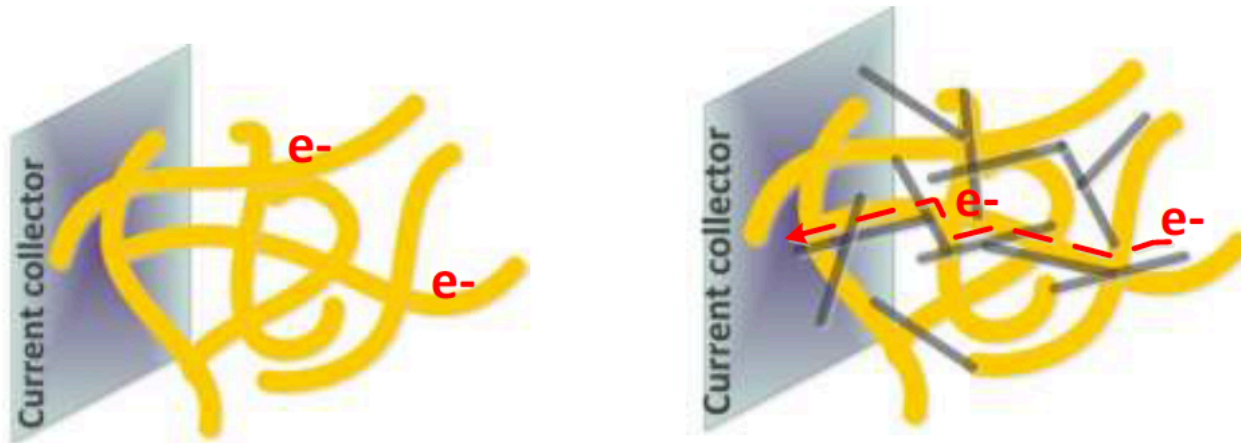
Fe(III) PO_4 / Li Fe(II) PO_4



How can a phage scaffold improve battery?

- ion diffusivity → nano structuring active material surface-to-volume ratio is high
- electronic conductivity → integrating additives (“doping”) gold screened by phage display

Example: adding carbon nanotubes to phage cathode

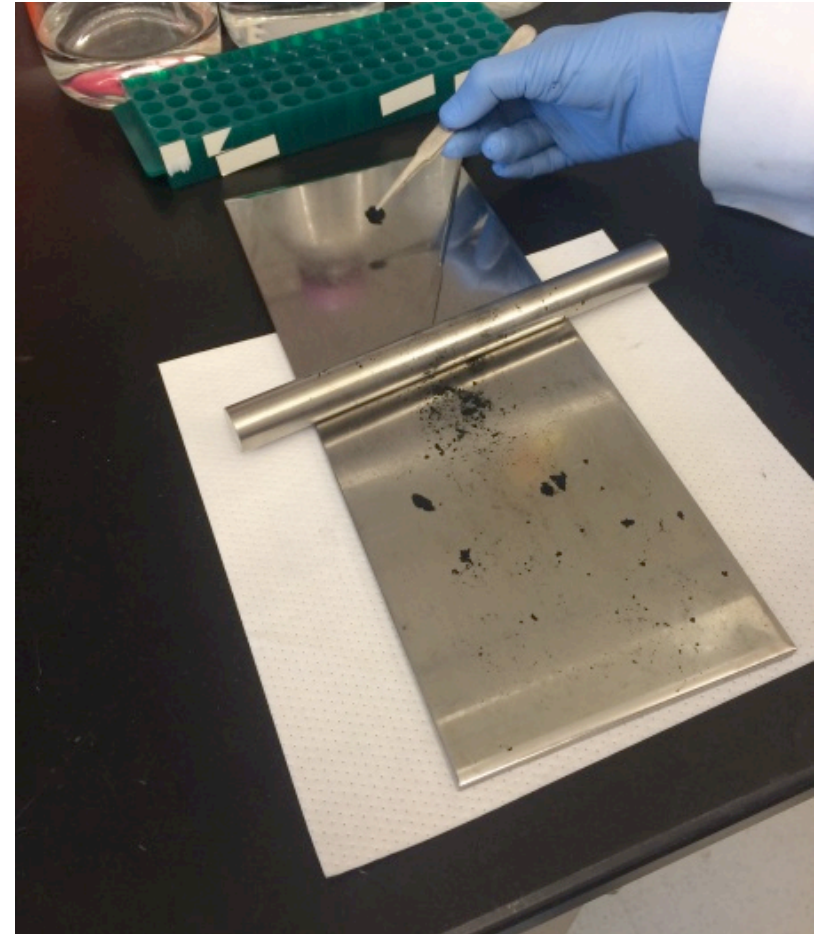


from Dr. Moradi, Belcher Lab

➤ How might AuNP quantity affect your battery capacity?

How will you construct your cathode?

1. Weigh Fe(III)-phage-AuNP nanowires (active material)
2. Mix with Super P: **carbon** and PTFE: **teflon binder**
3. Roll material into thin sheet
4. “Punch out” cathode disc
5. Weigh cathode
6. Dry cathode



T/R
One large ~~W/F~~ team:

- Part 1: cathode construction in the Belcher Lab
bring a lab coat
safety goggles
- Part 2: peer review in the 20.109 Lab
one student stays at his/her bench
the other one travels "to the right"