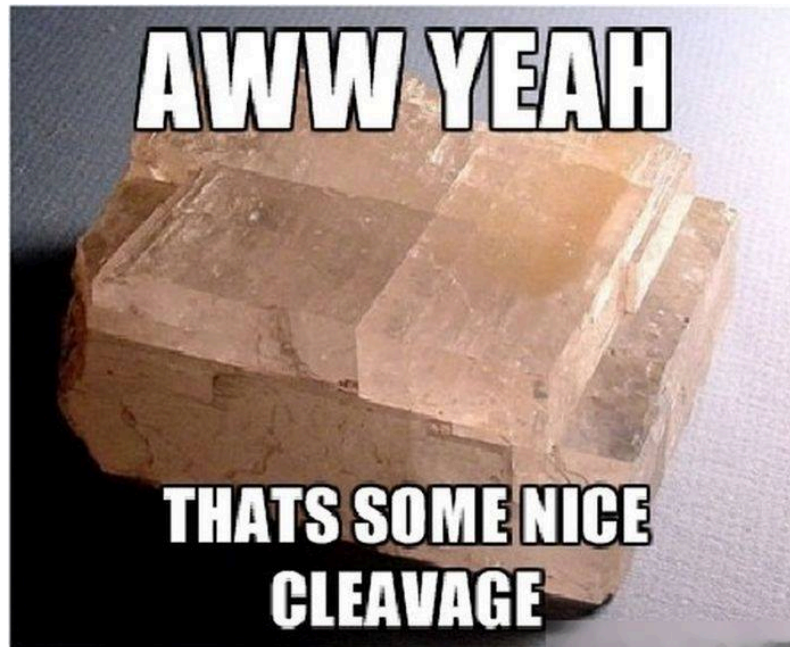


M3D1:Growth of phage materials

04/14/16

1. Purify M13 bacteriophage (phage)
2. Prelab during 60min incubation
3. Finish M13 purification and measure concentration of M13 phage
4. Incubate phage with gold nanoparticles (AuNP)



- ***Extra office hours this week:***
 - Friday 04/15: 9am-11am 16-239; 3pm-4pm in 16-429b
 - Saturday 04/16: 3pm-5pm 56-302
 - Sunday 04/17: 10am-12pm; 2pm-5pm in 56-302
- *System engineering research article (25%):*
due at **5pm on Monday, April 18th**
- *Blog posts:* (1) post-Journal Club
(2) post- Mod 2 research article, April 19th 5pm
- ***M3 major assignments***
 - Research proposal oral presentation (20%)
 - Mini-report (5%)

Topics for M3 Comm Lab meeting assignment (questions to discuss with the Fellows):

Prior to M3D2: How do I identify where to start?

Prior to M3D3: How do I identify what the knowledge gaps are currently in the field?

Prior to M3D4: How do I identify the holes in my plan?

****By D4 you should be working toward fine-tuning your research proposal.**

Prior to M3D5, Have prepared answers for and ask for feedback:

Will my research plan (methods) answer my research question?

What are the expected results?

What if I do not get the expected results?

What will I learn if I get expected results?








What will I learn if I get unexpected results?

Prior to Presentation Day, Have slides prepared and ask for feedback:

Do my slides convey my message clearly and appropriately?

Does my script convey my message clearly and appropriately?

We are in the homestretch...

3	1	R/F Apr 14/15	AB 	Growth of phage materials	Homework due
		T/W Apr 19/20		Patriots' day holiday	System engineering research article due Mon, Apr 18 at 5 pm
3	2	R/F Apr 21/22	AB 	Phage nanowires	Homework due
3	3	T/W Apr 26/27	AB 	Cathode construction	Lab quiz Homework due
		R/F Apr 28/29	AB 	Lecture, but no laboratory	
3	4	T/W May 3/4	AB 	TEM	Homework due
3	5	R/F May 5/6	AB 	Battery assembly and testing	Lab quiz Homework due Biomaterials engineering mini-report due Thu/Fri, May 5/6 at 10 pm
3	6	T/W May 10/11		Research proposal presentations	Research proposal presentation slides due Tue/Wed, May 10/11 at 1pm
		R May 12		Feedback and celebratory lunch	

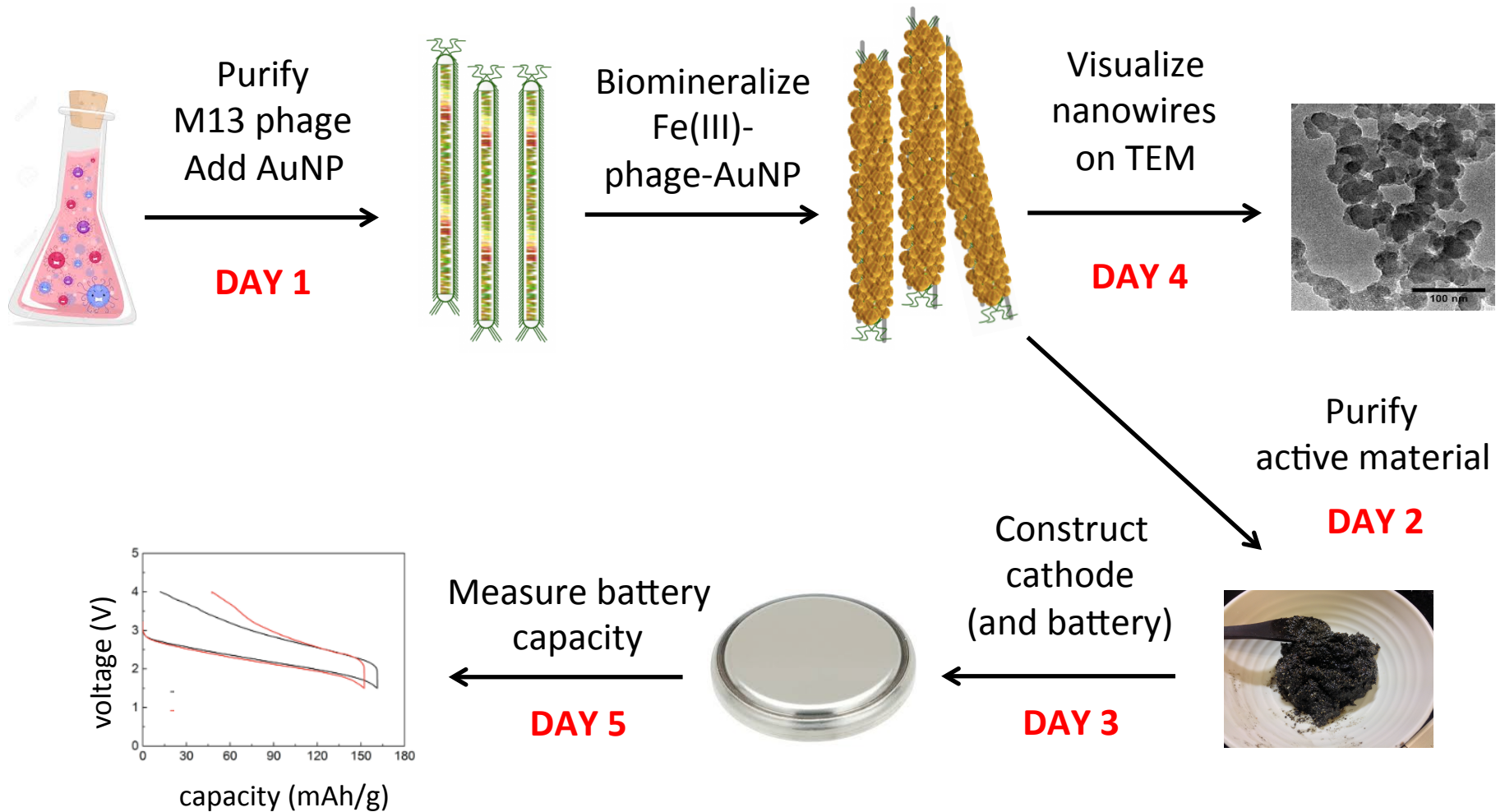
Thurs 28th elevator pitch of research proposal

Module 3: biomaterials engineering

How does gold size/quantity affect battery capacity?

3.6nm

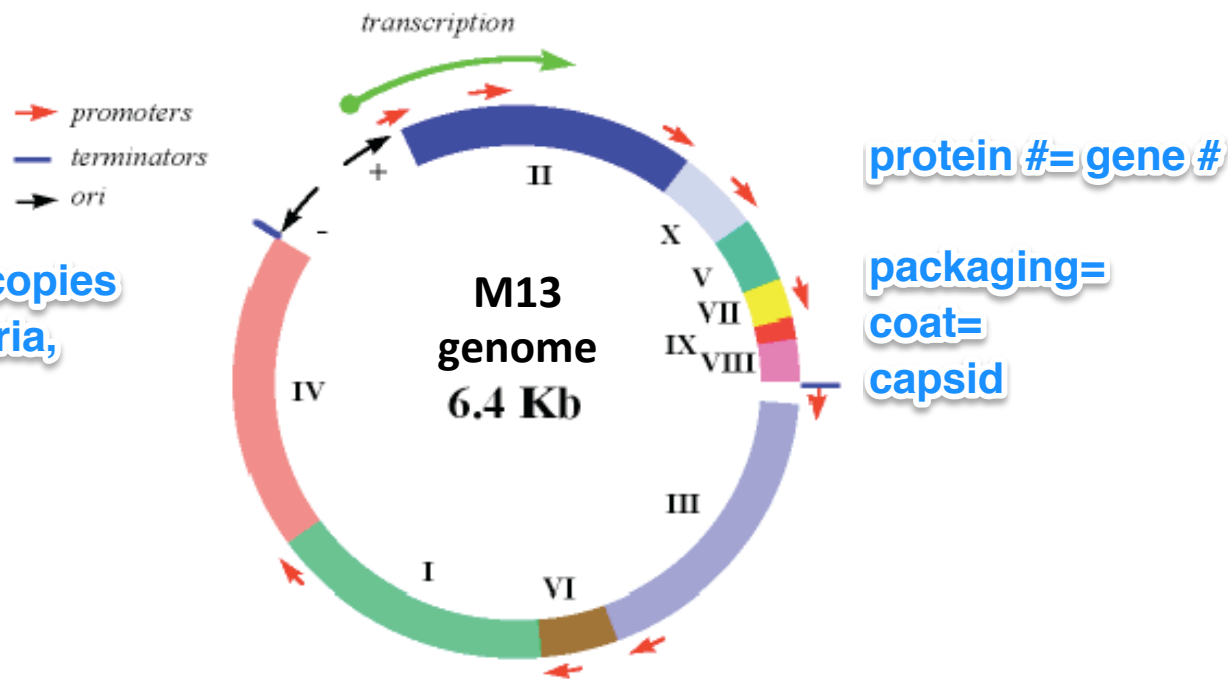
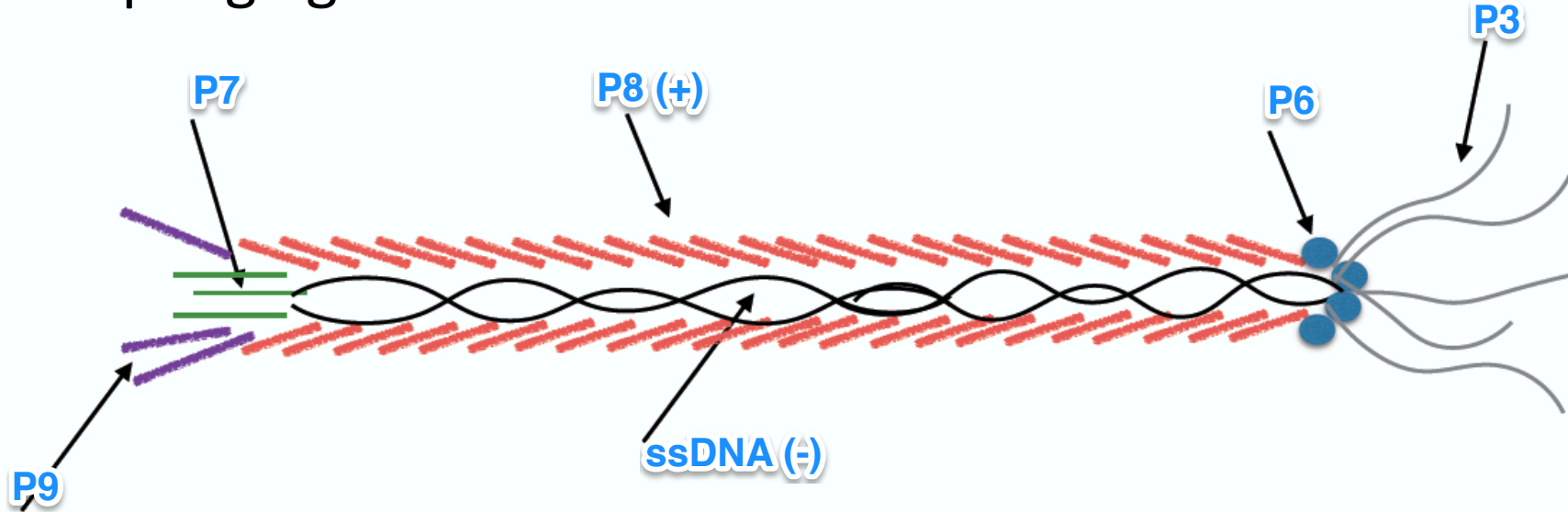
3 phage per AuNP option



900nm long, 6nm wide

Phage essentially: proteins for packaging, protein for replication and ssDNA

M13 phage genetics and structure



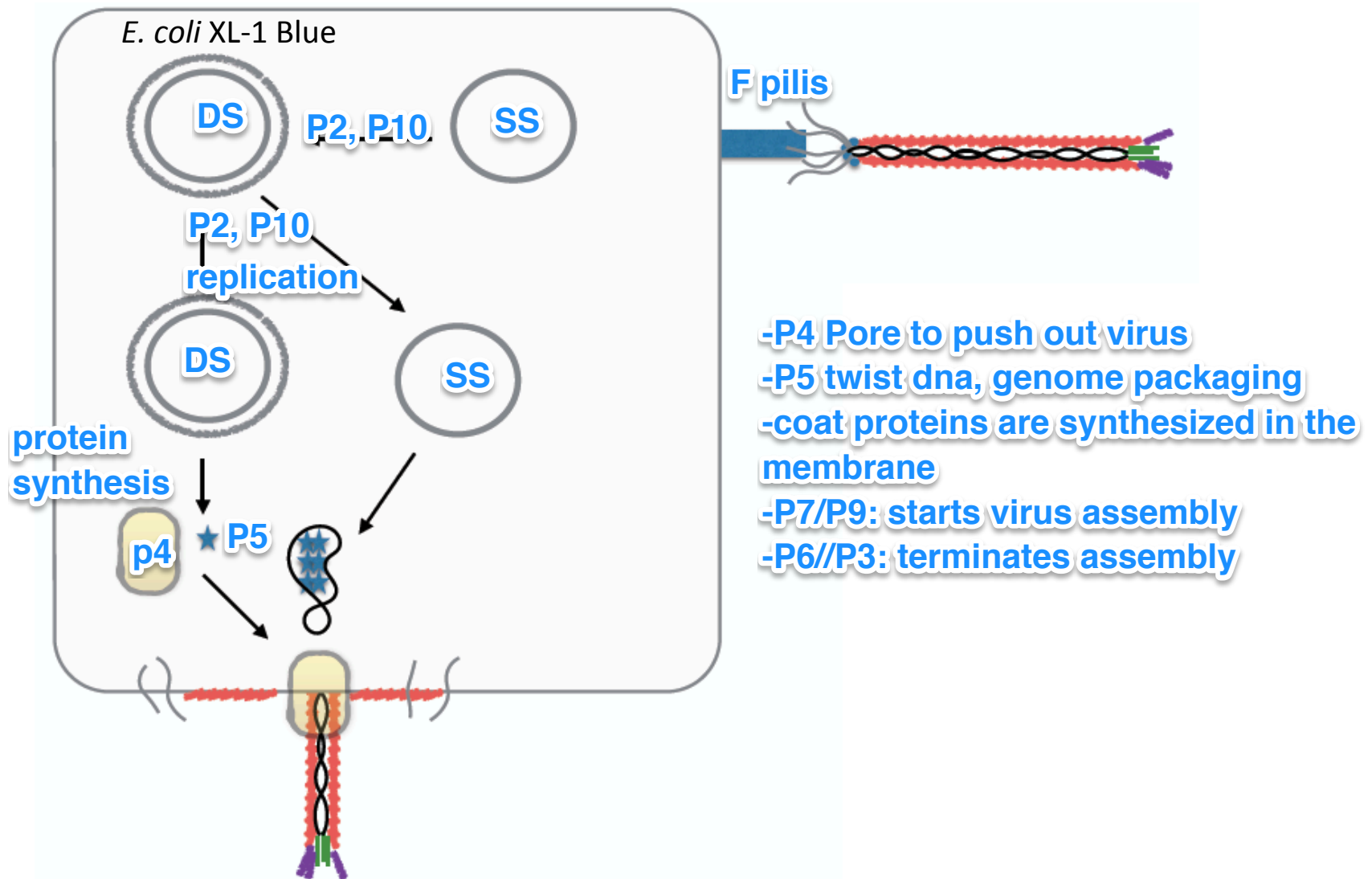
P8: packaging, 2700 copies

P3: infection of bacteria,

5 copies

M13 phage life cycle

Nonlytic phage needs a way to get out!

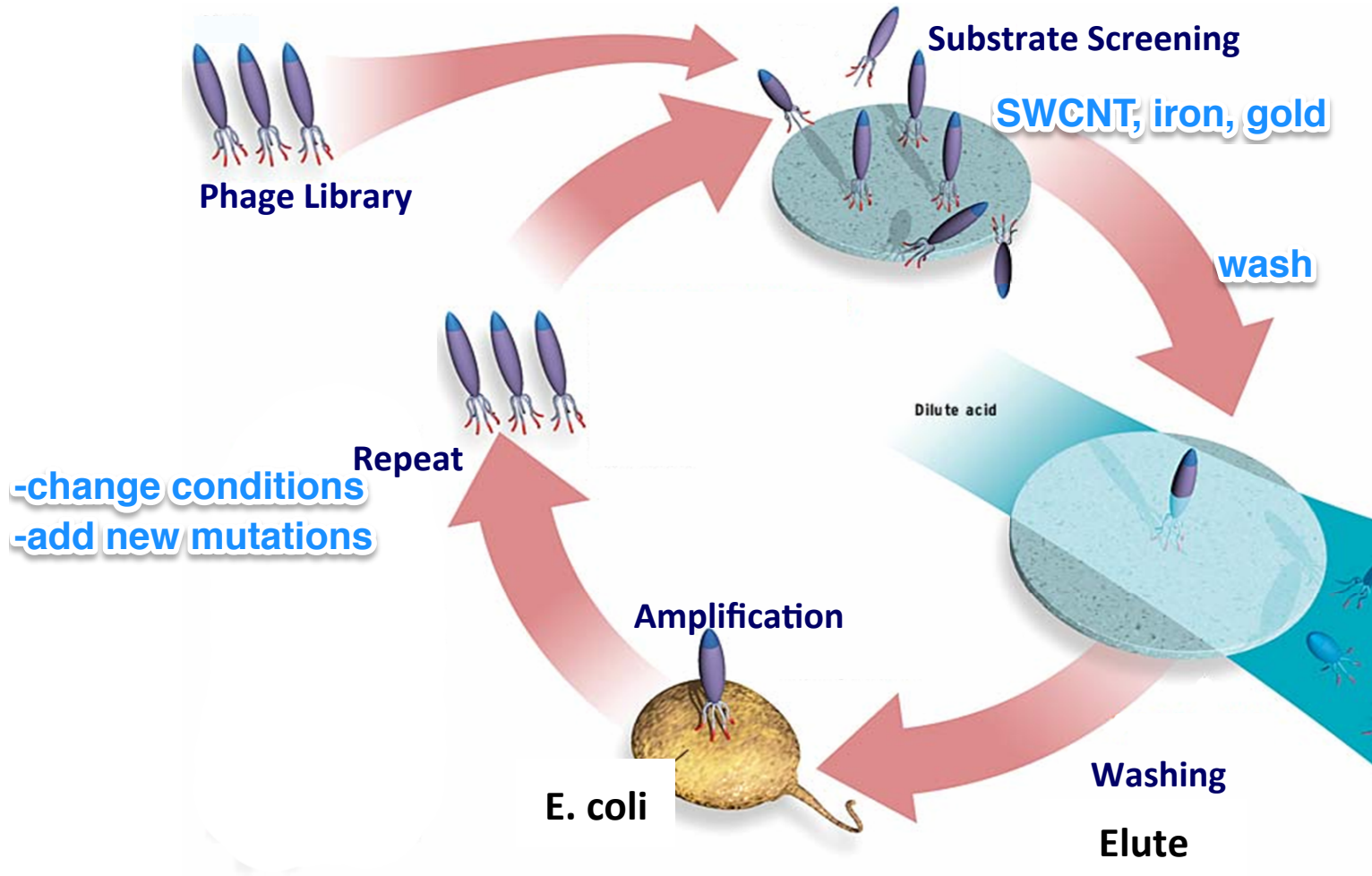


start with a pool of 1 billion peptides
isolating 10-1000 candidate sequences

Overview of phage display

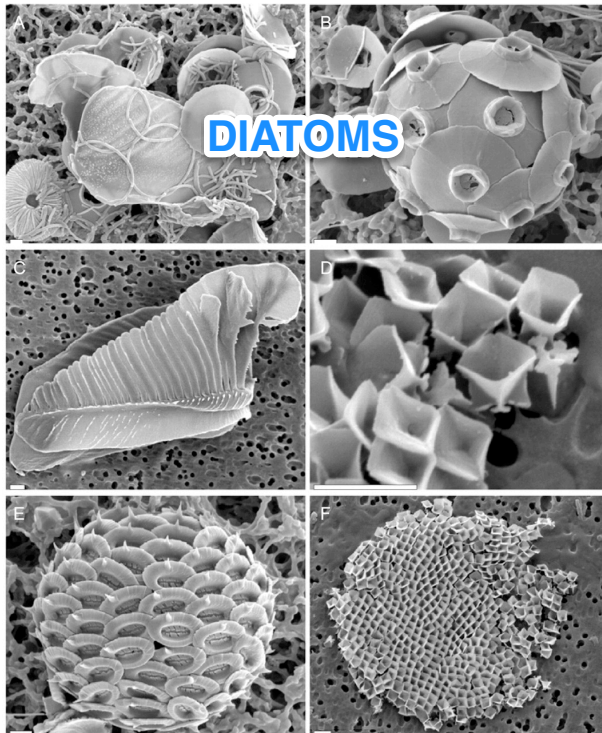
P3: 5 copies, 20- 30 amino acids

P8: 2700 copies, 4-6 amino acids



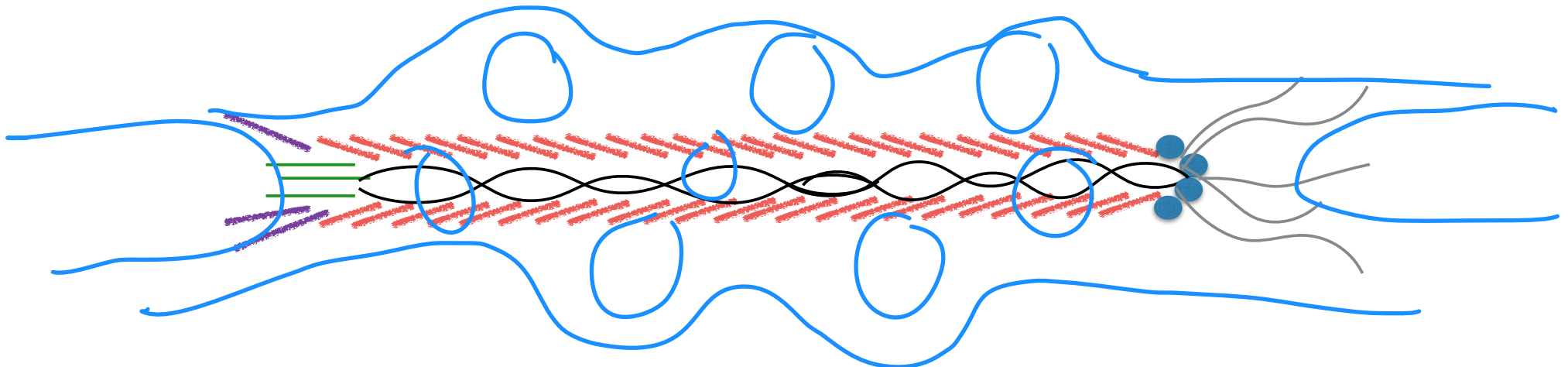
irrational design, directed evolution

Examples of biomineralization from nature:

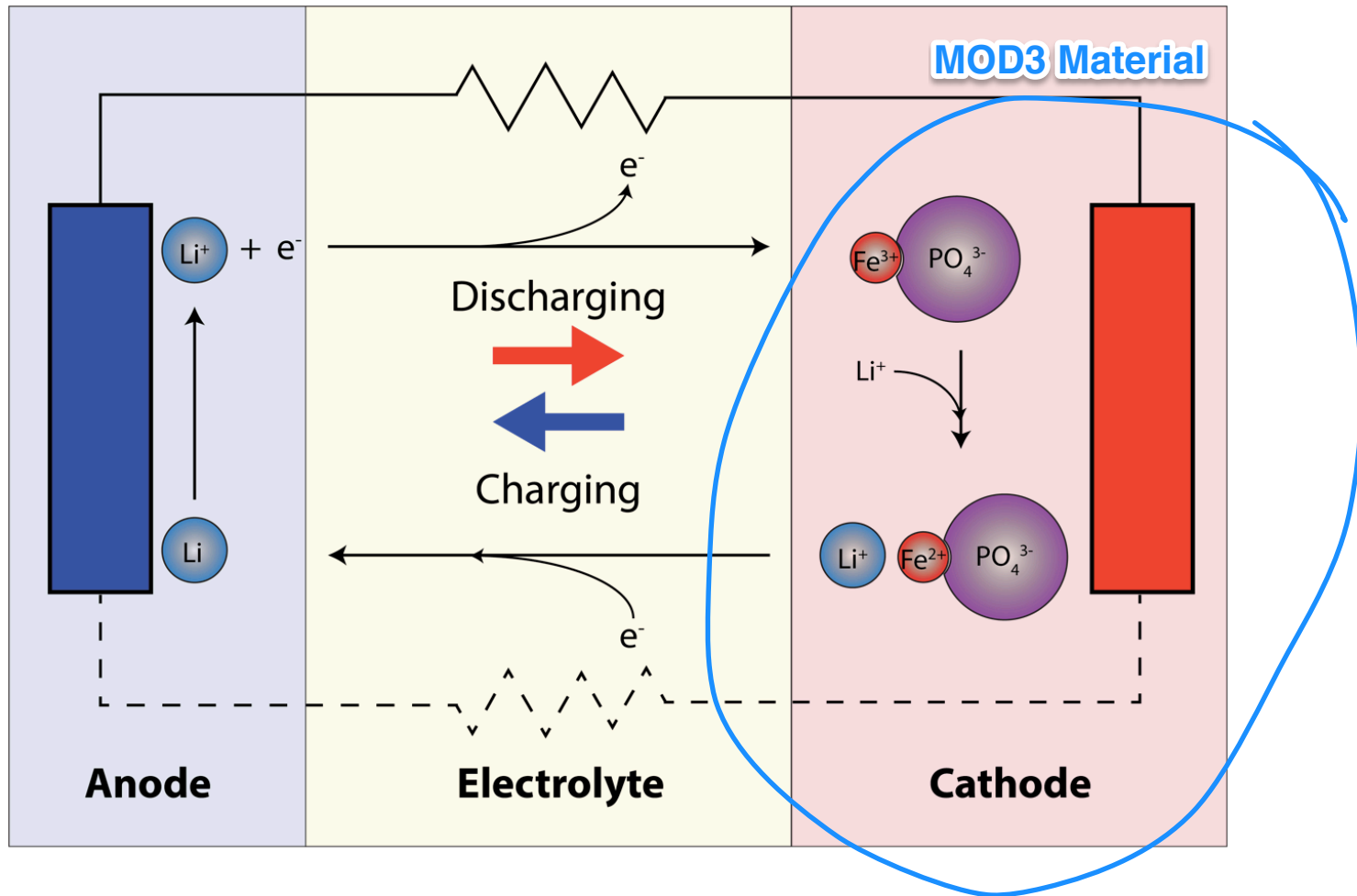


Engineering biomineralization using M13 phage:

- Environmental conditions
4°C, buffer, H₂O
- Structural organization
align gold and iron along their 900nm length
- M13 provides scaffold for Li(FePO₄) cathode construction
application

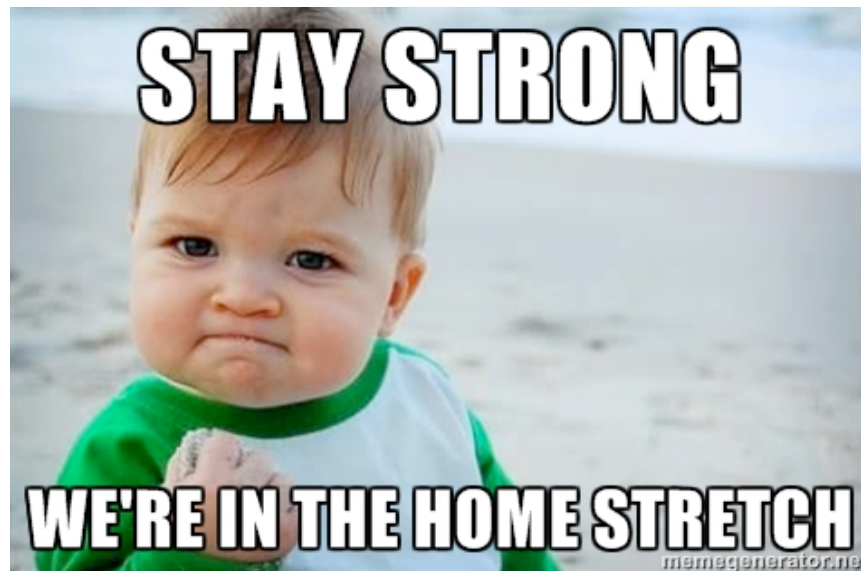


M13 nanowires as battery cathode



Today in lab...

- Finish phage purification
- Calculate phage number
- Begin construction of phage-AuNP-FePO₄ nanowires



ACCOUNT FOR DILUTION!

$$\text{phage/ml} = \frac{(6 \times 10^{16}) \text{ (A269 - A320)}}{\text{\# bases in phage genome}}$$

7220bps