- Announcements
- Pre-lab Lecture
  - Mod3 Concepts
  - Intro to M13 Virus
  - Intro to Solar Cells Materials
  - Today in Lab (M3D1)

Announcements

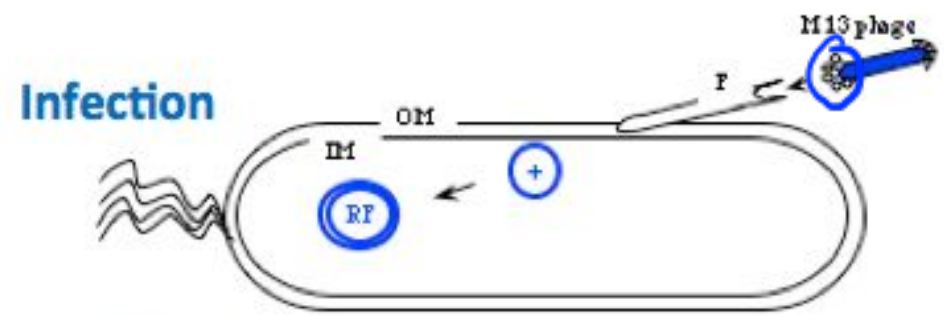
- Introducing… Tahoura, TA for Module 3
  … and bonus TA, Jackie!

- Quiz next time
- Mod 2 research paper
  - due 11/12 at noon
  - *revision* due 11/26 at 5 pm
  - a few general comments on framing
  - OH: NLL Mon 10-12, SKH Mon 3-5, ANS Tue 3:30-5
  - And Natalie OH by appt (nkuldell)

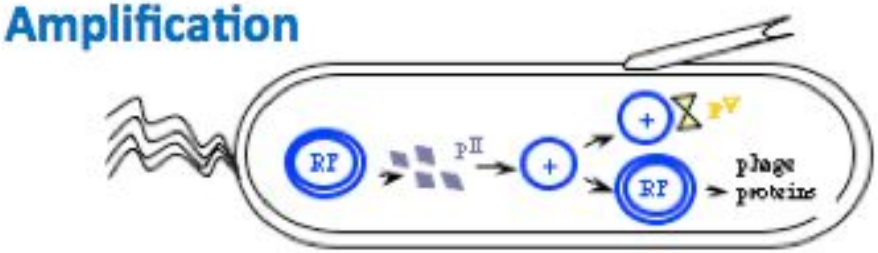
Module 3 Foundations

- Biology can interface with nano- and micro-scale materials
  - cells 1–10+ μm
  - ★ viruses 0.01–1 μm
  - proteins / complexes 1–100 nm
- Nanoscale materials may have improved or even emergent properties
  - improved
    - elec / mag
    - optical
    - catalytic
    - ...
  - emergent
    - tough to predict
    - e.g. upon assembly
  - ★ benefits + risks ★
- Our nanomaterial is a phage!
  - 100 M

M13 phage life cycle (life cycle)



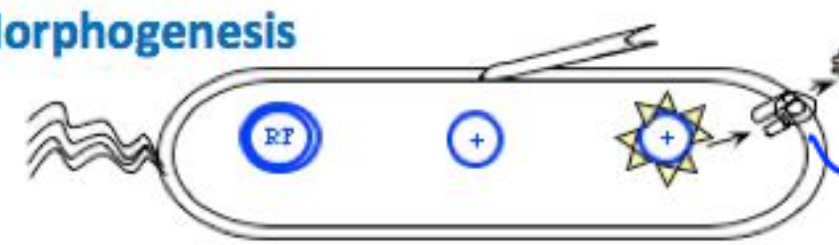
(p3)/p6 entry at TolA of the F pilus of E coli



p2, 5, 10 replication in DS form

DS = double stranded

packaged in SS form → coated by (p8)



p7/p9 exit

p4, 11, 1 - make pore

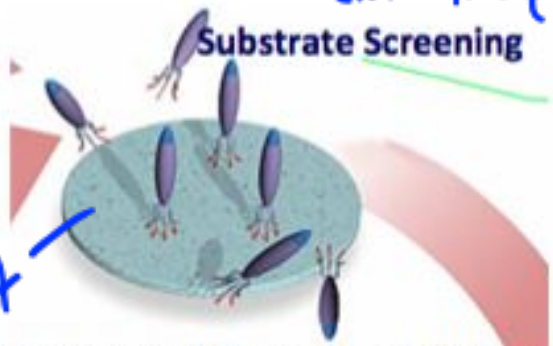
initial ϕ w/in 10' after infection

Image from Fall 2007 wiki. RF = replicating form

M13 as engineering substrate

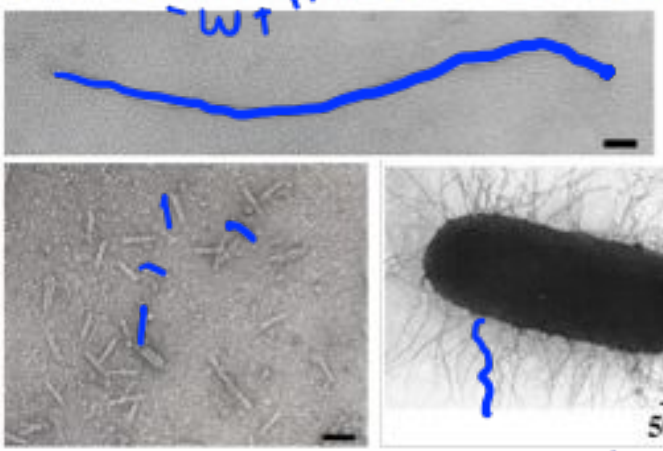
- Length of DNA (to be packaged) dictates phage size… w/in limits
- Surface proteins for functional peptide display
- Method: (1) design library (2) binding assay screen

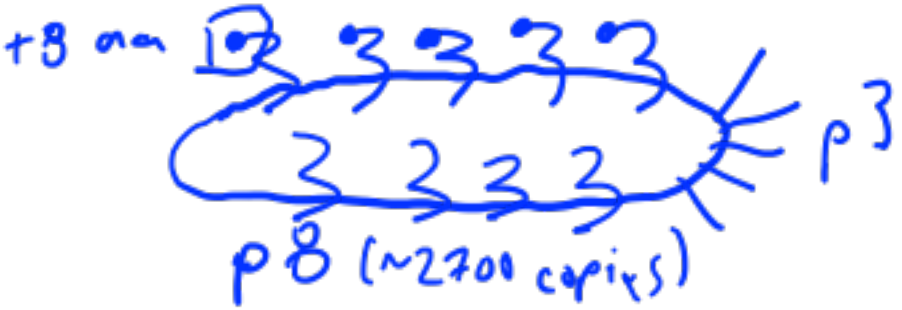
move next time!



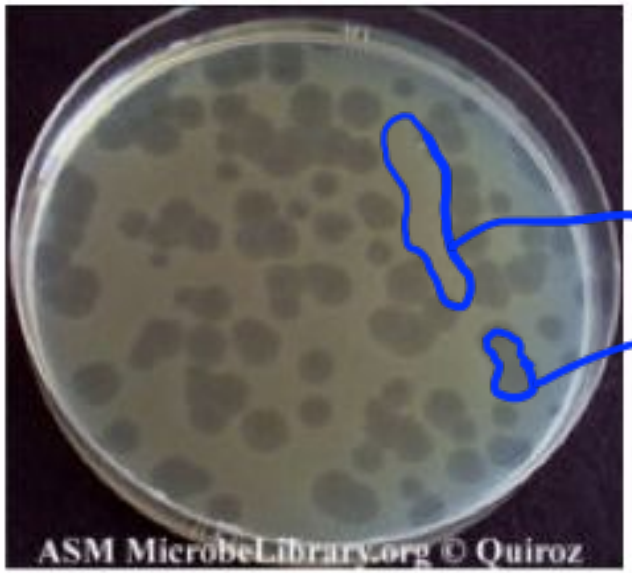
Schematic from A. Belcher

Micrographs from 20.109 wiki





Phage titer: plaque assay or spec.



By plating:

Phage slow *E. coli* growth upon infection

"lawn" ~opaque = bacteria (saturated w/)

"plaque" clear = less dense bacteria, ∴ infected by Ø

PFU (cf CFU)

By spectroscopy:

$$\#\text{ phage particles} = \frac{6\times10^{16}\,(A269 - A320)}{\#\text{ DNA bases in phage genome}}$$

& etc.

biol. content

A_{260} = D/RNA peak

A_{280} = protein peak

→ background

for given Abs, genome size ↑ means # particles ↓ (cf blob: ins)

(SWNT-)Au/TiO2 nanocrystal approach

- Begin today: react phage w/gold
  - Au ↑ usable light collection → your exp't
  - SWNT ↑ e- collection efficiency → TA exp't
- Why bother with phage?
  - surfactant for SWNT
  - bring TiO2 proximate to SWNT or Au
- Vary *size* of Au nanoparticles
- Next time react w/Ti(OCH(CH3)2)4
- Eventually…
  - TEM observation
  - solar cell assembly

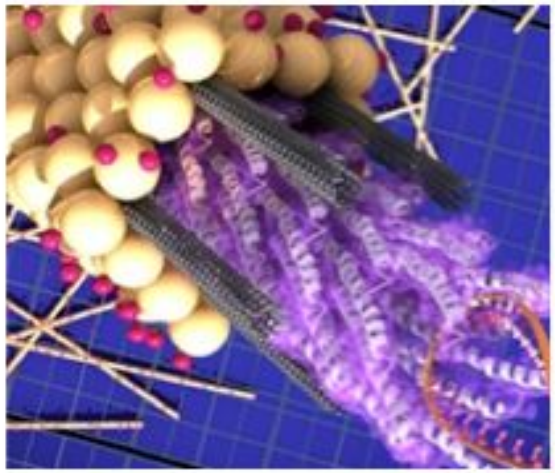


Image: Matt Klug

Today in Lab (M3D1): Workflow

- Prepare phage by precipitation with PEG/NaCl
  - Incubations/spins *alone* are almost 2 h
  - At the ~~end~~ beginning, phage are in the supernatant!! (in final steps, they are pellet)
  - Pellet is bacteria
- Obtain viral titer
  - take care with quartz cuvettes!
- React phage w/gold
- Downtime: calculation sheet, ~~reflections, FNT~~, etc. M2 report (2)

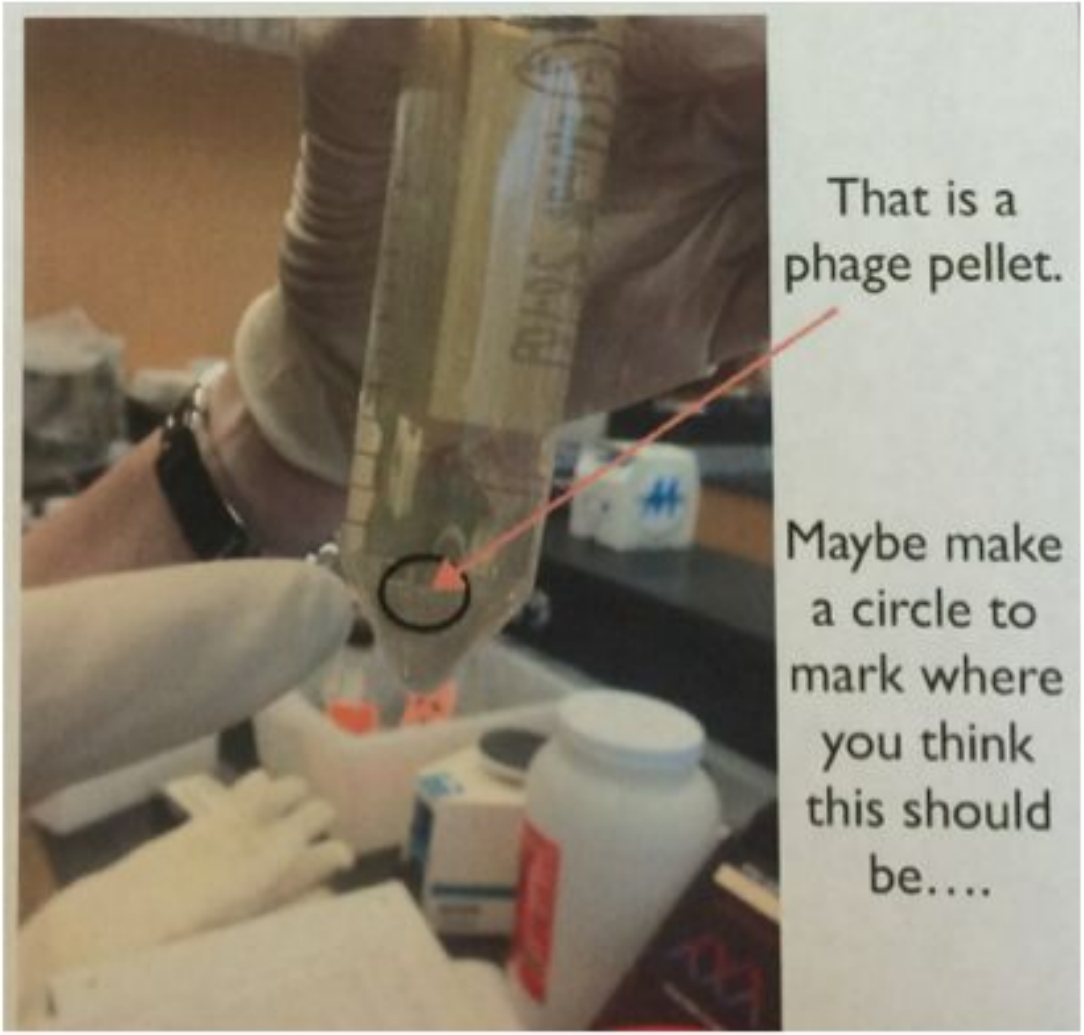
in advance

Today in Lab (M3D1): Samples and Steps

Group (T/R)	AuNP Size (nm)	Group (W/F)	AuNP Size (nm)
Red Cherries	5	Green	20
Tiger	50	Blue	5
Yellow	20	Pinkle	50
Green	20		
Blue	5		
Pink	20		
Purple	50		

- Measure # phage/mL
- Calculate volume Au needed
  - stocks given in g/mL
- Goal: 1.45e-17 g gold/phage
- Mix in glass scintillation vial
- Store in fridge

Today in Lab (M3D1): Key Tip from Shannon



★ orient to know pellet location ★