

- Announcements
- Pre-lab Lecture
  - ❖ Mod3 Concepts
  - ❖ Intro to M13 virus
  - ❖ Intro to Iridium
  - ❖ Today in Lab, FNT

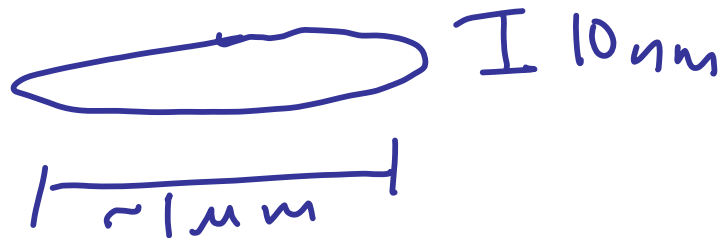
# Announcements

- Introducing... Luis, TA for Module 3
- Module 3 assessment: team oral presentation
- Two options
  - Novel research proposal
  - Collaborative art/science project

Mod 1 revision returned today

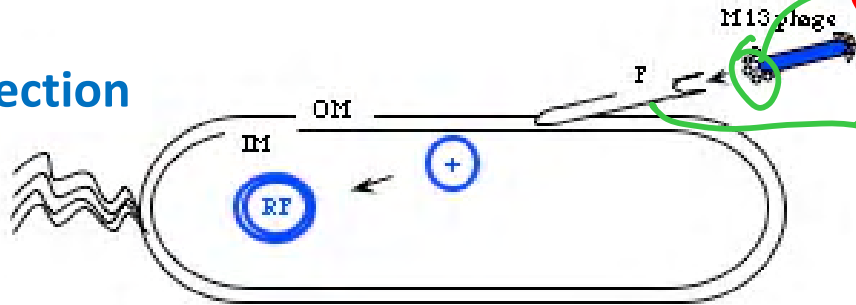
# Module 3 Foundations

- Biology can interface with nano- and microscale materials  
cells - 1-10  $\mu\text{m}$   
\* viruses - 0.01-1  $\mu\text{m}$   
(complexes) proteins - 0.1  $\mu\text{m}$ <sup>+</sup>
- Nanoscale materials may have improved or even emergent properties  $\rightarrow$  elec., opt., catalytic  
switch speed \* benefits vs. risks
- Our nanomaterial is a phage!



# M13 Phage "Life" Cycle

## Infection



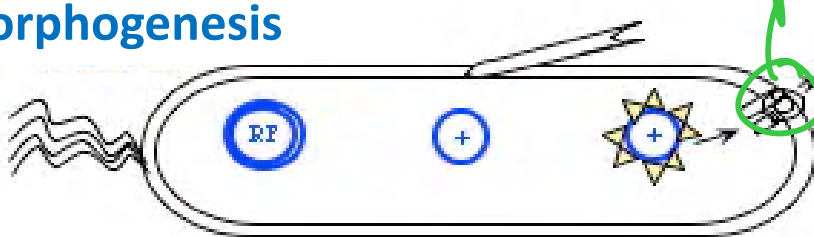
*p3 (p6)*  
 F pilus w/ TolA protein  
 interacts w/ p3

## Amplification



*p2, p5, p10 replicates in ds. form*

## Morphogenesis



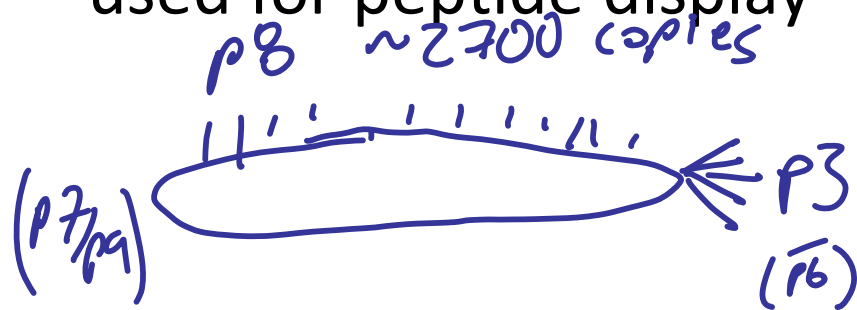
*pore*  
*p4/p11 pore*  
*p7/p9 exit proteins*  
 Coated with *p8*

Image from Fall 2007 wiki. RF = replicating form

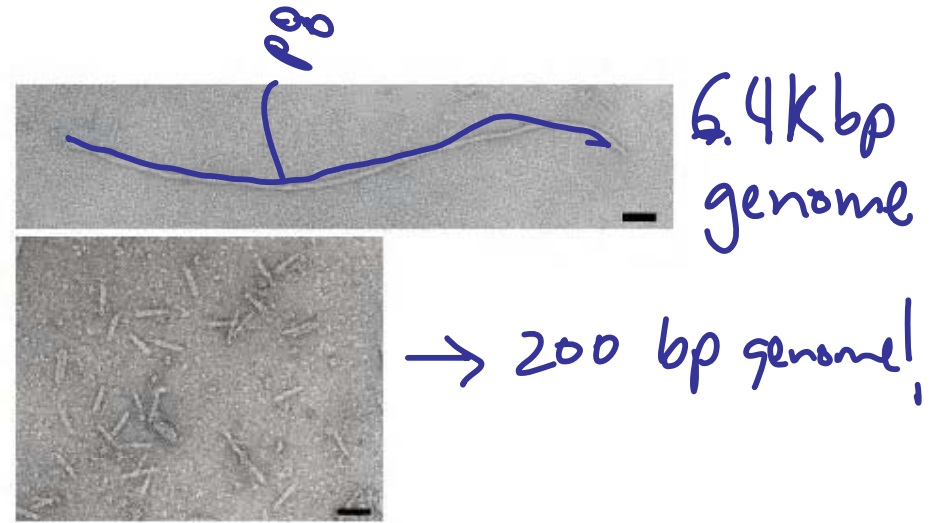
# M13 as Engineering Substrate

Length of DNA (to be packaged) dictates size of phage... w/in limits

Surface proteins can be used for peptide display



Images from 20.109 wiki



p3 cons: - copy # low

pros: - directional  
- p3 can display longer peptides

# Plaque assay



"lawns" = opaque = bacteria

"plaques" = clear = less dense, i.e., infected bacteria

Phage slow *E. coli* growth upon infection

Quantify: PFU/mL      PFU = plaque-forming units

Cf. transformation calcs.      ↓ serial dilutions of phage

# Iridium Nanowire Synthesis

- Begin today: hydrolyze iridium salt with citrate at 90 °C for 4 hrs to make colloidal particles
- Next time oxidize with hydrogen peroxide to form IrO<sub>x</sub> – this is what will react with the peptides on phage p8

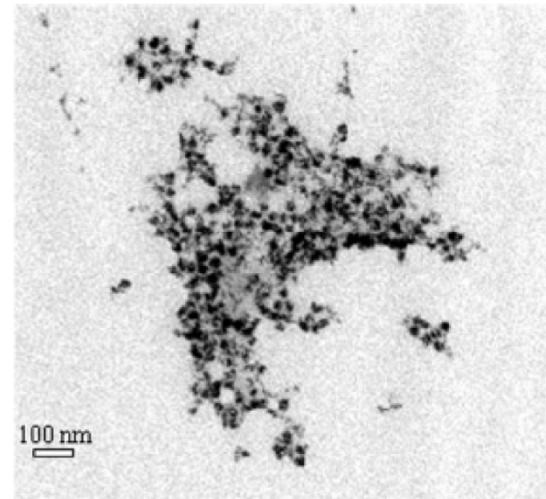
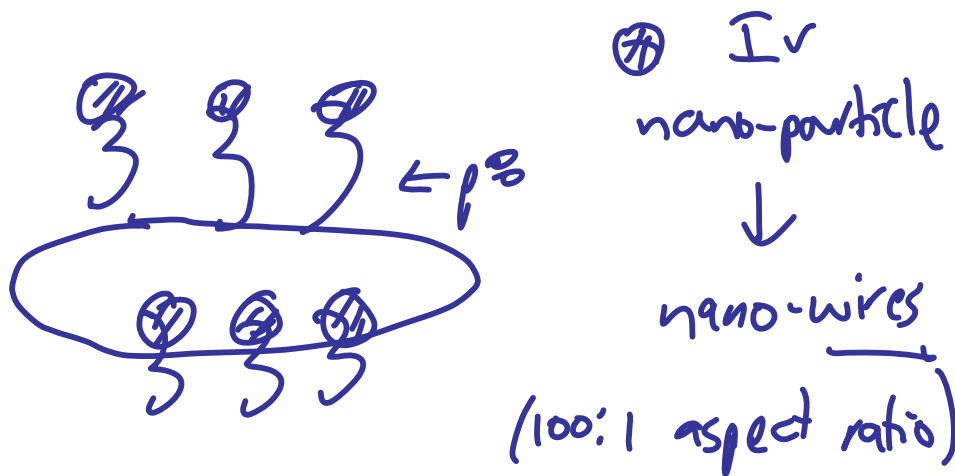


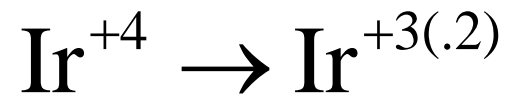
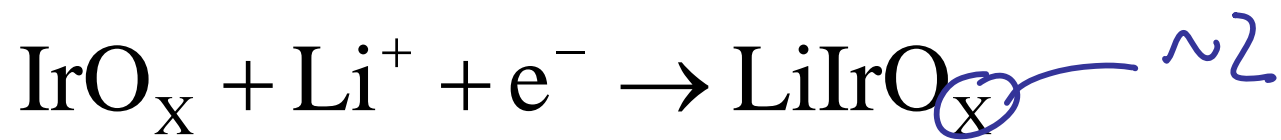
Image from N. Kuldell

# Looking ahead... electrochromic device

"on" = purple



"off" = clear



Images from 20.109 Fall 2007



# Today in Lab

- Prepare phage by precipitation with PEG/NaCl
  - Phage are in the supernatant!!
  - Pellet is *bacteria, some phage*
- Begin iridium particle synthesis
  - **Wear lab coat, gloves, safety glasses!!**
- Obtain viral titer (*plaque assay*)
  - Save remaining phage!!
  
- FNT = begin thinking about Mod 3 proposal