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

MoA1 revision returned today
Module 3 Foundations

• Biology can interface with nano- and microscale materials

\[
\begin{align*}
\text{cells} & : 1-10 \text{mm} \\
\text{viruses} & : 0.01-1 \text{ mm} \\
\text{(complexes/ proteins)} & : 0.1 \text{ nm} \\
\end{align*}
\]

• Nanoscale materials may have improved or even emergent properties

* benefits vs. risks

• Our nanomaterial is a phage!

\[
\begin{align*}
I_{10 \text{nm}} & : 1 \text{ mm} \\
\end{align*}
\]
M13 Phage "Life" Cycle

**Infection**
- F pilus w/ To1A protein interacts w/ p3

**Amplification**
- p2, p5, p10 replicates in ds form

**Morphogenesis**
- p4/1/11 pore
- p7/p9 exit proteins
- Coated with p6

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
Plaque assay

"lawn" = opaque = bacteria
"plagues" = 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 IrOx – this is what will react with the peptides on phage p8

Image from N. Kuldell
Looking ahead... electrochromic device

"on" = purple

"off" = clear

\[
\text{IrO}_x + \text{Li}^+ + \text{e}^- \rightarrow \text{LiIrO}_x \sim^2 \\
\text{Ir}^{+4} \rightarrow \text{Ir}^{+3(2)}
\]

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