M3D2: Biotemplating

4/16/15

1. Lab Treat
2. Complex Au:NP with Ti(I-Pro)3 (created your own nano composites!)
3. Set-up TEM grid
4. Wash your new nanowires

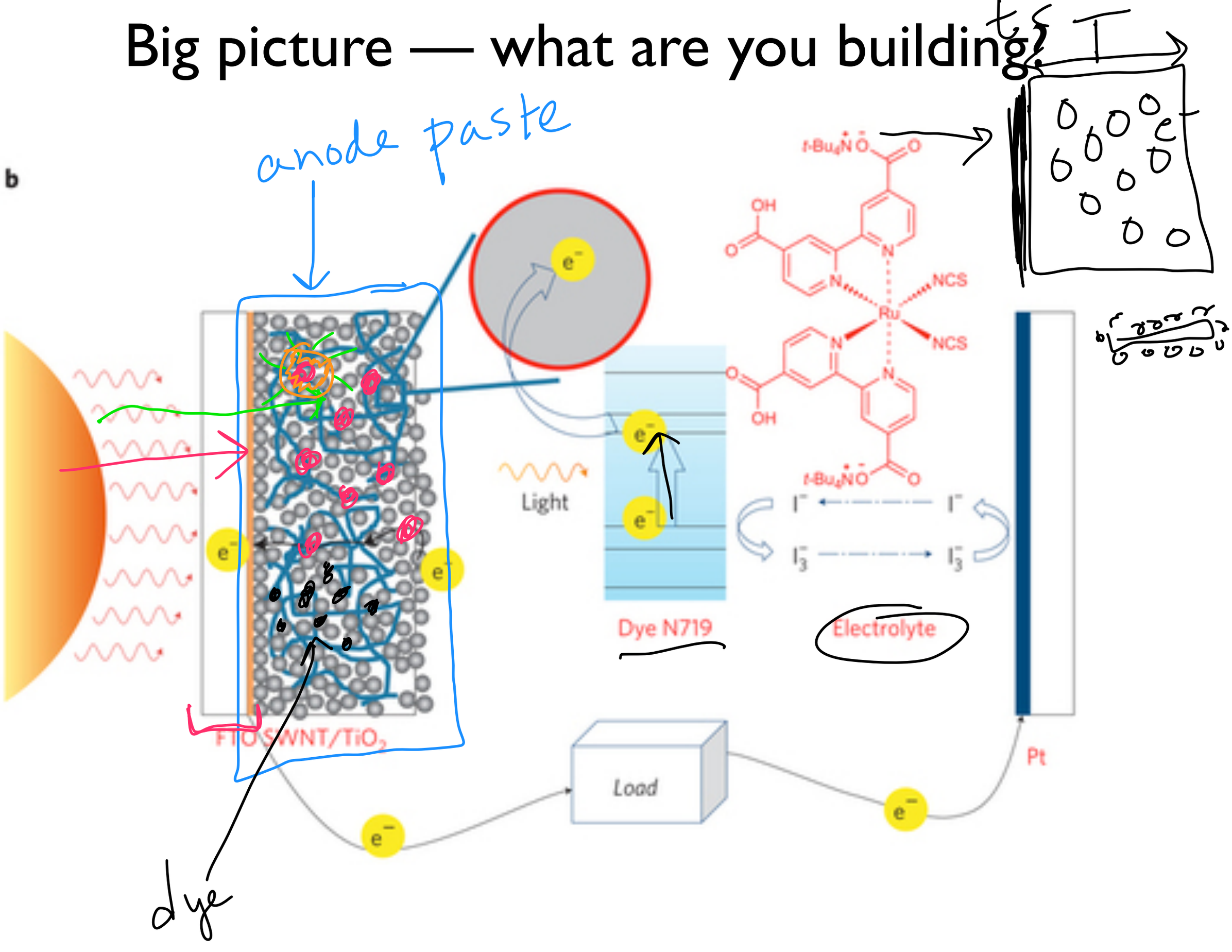
Peer review; Sunday

Office hours reminder:

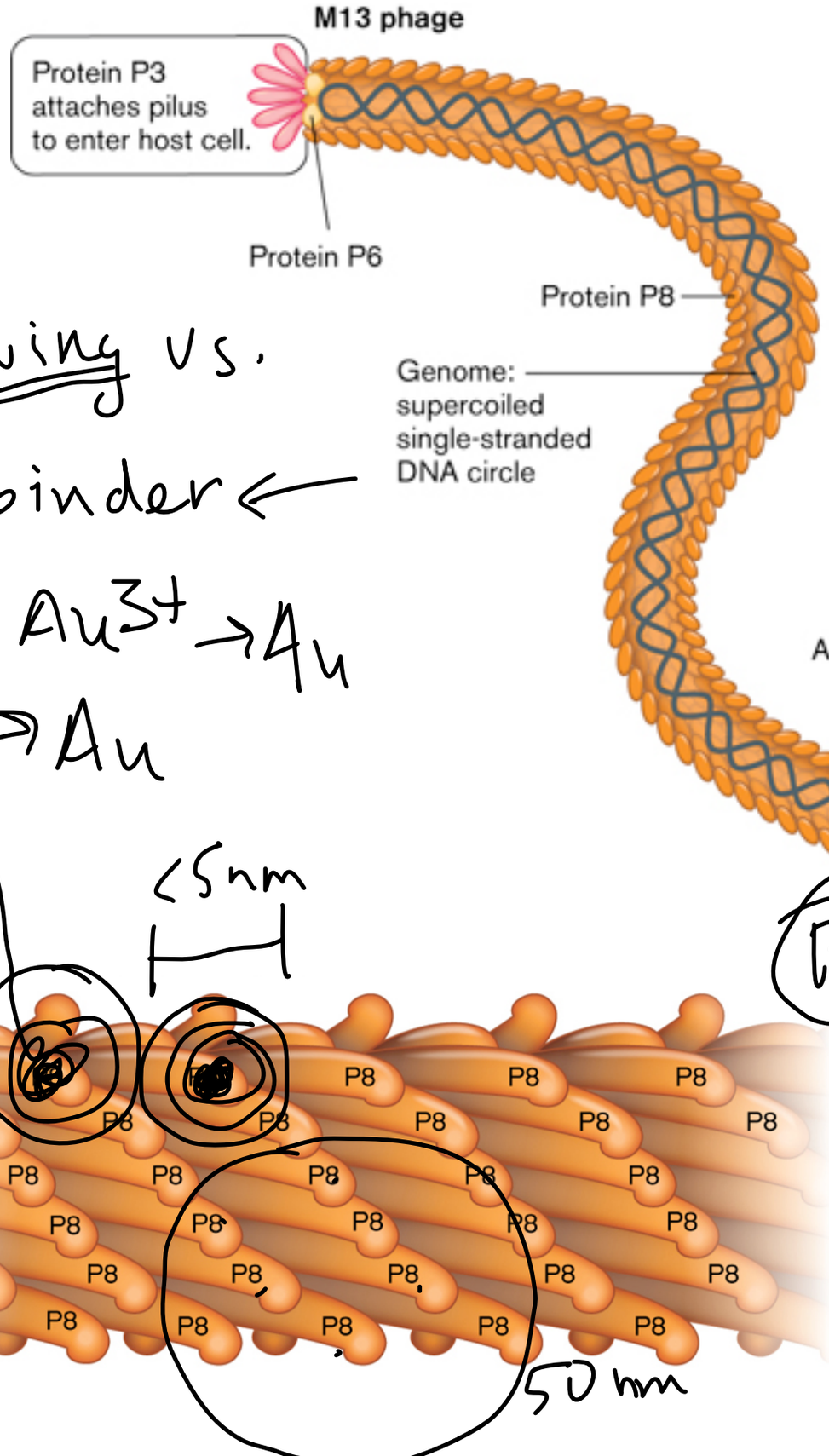
Friday 3-5pm

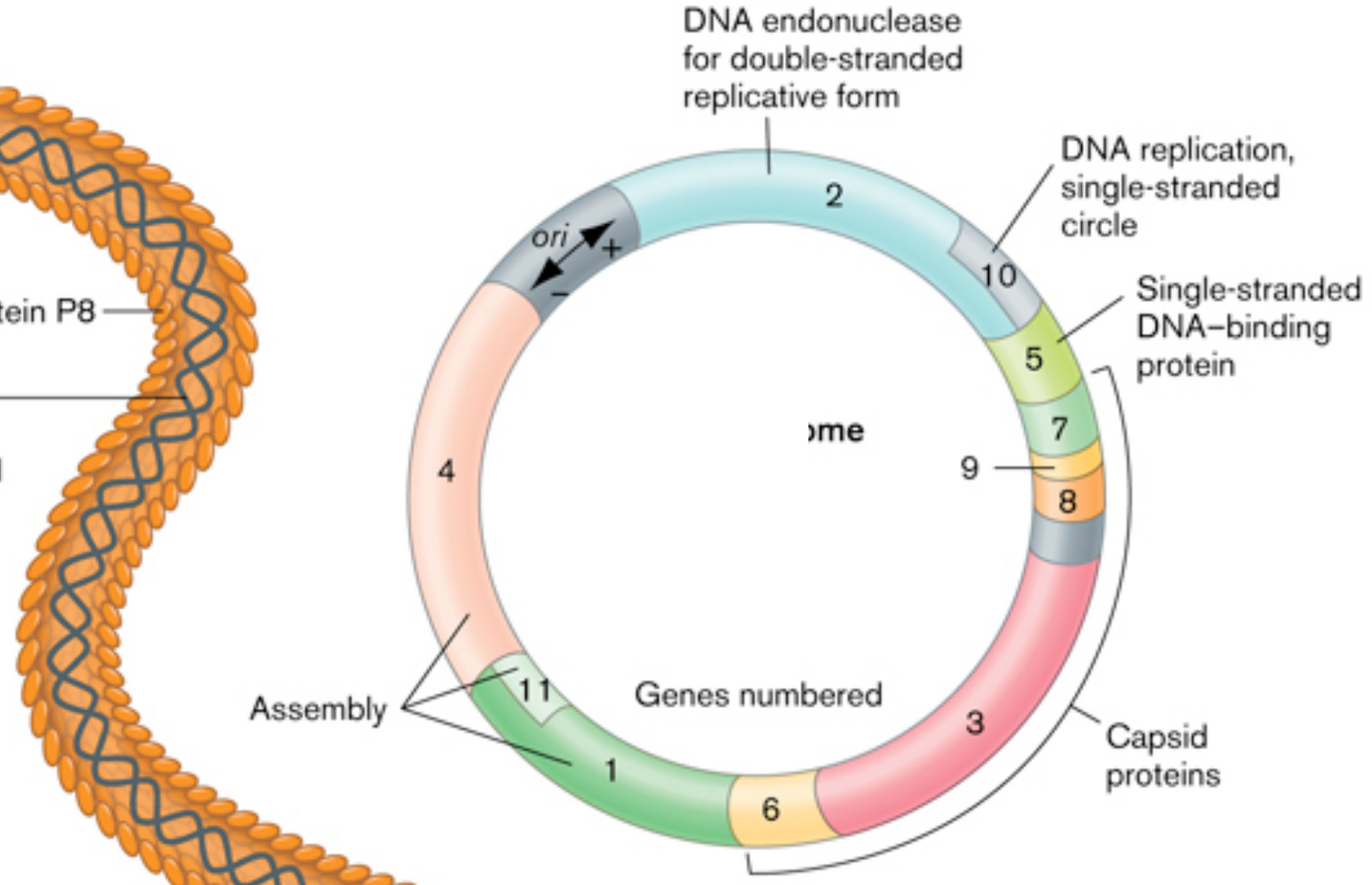
Sunday 10am-noon

Big picture — what are you building?



Our biological nanomaterial is the M13 phage



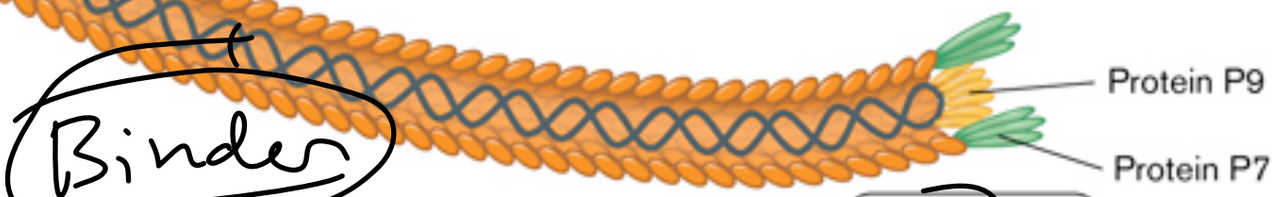


growing vs. binder ←

$Au^{3+} \rightarrow Au$

$Au^{3+} \rightarrow Au$

<5nm



Binder
- pick/tailor size
- less expensive

Grower
- possible holes

? attach

Engineering design choices — what would you do?

Engineering p3: (strepawidin)

- only 5 copies
- required for replication
+ p3 quite long — more p3 libraries
+ pattern

Engineering p8: (Gold interactor)

- might be hard modify & maintain function (for less p8 libraries)
- short
+ 2700 copies
+

Making the nanowire composites for DSSC: Biotemplating

Why do it with biology?

- lower pressure
- low/ish temperature
- low toxicity finished product

How does our reaction proceed?

T_1

$$Ti(OCH(CH3)_2)_4 + 2H2O \longrightarrow TiO_2 + 4\ (CH3)_2CHOH$$

Titanium isopropoxide → TiO_2 + IPA

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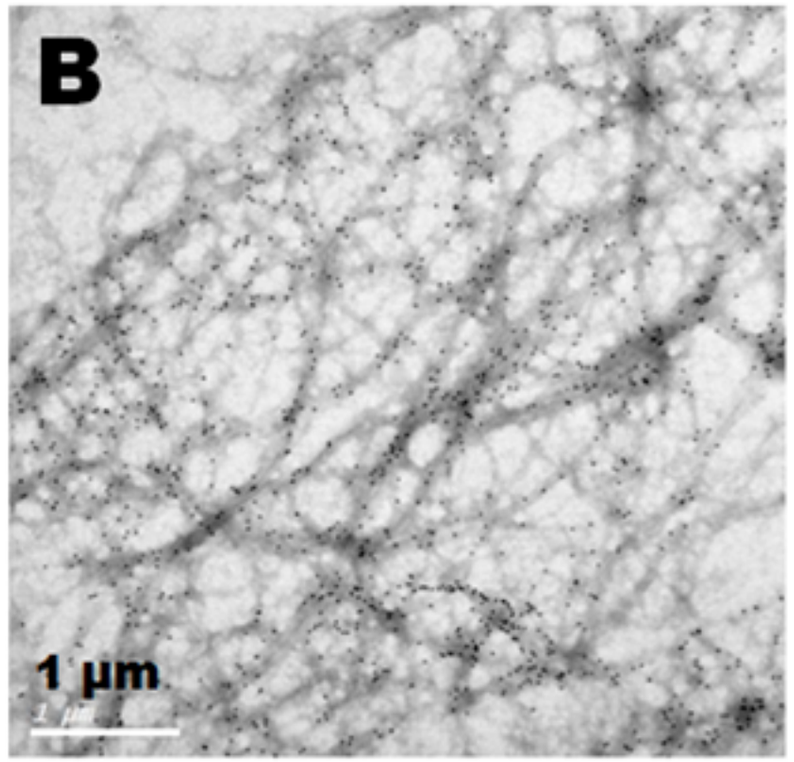
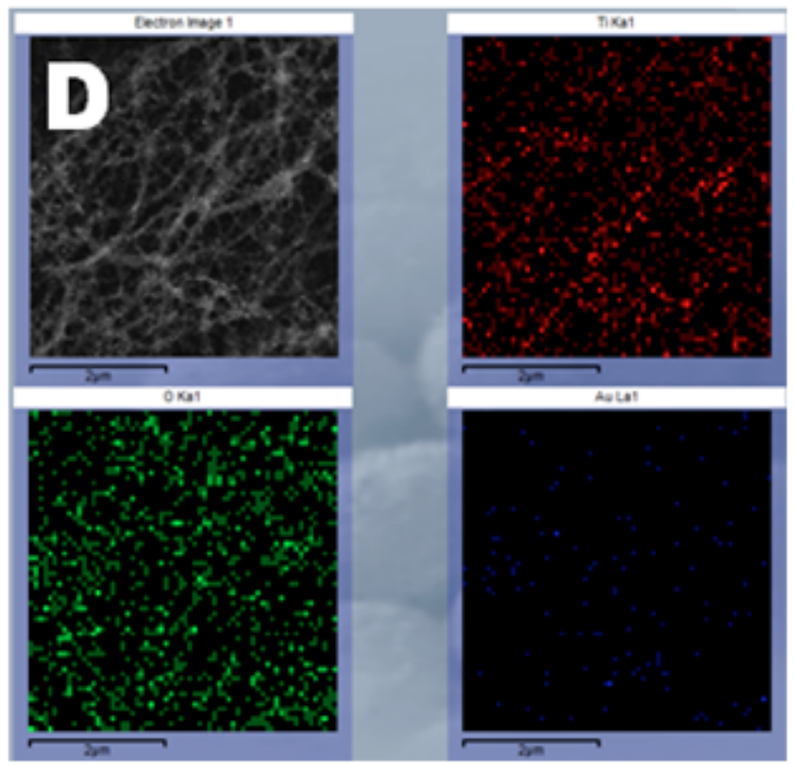
Preview of M3D3: images of your nanowires

TEM in Koch Institute





Remember the dimensions of the M13 phage:

Research Proposal:

1. What is your area of interest?

2. What is the current state of the technology?

3. How can you address the shortcomings in the field?

4. Why is your approach novel and exciting?

5. What do you need to accomplish your goals?

*Must be 109-related, but not related to your UROP project

Today in the lab:

- Be careful today — the unreacted titania is quite dangerous — LAB COAT + EYE PROTECTION
- Pay attention to the side of your TEM grid

31 µL ↑ 1×10^{13} phage particles → more gold

12nm gold ⇒ 92 µL

5nm gold ⇒ 2.5 mL

50nm gold ⇒ 2.3 mL

} calc. total volume

Next time in the lab (April 28th!!!):

- We'll split up for TEM time — everyone come at 1pm
- Start working on your research proposals