William Shih: Nanofabrication via Structural DNA

Lectures & Ke et al. *Science* 2012

Key words: DNA origami, Holliday junction, DNA tiles and bricks, DNA nanostructure tools

1. What are the chemical and physical principles that underlay how DNA origami is designed and constructed?

2. What is a Holliday junction and how are they used in the design of DNA origami?

3. What are advantages and disadvantages of DNA origami vs. DNA bricks?

4. What are some hurdles of using DNA nanotechnology as therapeutics?

5. Is there something unique about DNA that makes it an attractive molecule to use in the rational design of nanostructures? Could you imagine another class of molecules that could recapitulate the same functions and goals?

6. **Exercise:** In addition to the applications that Shih describes in the third lecture, what are some potential novel applications of DNA nanotechnology in biology and technology? Please talk briefly (and sketch out on the board, if needed) your own example.

Derr et al. *Science* 2012

Key words: dynein, kinesin, processivity, DNA origami, chassis, synthetic cargo

1. Describe how Derr et al. used DNA origami to design a synthetic cargo that could be attached selectively to kinesin or dynein motor proteins.

2. How do the motile properties of dynein and kinesin cargo transport differ according to the single molecule chassis-motor assays (see Figure 2)?

3. How does the mixed-motor photocleavable chassis experiments support a tug-of-war model for opposite-polarity motor proteins (see Figure 4)?

4. Are you convinced that this engineered chassis-motor protein complex accurately recapitulates motor-protein directed microtubule transport?