ME 498 / ME 599

Biological Frameworks for Engineers

Class Organization

- HW1 assigned. Due Friday Oct 7th.
- Lab 2
  - Friday, Oct 21, 2:30-4pm
  - More 320
- Lab 3
  - Wed, Nov 16th, 2:30-4pm
  - MEB 127
  - One student has priority

Who are you?

- Alex, Grad, CE from Arizona
- Drew, Sr, Kenmore, WA
- Morgan, Sr, Ballard, WA
- Adam, MS, West Seattle
- Evan, Grad, Kalamazoo
- Brian, MS, Gig Harbor
- Grier, MS, Penn St.
- Kevin, PhD, Lansing, MI
- Nolan, Sr, Edmonds, WA
- Thomas, Jr, Olympia, WA
- Brandon, Jr-ish, Seattle, WA
- Tyler, Sr, Gig Harbor, WA
- Andrew, Sr, Yakima, WA

Biological Frameworks for Engineers

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Information Handling

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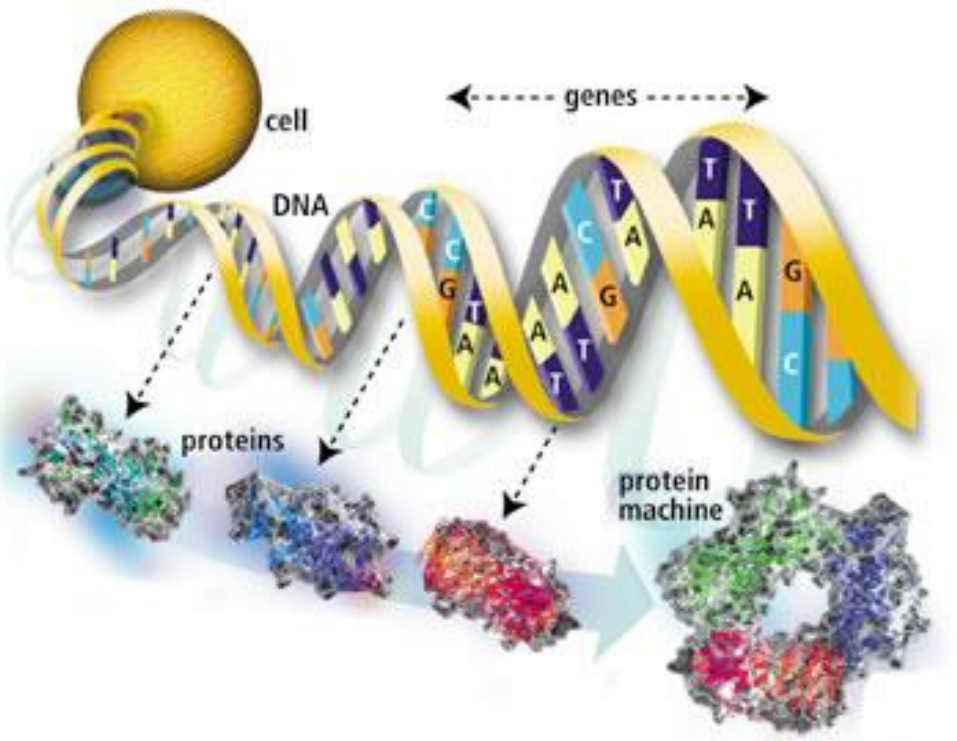
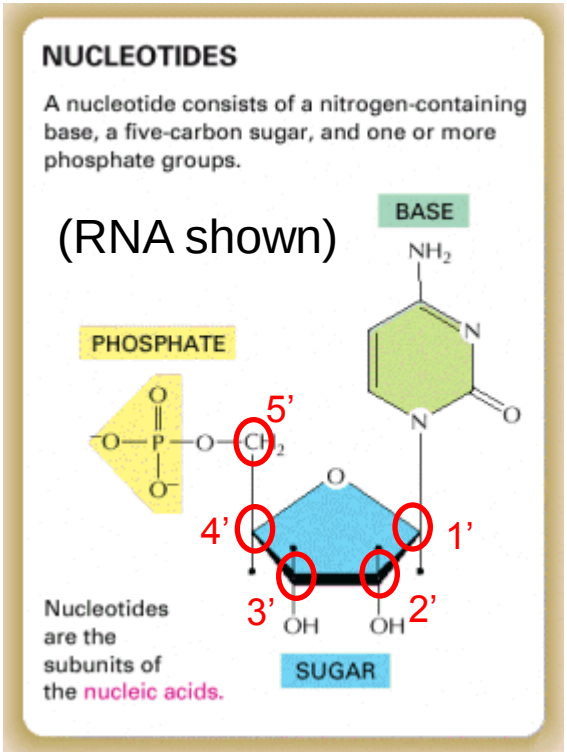
Deoxyribonucleic Acid

DNA is a polymer of nucleotides that encodes the sequence of amino acid in proteins through a template called messenger RNA



Nucleotides

Consists of a nitrogen base, 5-carbon sugar, and a phosphate from the *5' end* of the sugar.



Sugar

Ribonucleic acid (RNA)
Deoxyribonucleic acid (DNA)

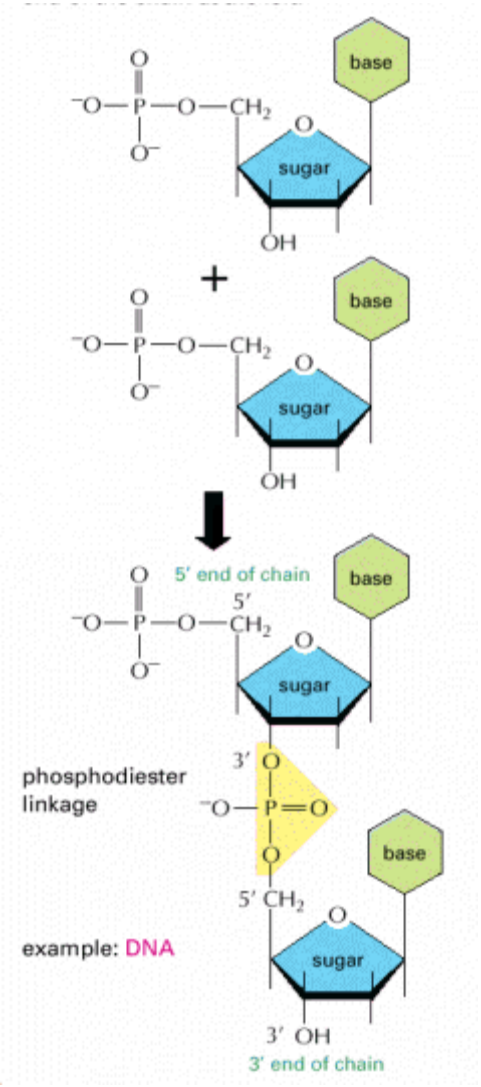
Nitrogen Bases

G: Guanine	(Purine)
A: Adenine	(Purine)
T: Thymine	(Pyrimidine)
C: Cytosine	(Pyrimidine)
U: Uracil	(Pyrimidine)

DNA Polymerization

A nucleic acid strand has a pentose-phosphate backbone.

A phosphodiester bond connects the 3' end of one nucleic acid with the 5' end of the next *mer*.

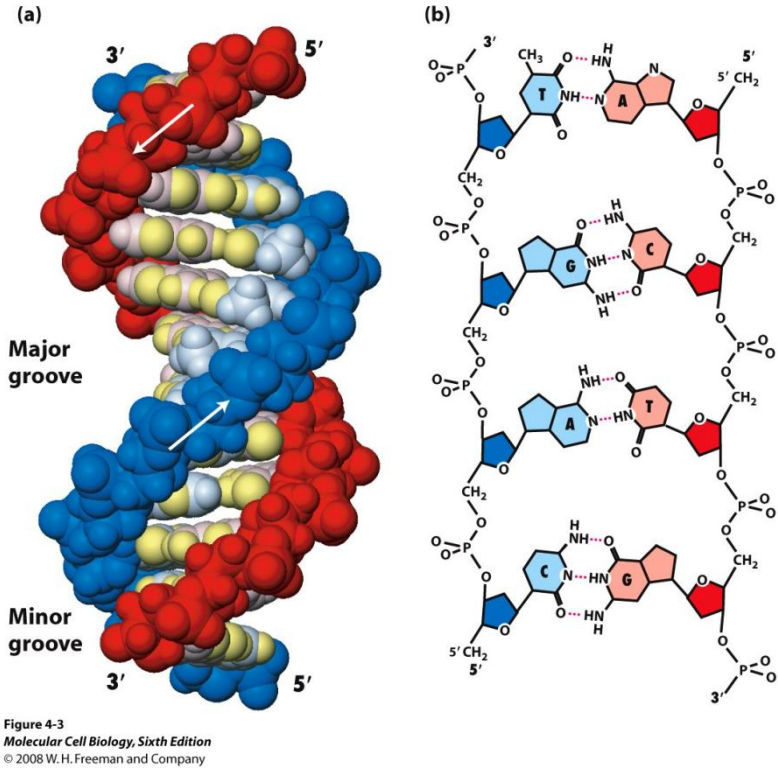


(DNA shown)

DNA Structure

1953: Watson and Crick proposed the double-helix structure of DNA*

- Right-handed, Anti-parallel
  - 5' / 3' → 3' / 5' (Strands run opposite)
- Base pairs on the inside
  - A • T has two H-bonds
  - G • C has three H-bonds
- Dimensions
  - 2.0 nm wide
  - 3.4 nm length per turn
  - 10 base pairs per turn
- Grooves
  - Major: 2.2 nm wide (protein docking)
  - Minor: 1.2 nm wide



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* using Maurice Wilkins and Rosalind Franklin's X-ray diffraction data. (Theorists 1, Experimentalists 0)

It's Bend-y!

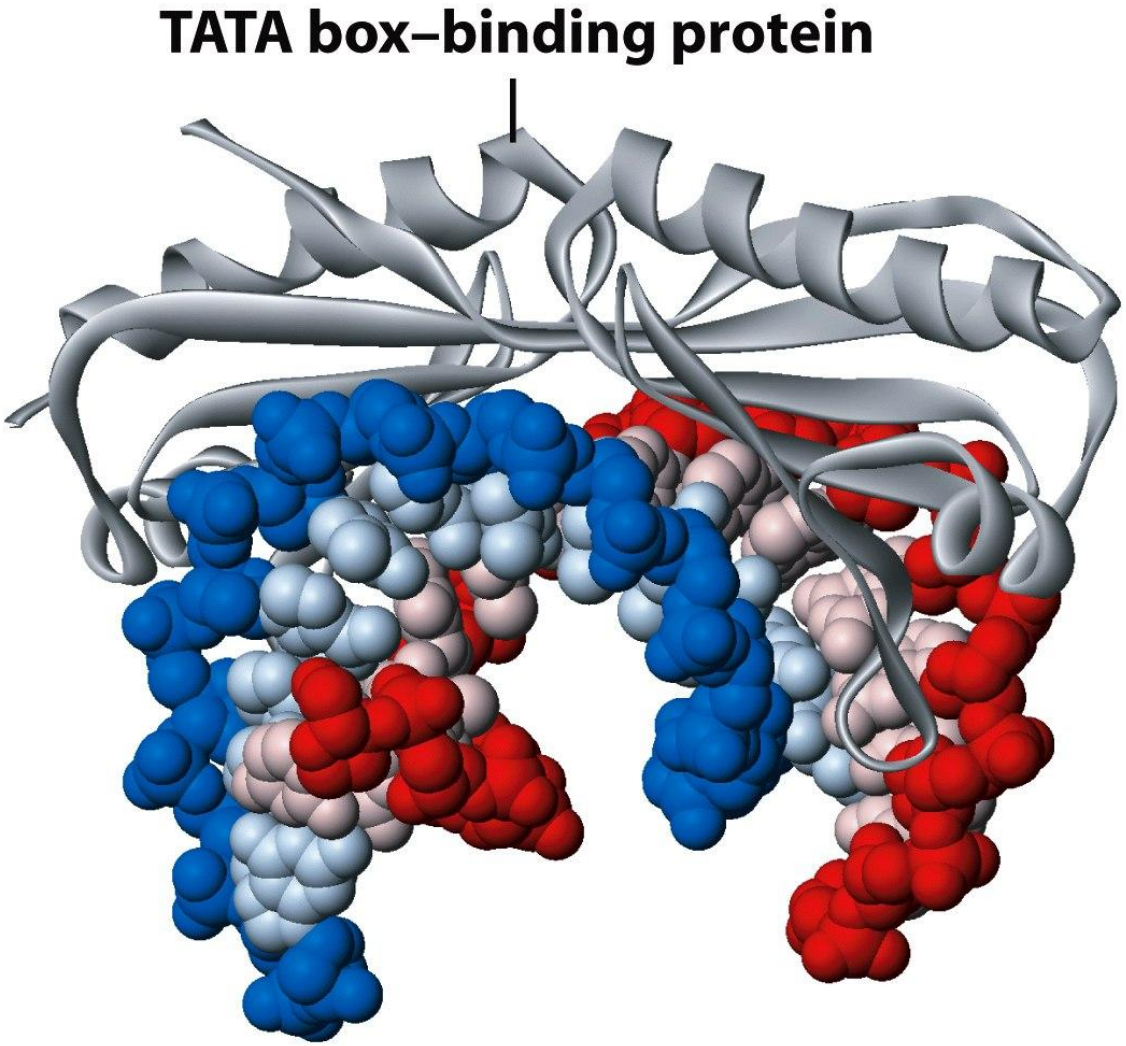
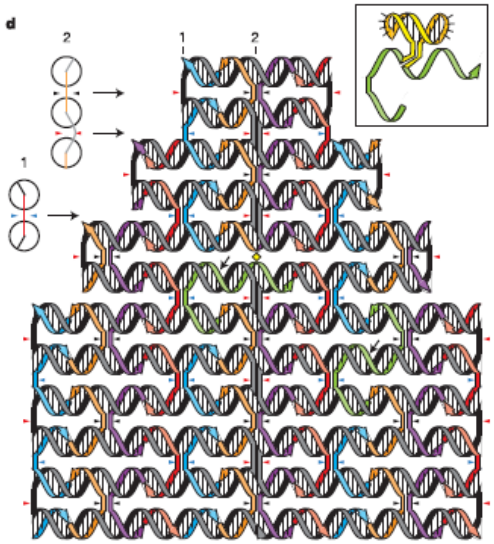
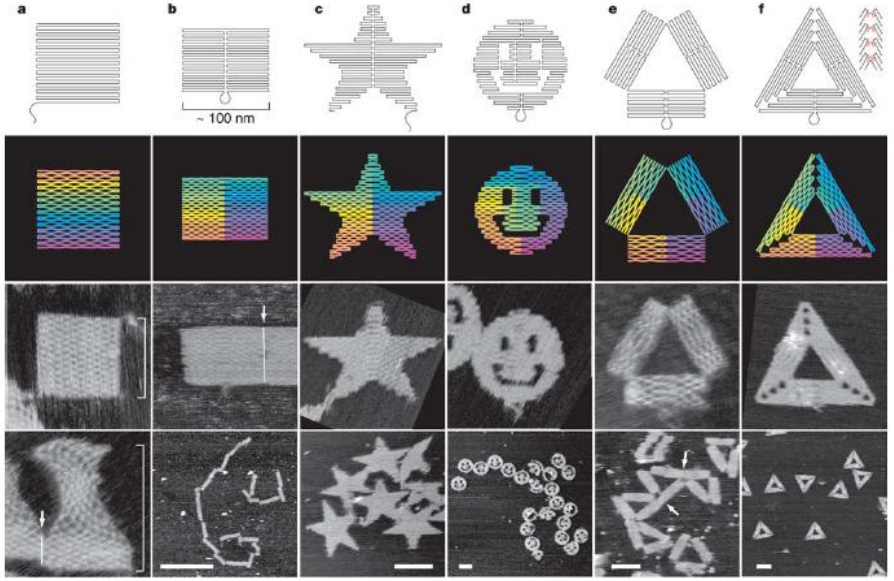


Figure 4-5
Molecular Cell Biology, Sixth Edition

Flexibility arises because H-bonds run perpendicular and not parallel to long axis

It's Constructable!





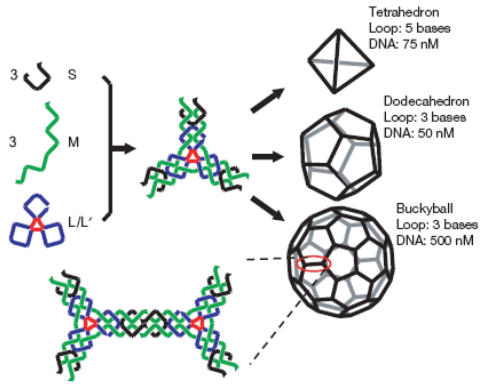
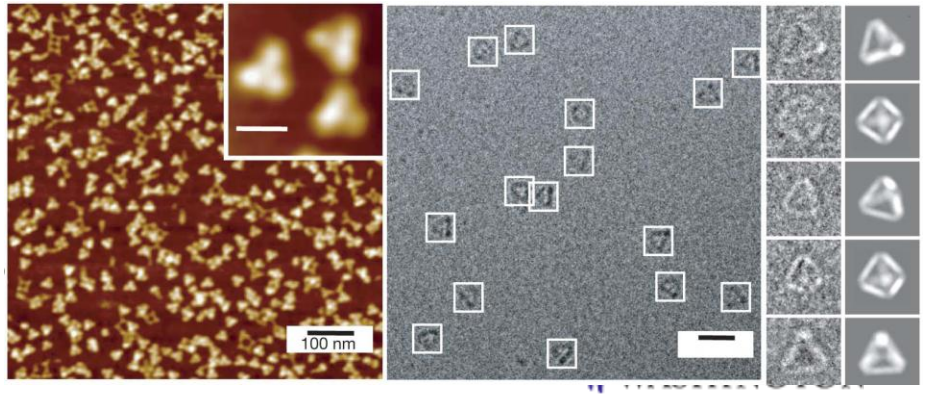


Figure 1 | Self-assembly of DNA polyhedra. Three different types of DNA single strands stepwise assemble into symmetric three-point-star motifs (tiles) and then into polyhedra in a one-pot process. There are three single-stranded loops (coloured red) in the centre of the complex. The final structures (polyhedra) are determined by the loop length (3 or 5 bases long) and the DNA concentration.



Hw 1…

Explore information handling in

Replication (DNA → DNA)

Transcription (DNA → RNA) &
Translation (RNA → Proteins)