

ME 411 / ME 511

Biological Frameworks for Engineers

Class Organization

- HW1 assigned. Due Fri Oct 3.
- Office Hours
 - Prof. Sniadecki, MEB 318, MW, 3:30-4pm
 - TA Nikita Taparia, AERB 328, Th, 5-6pm

ME 411 / ME 511

Information Handling

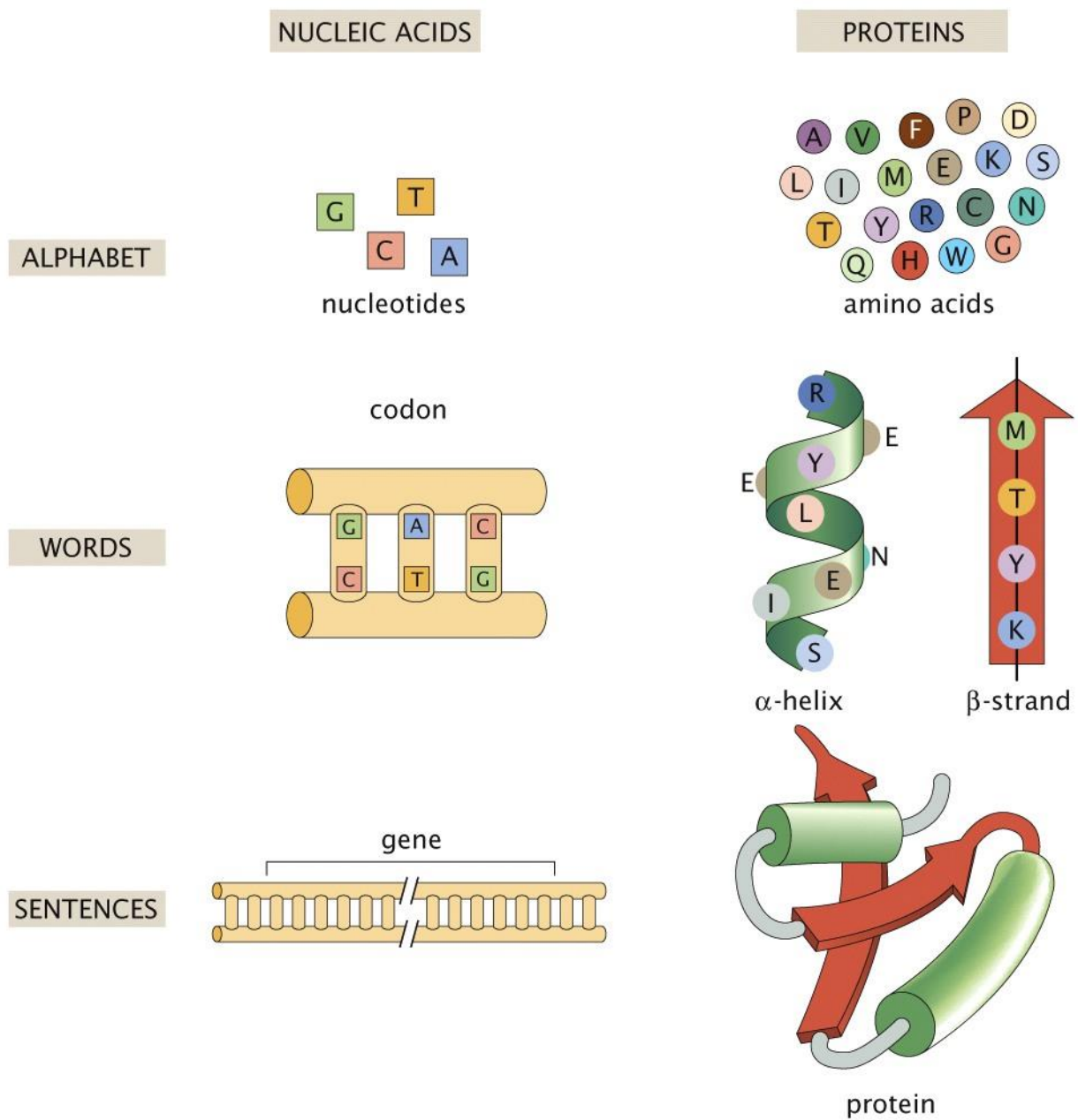


Figure 1.2 Physical Biology of the Cell, 2ed. (© Garland Science 2013)

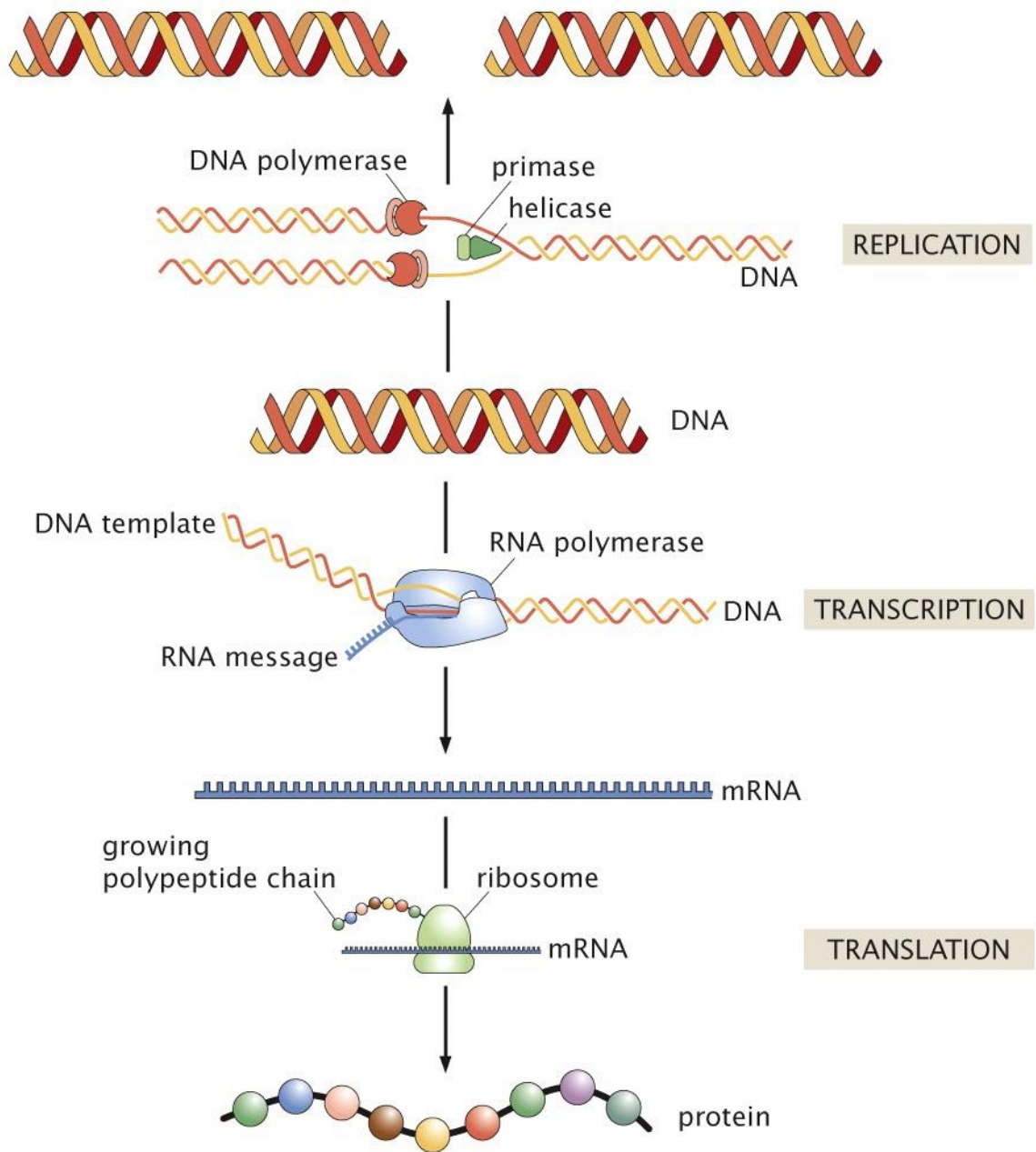
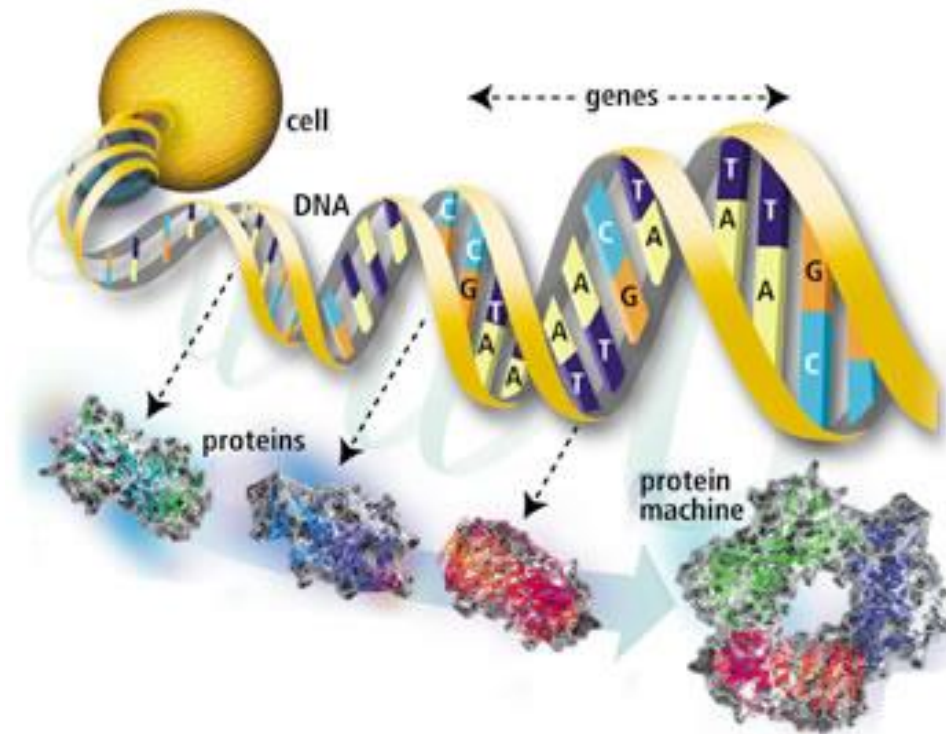


Figure 3.12 Physical Biology of the Cell, 2ed. (© Garland Science 2013)

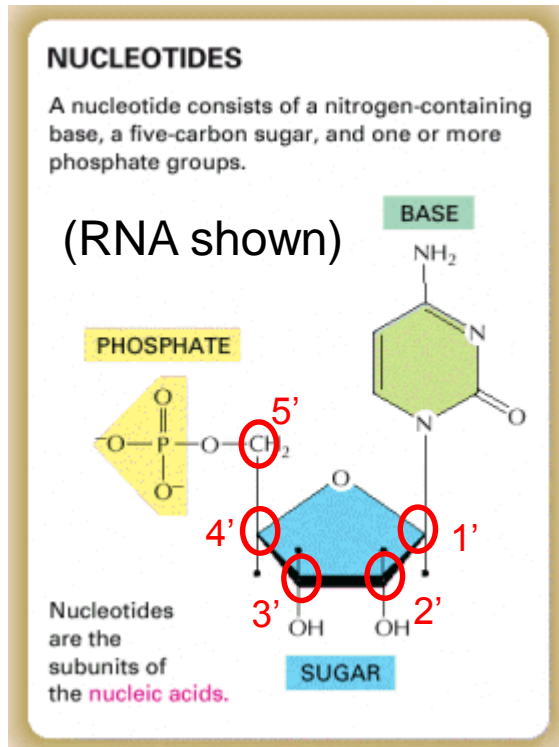
Deoxyribonucleic Acid

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)

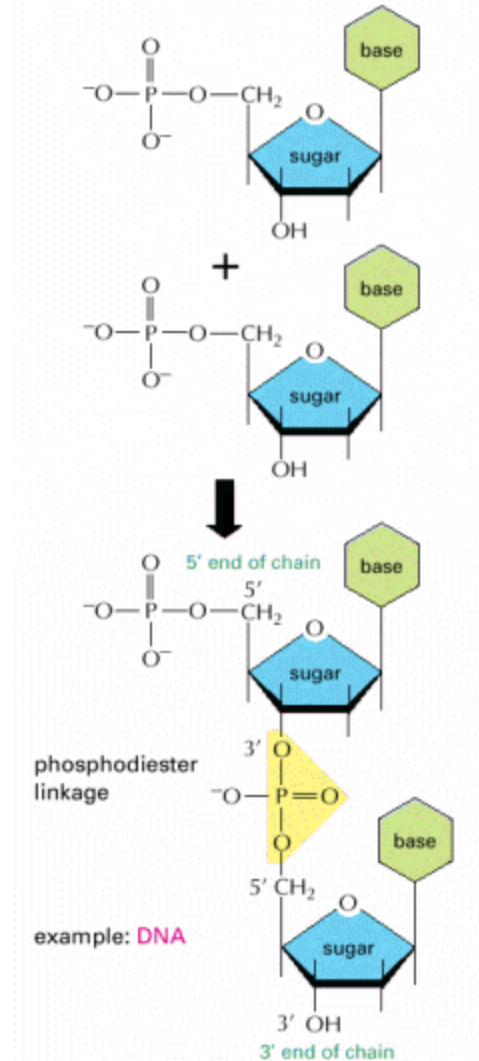
C: Cytosine (Pyrimidine)

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

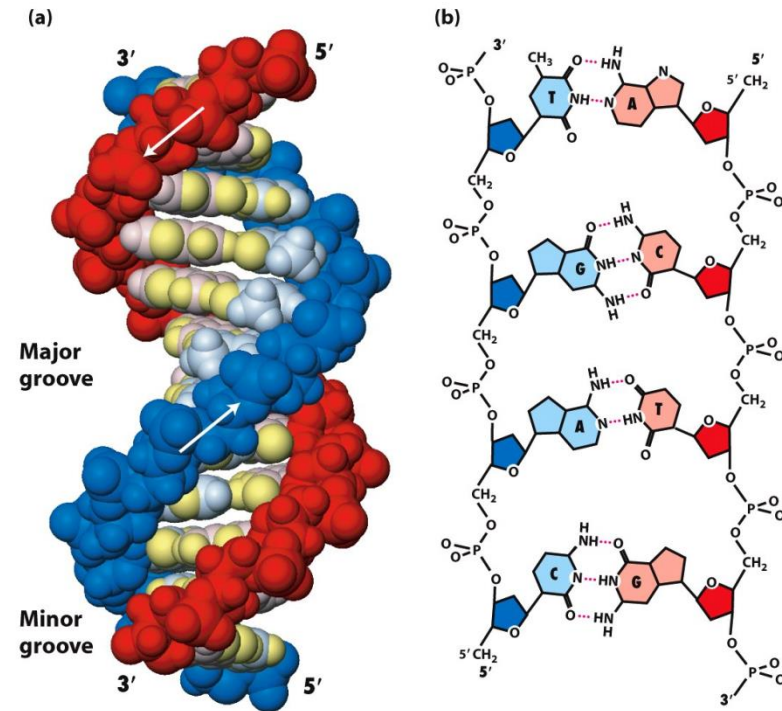
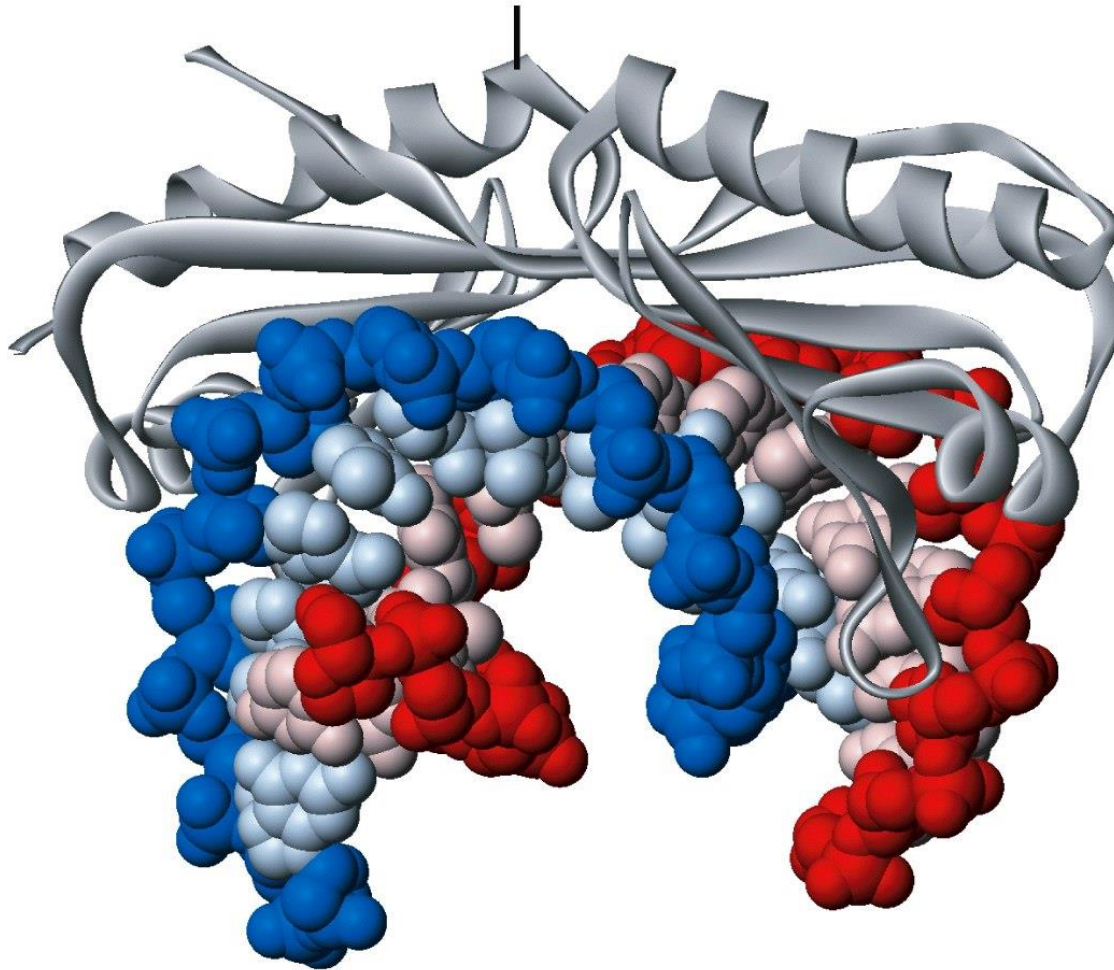


Figure 4-3
Molecular Cell Biology, Sixth Edition
© 2008 W.H. Freeman and Company

* using Maurice Wilkins and Rosalind Franklin's X-ray diffraction data.

It's Flexible!

TATA box-binding protein



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

It's Constructable!

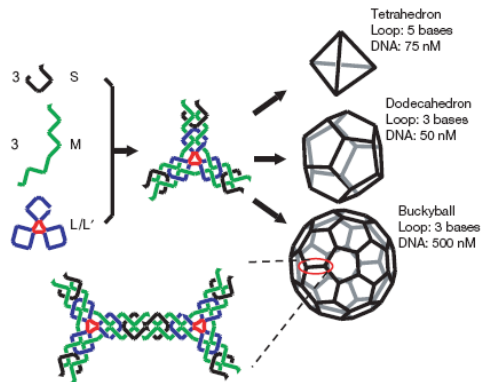
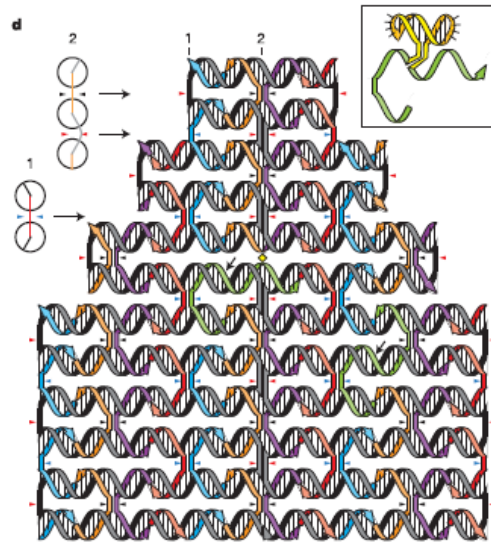
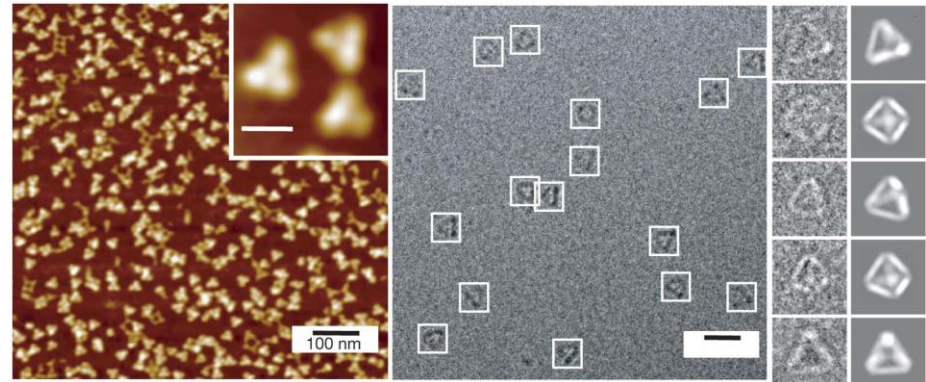
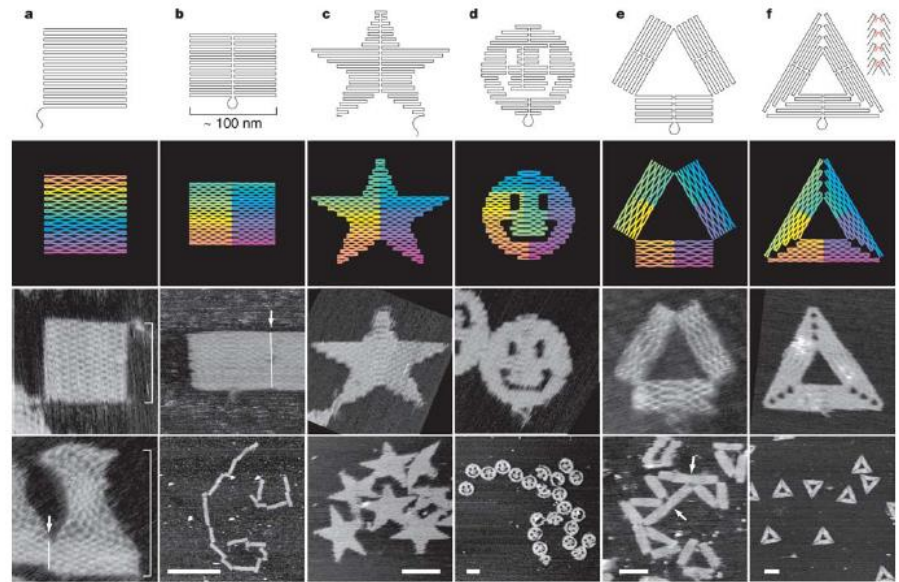


Figure 1 | Self-assembly of DNA polyhedra. Three different types of DNA single strands stepwise assemble into symmetric three-point-star motifs (tiles) and then into polyhedra in a one-pot process. There are three single-stranded loops (coloured red) in the centre of the complex. The final structures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



Hw 1...

Explore information handling in
Replication (DNA \rightarrow DNA)
Transcription (DNA \rightarrow RNA) &
Translation (RNA \rightarrow Proteins)