Nucleic acid structure

• Most of the “machines” in the cell are protein-based
• Nucleic acids (DNA and RNA) act primarily as information carriers
• However, they’re not just long threads. They can take on well-defined structure, which is important in two ways:
  – It influences gene expression (the extent to which proteins are produced from the DNA that codes for them)
  – Nucleic acids—especially RNAs—can also act as machines. (In fact, life may have originated this way.)
Topic 1: Predicting RNA secondary structure

• For RNA “secondary structure” — that is, how the bases pair — is of great interest

http://www.tbi.univie.ac.at/~pkerp/forgi/_images/1y26_ss.png
Predicting secondary structure of RNA pseudo knots

- RNA secondary structure is typically predicted using dynamic programming algorithms that assume all loops are “nested”
- *Pseudoknots* violate this assumption
- One of Monday’s paper proposes an algorithm to overcome this problem, incorporating information from SHAPE experiments (also used in EteRNA)

![Diagram of typical secondary structure](http://www.tbi.univie.ac.at/~pkerp/forgi/_images/1y26_ss.png)

![Diagram of pseudoknot](http://www.tbi.univie.ac.at/~pkerp/forgi/_images/1y26_ss.png)

Topic 2: Design of DNA structures

- DNA has been used previously to design “origami” shapes

Designing a DNA–protein complex

- One of Monday’s papers describes design of a self-assembling “wire” including repeating protein and DNA units