Nucleic acids (chapters 3 and 6) **Page 1**

Nucleic acids

DNA and RNA are the two types of nucleic acids

DNA is the genetic molecule (the "blueprints" of life)

Polymers of nucleotide monomers

Nucleotides

Small organic molecules made of …

- A phosphate group
- A five carbon sugar (ribose)
- A nitrogenous base

Fig 5.26

DNA (**Deoxyribo**nucleic acid)

- The ribose in DNA is missing one oxygen atom
- The DNA nitrogenous bases are G, A, T, and C

Fig 5.26

RNA (**Ribo**nucleic acid)

- The ribose in RNA has all oxygen atoms
- The RNA nitrogenous bases are G, A, U, and C

Fig 5.26

Nitrogenous bases

Ring-shaped molecules with backbones of nitrogen and carbon Atoms

- There are five nitrogenous bases:
  - √ Adenine (A)
  - √ Guanine (G)
  - √ Cytosine (C)
  - √ Thymine (T) (in DNA only)
  - √ Uracil (U) (in RNA only)
- T and U are very similar in shape and function
- A and G are purines (backbone has two fused rings)
- C, T, and U are pyrimidines (backbone has one ring)

Nucleic acids (RNA and DNA)

DNA is a polymer of DNA nucleotide monomers

RNA is a polymer of RNA nucleotide monomers

- Nucleotides are linked together by joining the ribose of one to the phosphate of the next

  √ Backbone of nucleic acid = the alternating phosphates and riboses

  √ 5' end = the end of the backbone with a free phosphate

  √ 3' end = the end of the backbone with a free ribose

- The *sequence* of nitrogenous bases along the backbone holds the genetic information

Fig 5.26

Complementary base pairing

Pairing of certain nucleotides by hydrogen bonds between their nitrogenous bases

- G complementary base pairs with C
- A complementary base pairs with T or U

Figs 16.7 and 16.8

Double stranded DNA

Two DNA strands that are antiparallel (in opposite directions), joined together by complementary pairing between the bases on opposite strands

- Double helix = the coil shaped structure that double stranded DNA twists into

- Chromosomes are long pieces of double stranded DNA that hold a cell's genetic information

Figs 16.7 and 19.2

Base pairing (hybridizing)

When two strands attach to each other by complementary base pairing

- Two strands will base pair only if they are complementary

  √ A strand will find and base pair to its complementary strand even in a mixture of non-complementary strands

- High temperatures (near boiling) will prevent two strands from base pairing

RNA strands

- RNA is single stranded
- Some RNA strands function as temporary (disposable) copies of the DNA's genetic information

Three special RNA molecules:

Adenosine Triphosphate (ATP)

The major energy delivering molecule of the cell
("energy currency")

- An RNA Adenosine nucleotide with 3 phosphates
- Energy requiring processes get energy out of ATP by splitting it to adenosine diphosphate (ADP) and inorganic phosphate (P_i)

Figs 8.8 and 8.11

NADH and $FADH_2$

RNA coenzymes that specialize in carrying high energy electrons

- Both carry hydrogen atoms along with the high energy electrons

Fig 9.4