UNIT 5:
DNA, RNA, AND PROTEIN SYNTHESIS

What is DNA?

- Deoxyribose Nucleic Acid (DNA)
- The genetic material!

- 1950s - Structure determined by Watson and Crick

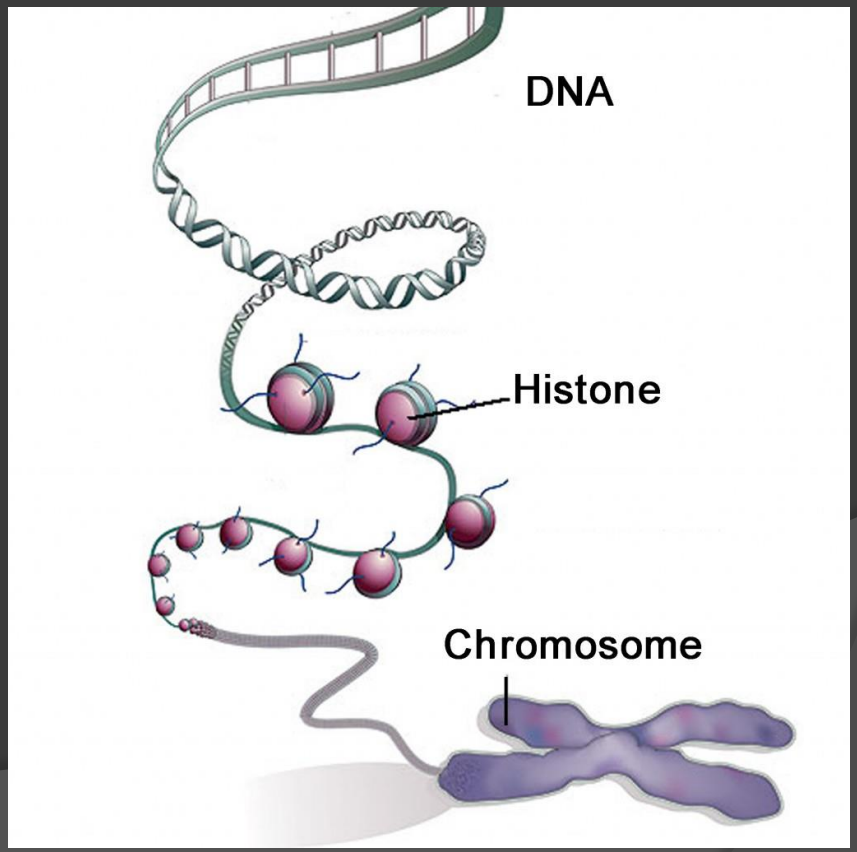
Where is DNA found?

- Prokaryotes – cytoplasm
  - Plasmid – circular DNA
- Eukaryotes – nucleus
  - Chromosomes

there is also DNA in the mitochondria

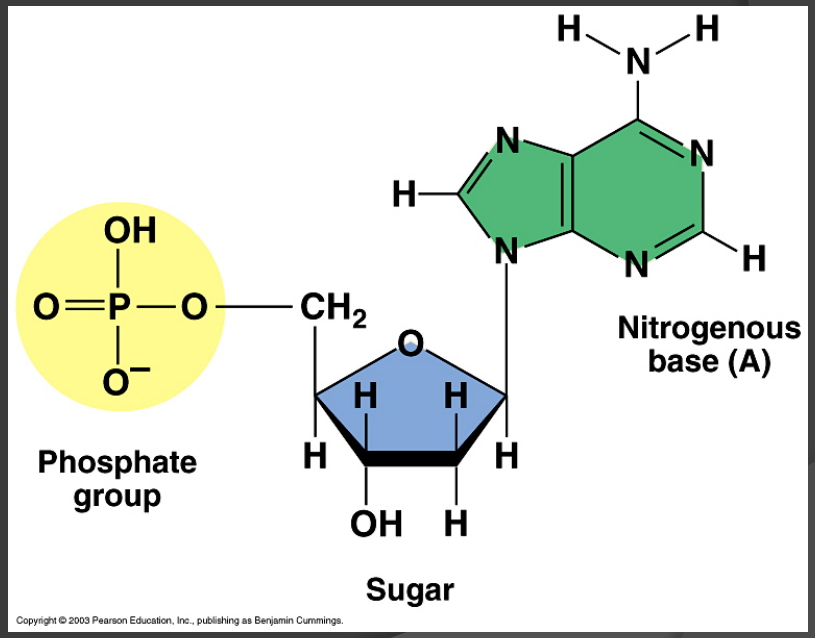
DNA Properties

- DNA IS LONG!!!
- Must be packed tightly in order to fit
  - Nucleus of a human cell contains more than 1 meter of DNA



Nucleic Acids

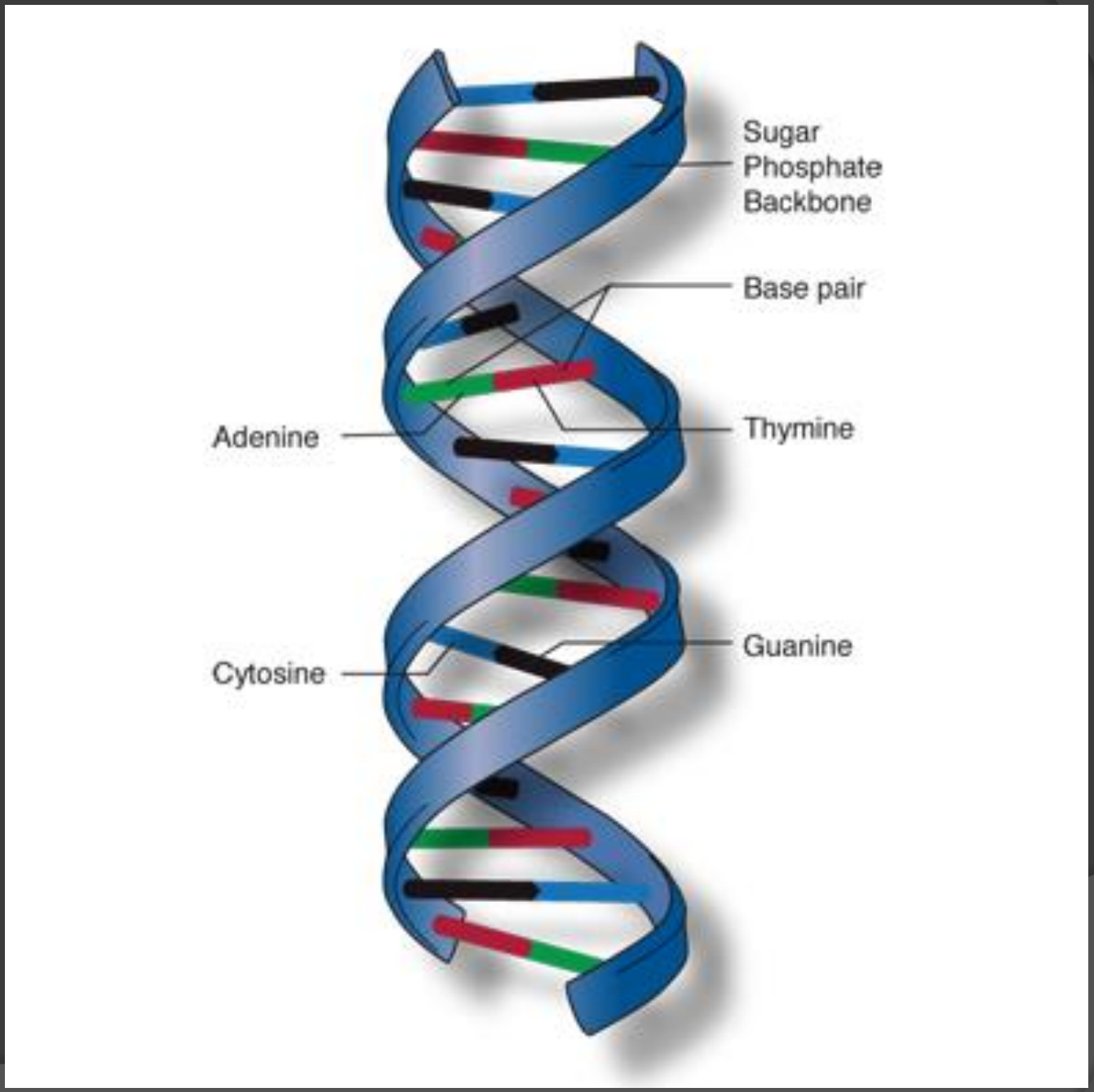
- Composition: carbon, hydrogen, oxygen, nitrogen, and phosphorous
  - Nucleotides consist of 3 parts:
    1. 5-carbon sugar
    2. Phosphate group
    3. Nitrogenous base

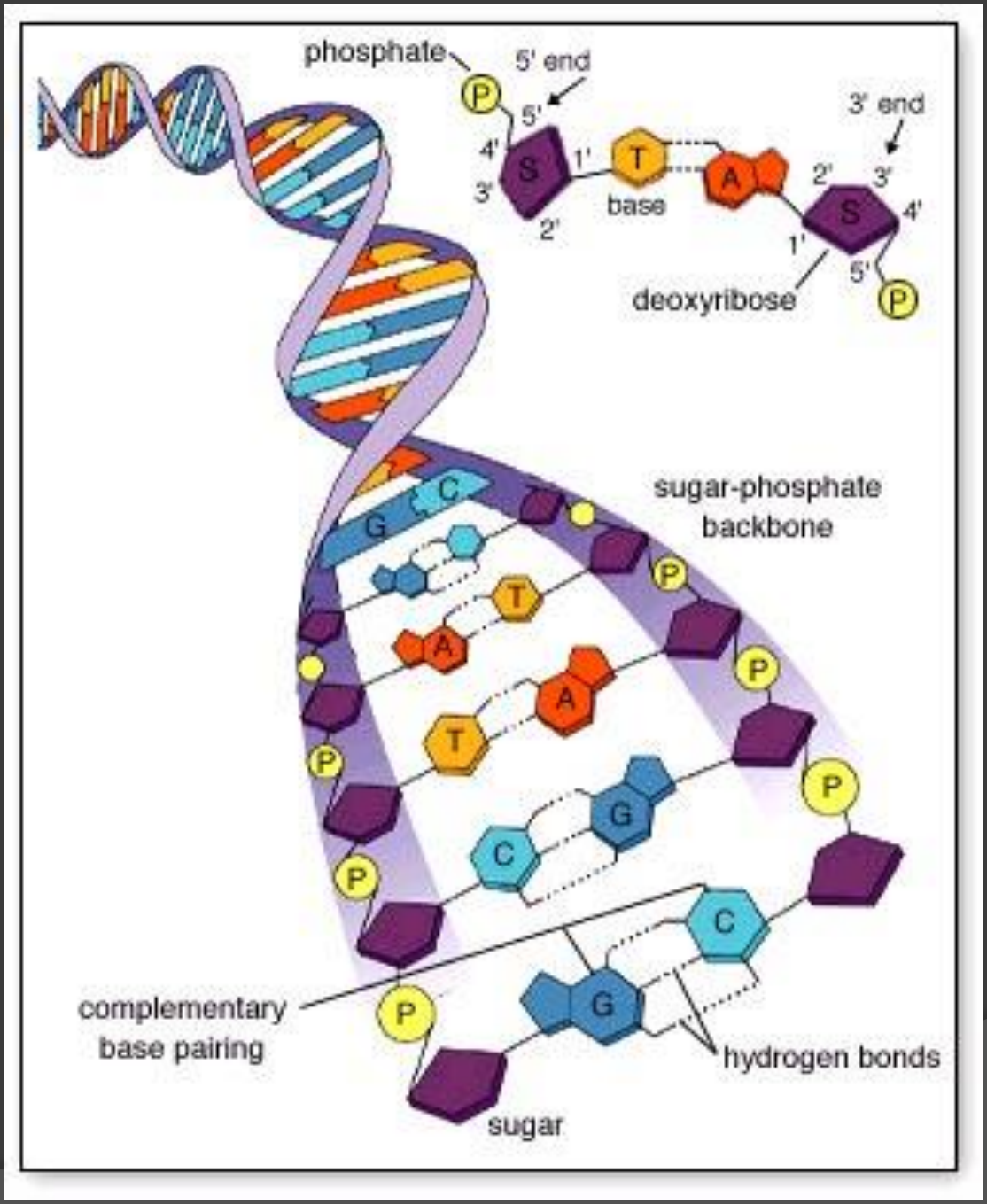


- Monomer: Nucleotide
- Polymer: DNA and RNA

DNA Structure:

- Double helix - “Twisted Ladder”
- The sides are composed of alternating phosphate-sugar groups
- The rungs of the ladder are composed of nitrogenous bases


Sugar
Phosphate
Backbone
Base pair
Adenine
Thymine
Guanine
Cytosine

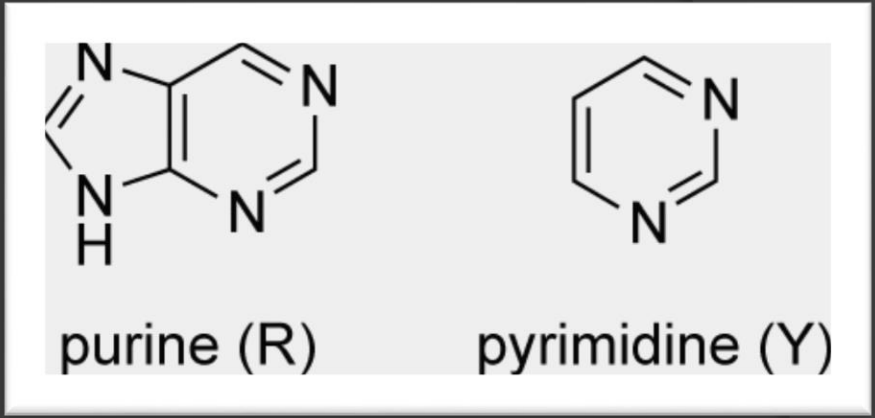

phosphate
5' end
3' end
base
deoxyribose
sugar-phosphate backbone
complementary base pairing
hydrogen bonds
sugar

Nitrogenous Bases:

- There are four:
  - Adenine
  - Guanine
  - Thymine
  - Cytosine

= Purines

= Pyrimidines



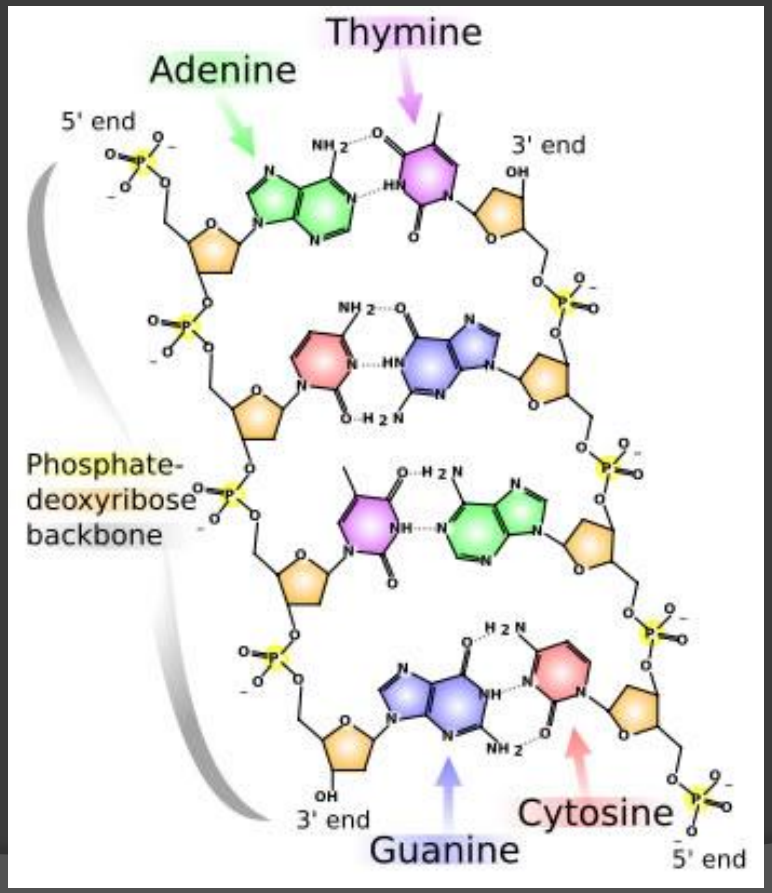
- They do <u>complementary</u> base-pairing:

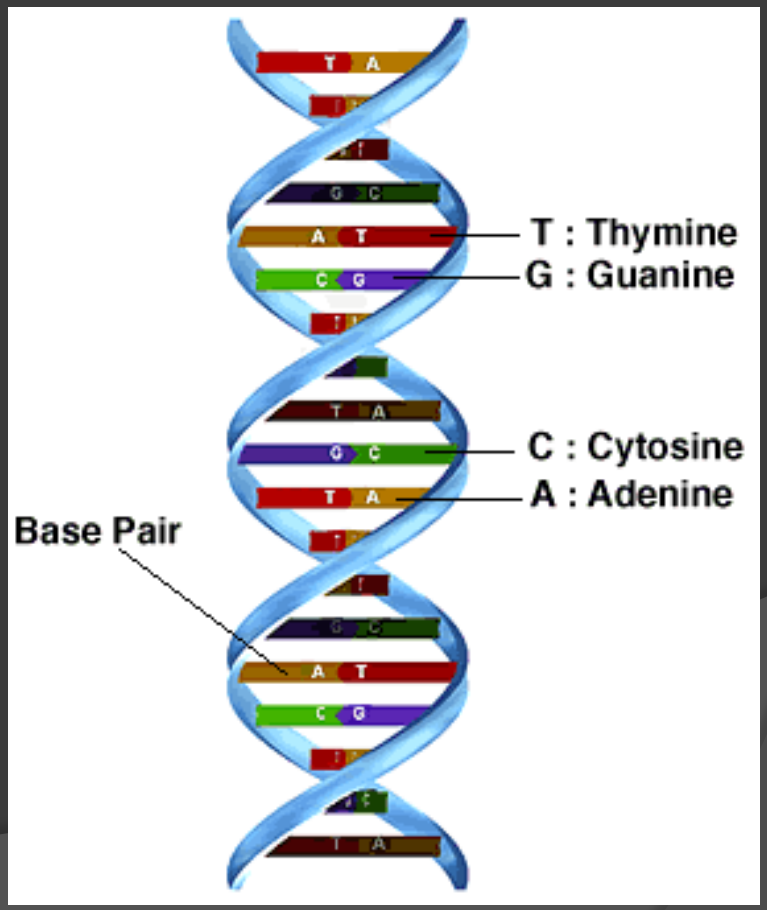
A-T

G-C

Base Pairs

- Bound by weak hydrogen bonds!





Do all cells have the same DNA?

- Yes! DNA is the SAME in EVERY cell

DNA Replication

- Process that makes copies of DNA for new cells
- DNA is needed in every cell to make PROTEINS
  - -Sequence of nucleotides in DNA codes for proteins
- An exact copy of the DNA must be passed on in order to function correctly

When/where does DNA Replication occur?

- Cells must replicate their DNA and then divide
  - Series of events in which a cell divides is called the CELL CYCLE
- DNA Replication occurs during the S phase of the cell cycle

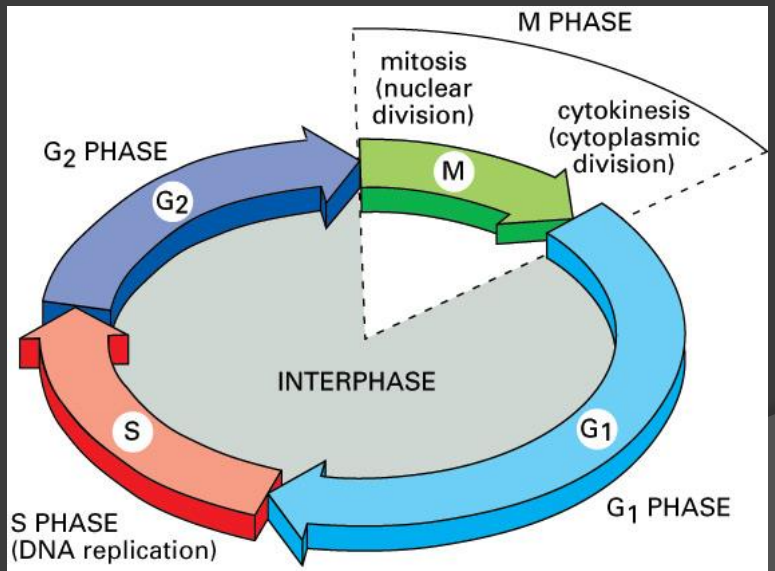
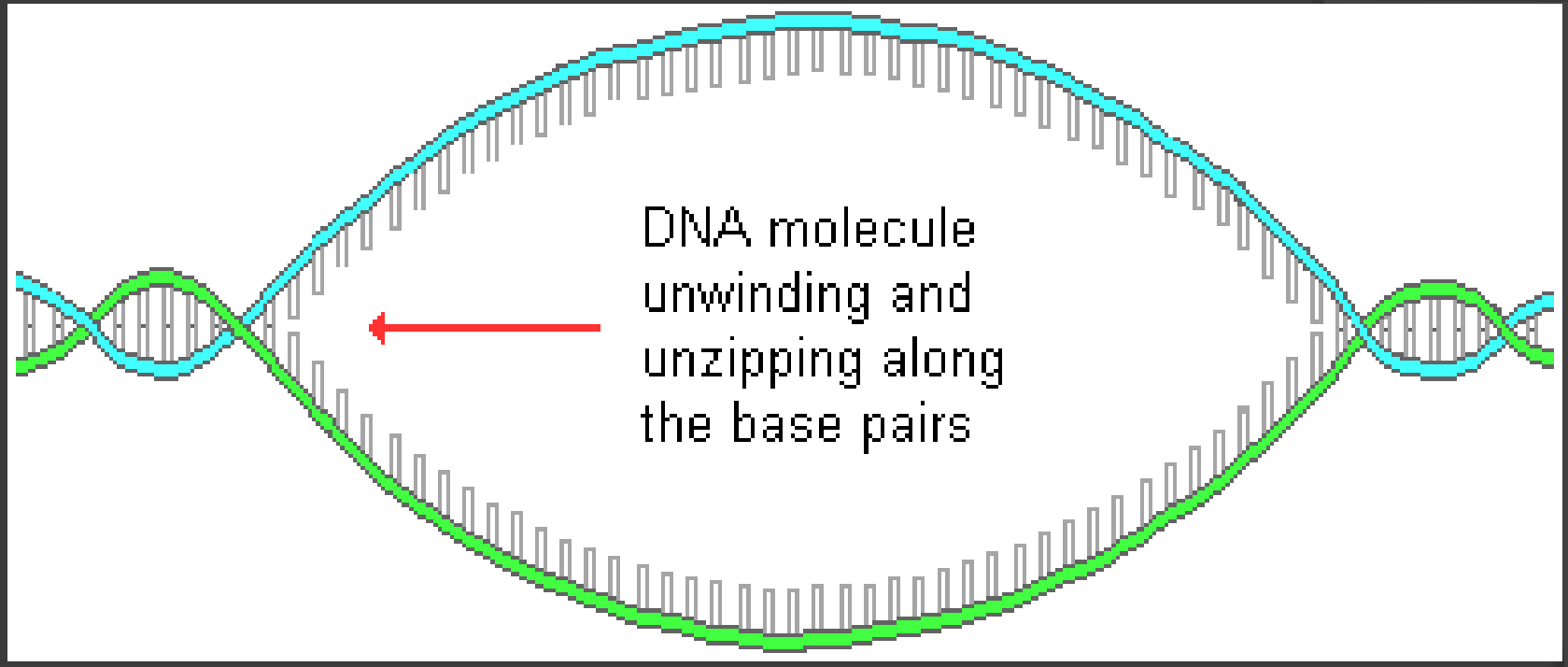
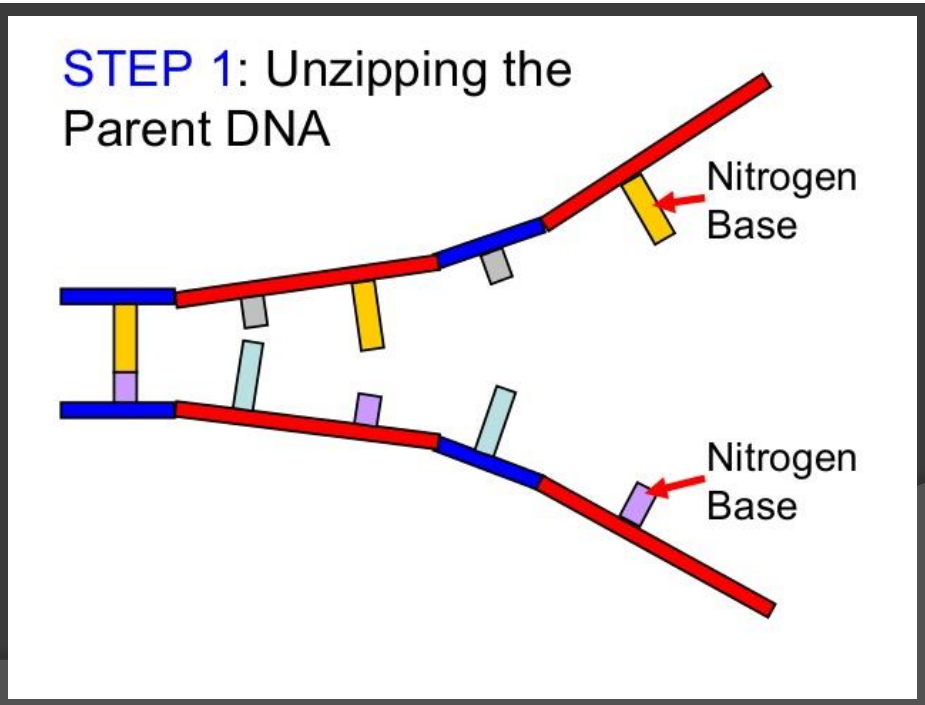


Figure 17–3. Molecular Biology of the Cell, 4th Edition.

DNA Replication

- DNA molecule separates into two strands – “unzips”
  - Unzipping is carried out by helicase enzymes
- Each strand serves as a template for a new strand

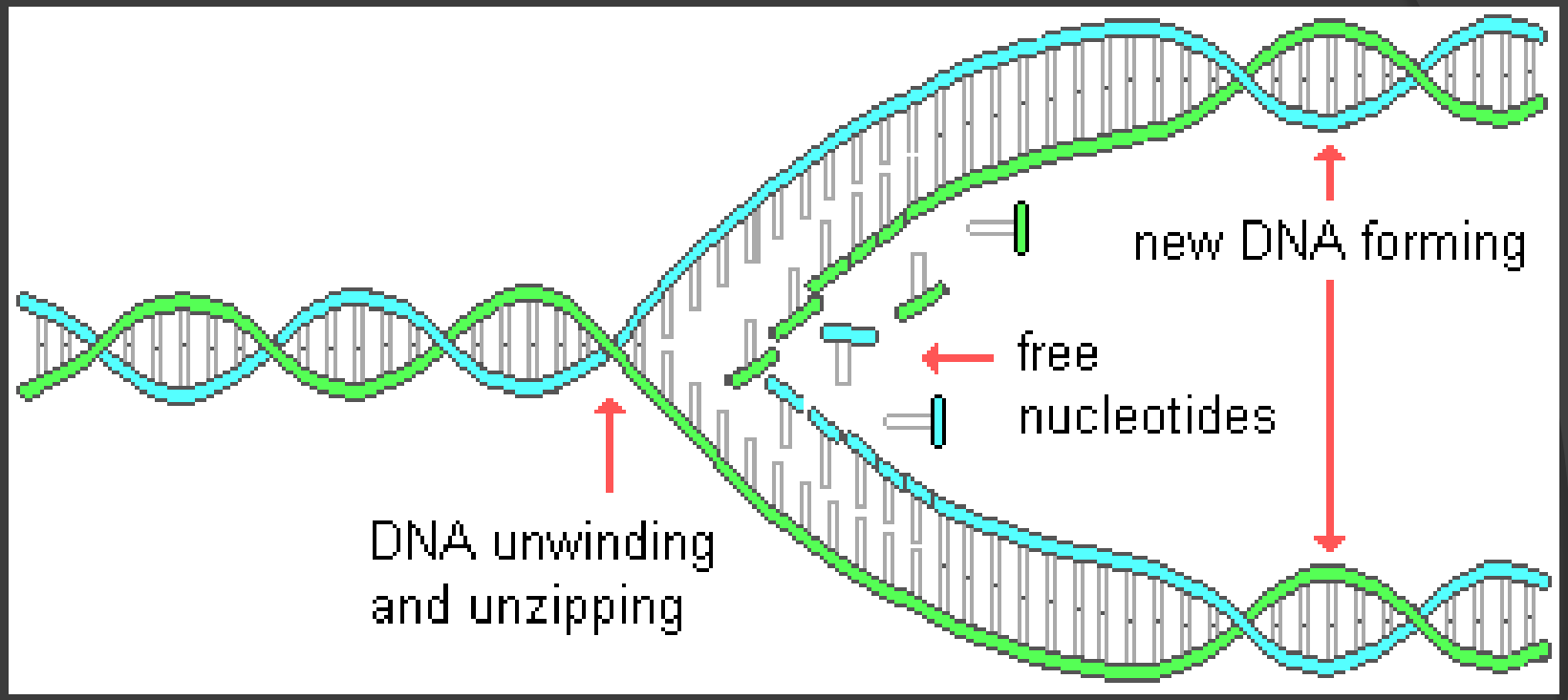

DNA molecule
unwinding and
unzipping along
the base pairs


STEP 1: Unzipping the
Parent DNA
Nitrogen
Base
Nitrogen
Base

DNA Replication

- Another enzyme called DNA Polymerase joins individual nucleotides (A, G, C, T) to the template strand
  - Complementary base-pairing

    A- T, G-C
- Enzyme also proof-reads the DNA for errors


new DNA forming
free
nucleotides
DNA unwinding
and unzipping