Chapter 8

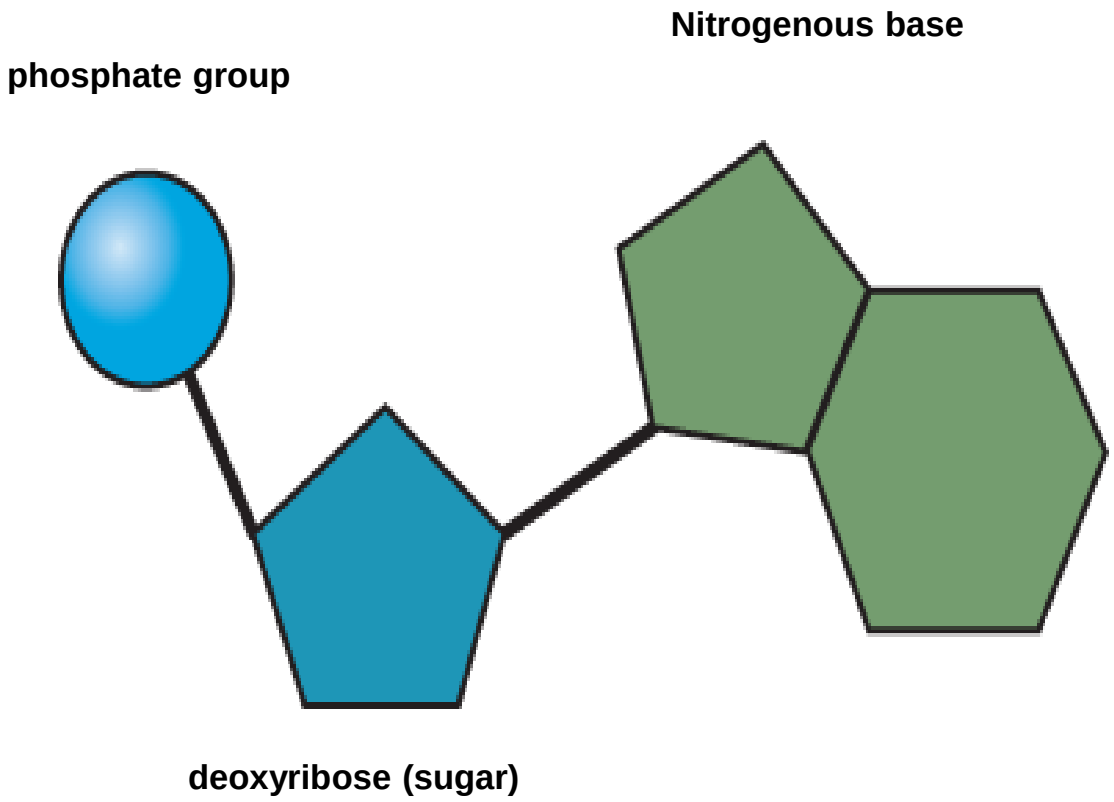
Sections 1-3

DNA & Replication

Deoxyribonucleic Acid

The Structure of DNA

- Building blocks of DNA called **nucleotides**
- 3 parts to a nucleotide:



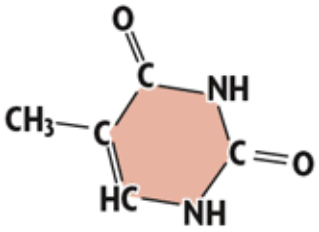
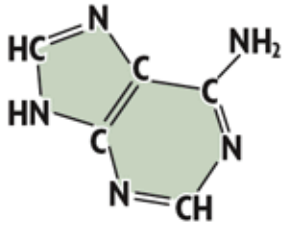
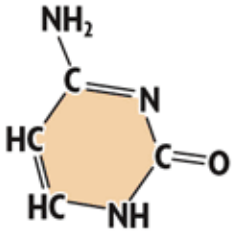
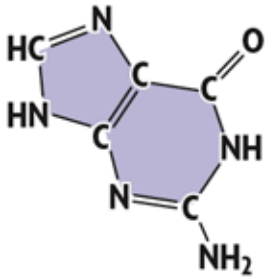
1). 5-carbon sugar called deoxyribose

2). Phosphate group

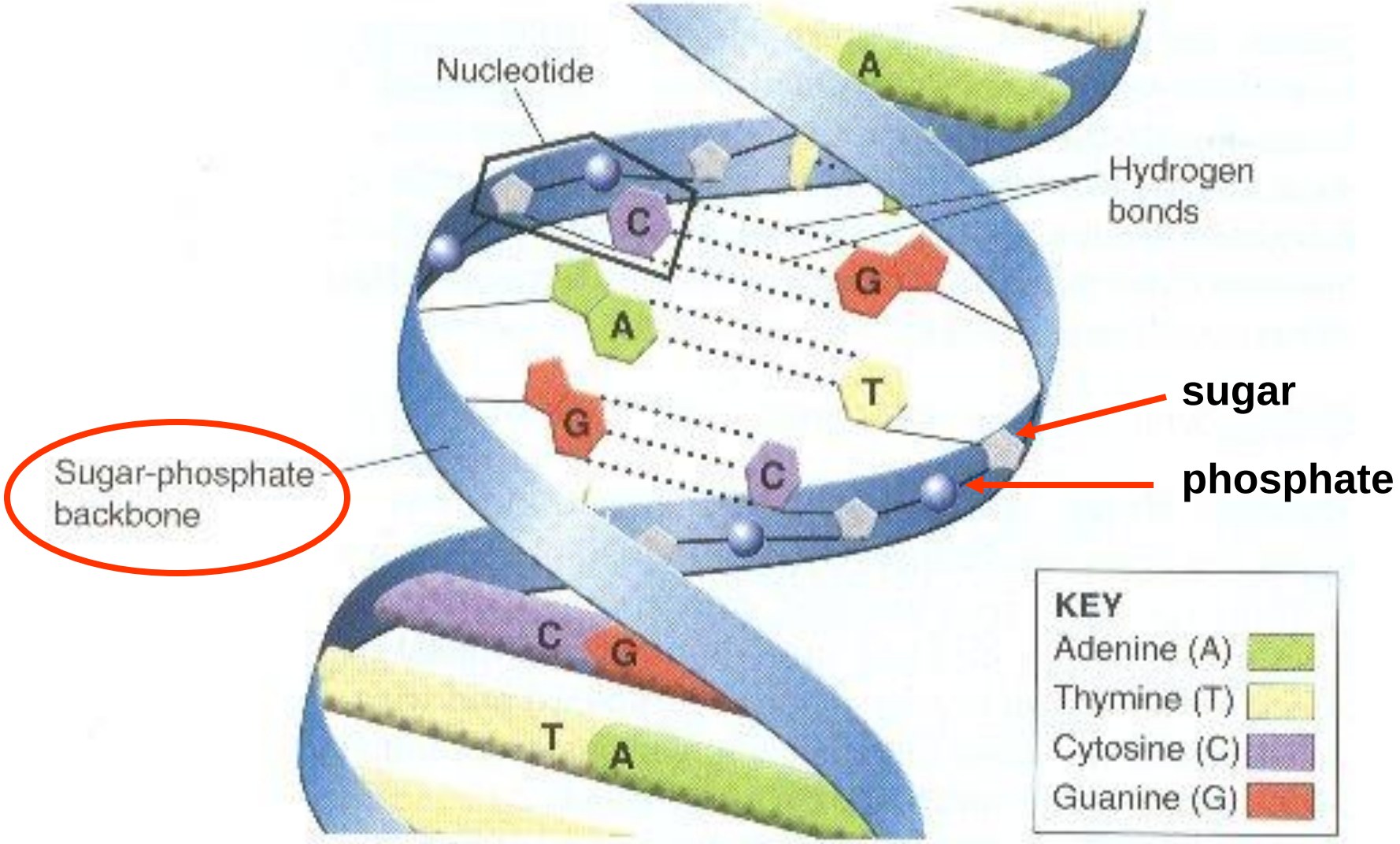
3). Nitrogenous base (A, T, C, or G)

4 nitrogen containing bases:

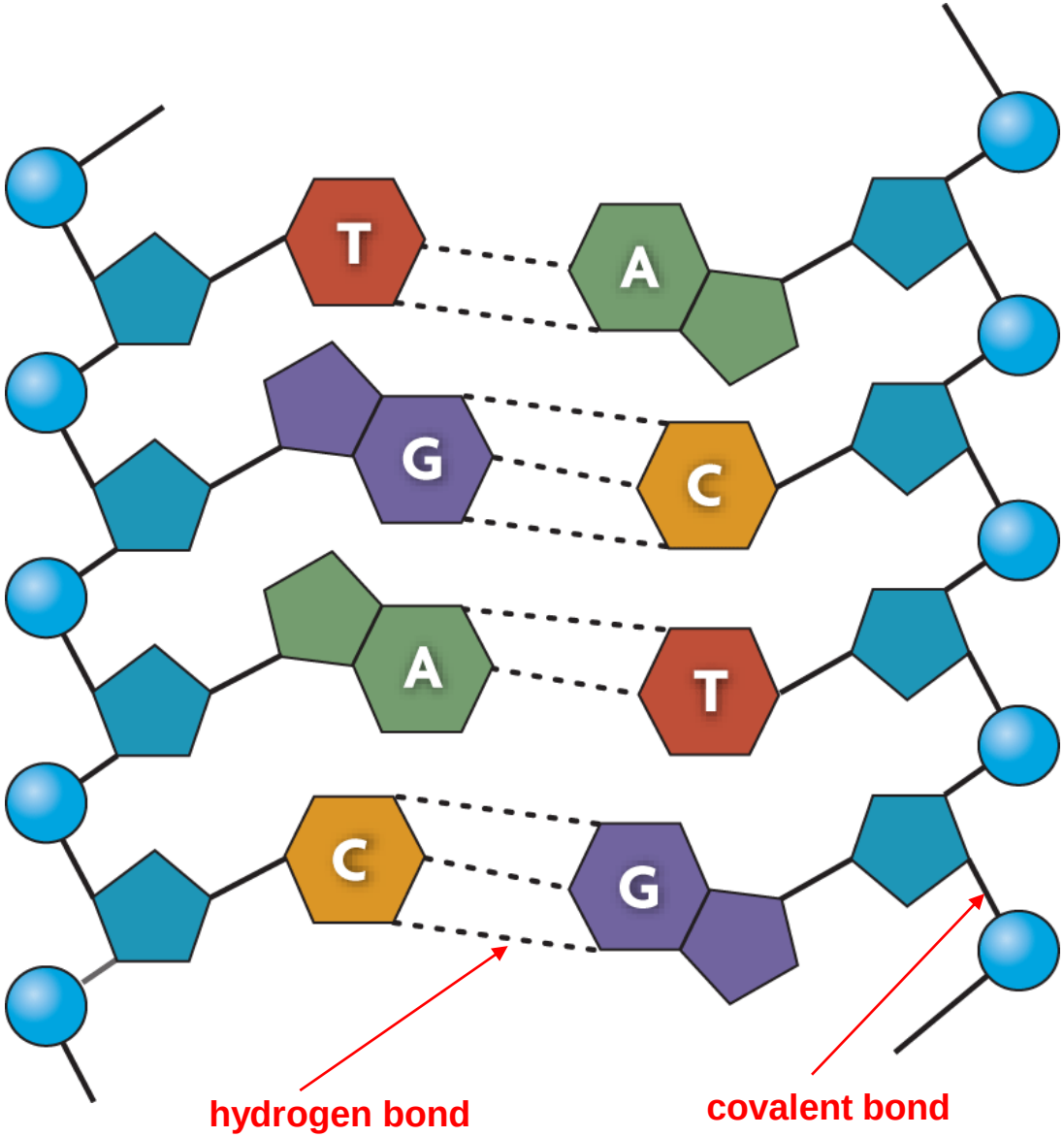
1. **Thymine**
2. **Cytosine**
3. **Adenine**
4. **Guanine**

PYRIMIDINES = SINGLE RING			PURINES = DOUBLE RING		
Name of Base	Structural Formula	Model	Name of Base	Structural Formula	Model
thymine			adenine		
cytosine			guanine		

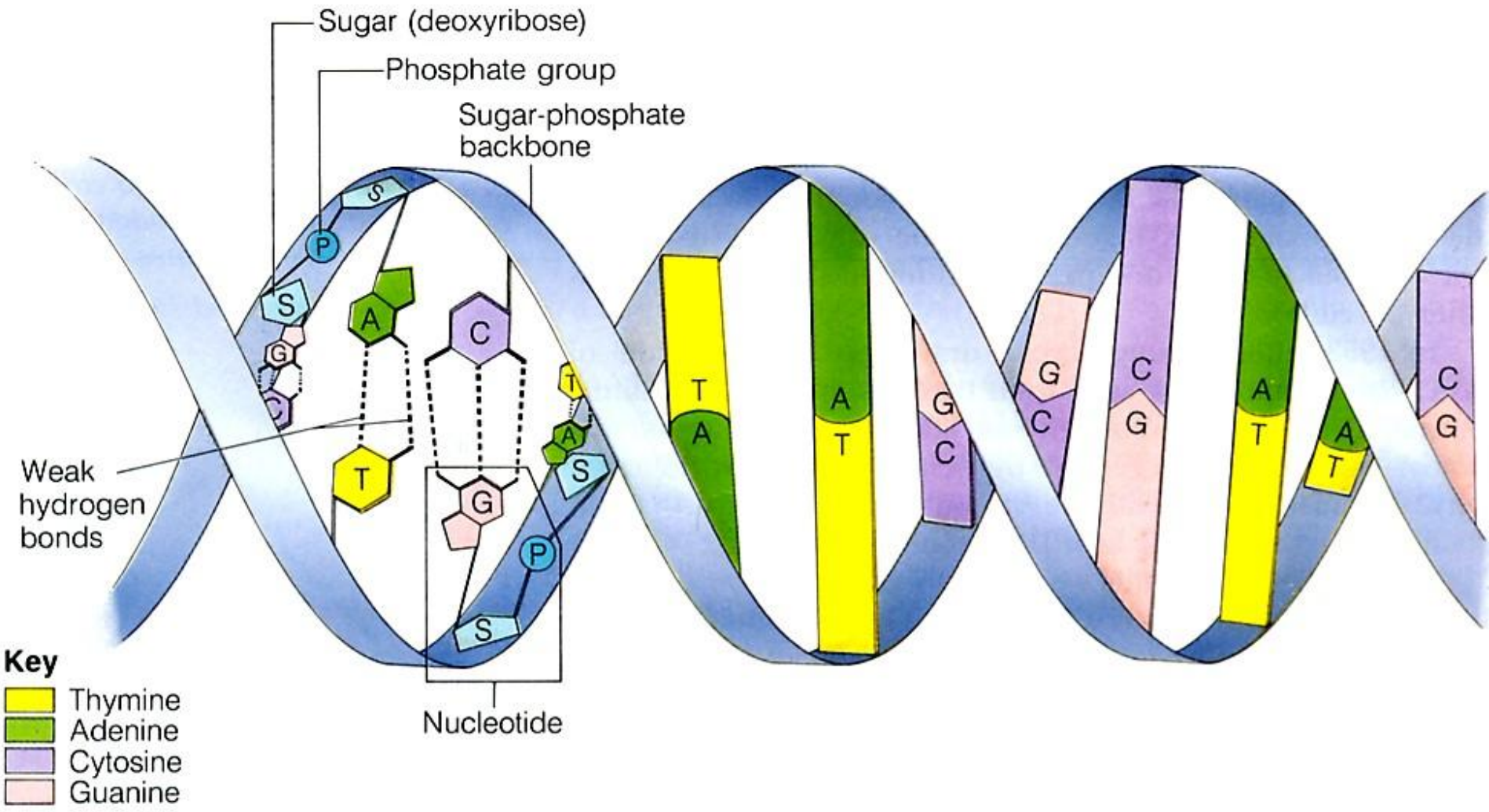
Double helix backbone in DNA formed by alternating sugar (Ribose) and phosphate groups



- The backbone is connected by covalent bonds.
- The bases are connected by hydrogen bonds.



The DNA Molecule



Chargaff's Rule

ratio of guanine:cytosine and adenine:thymine are equal

Percentages of Bases in Four Organisms

Source of DNA	A	T	G	C
Streptococcus	29.8	31.6	20.5	18.0
Yeast	31.3	32.9	18.7	17.1
Herring	27.8	27.5	22.2	22.6
Human	30.9	29.4	19.9	19.8

A = T and G ≡ C

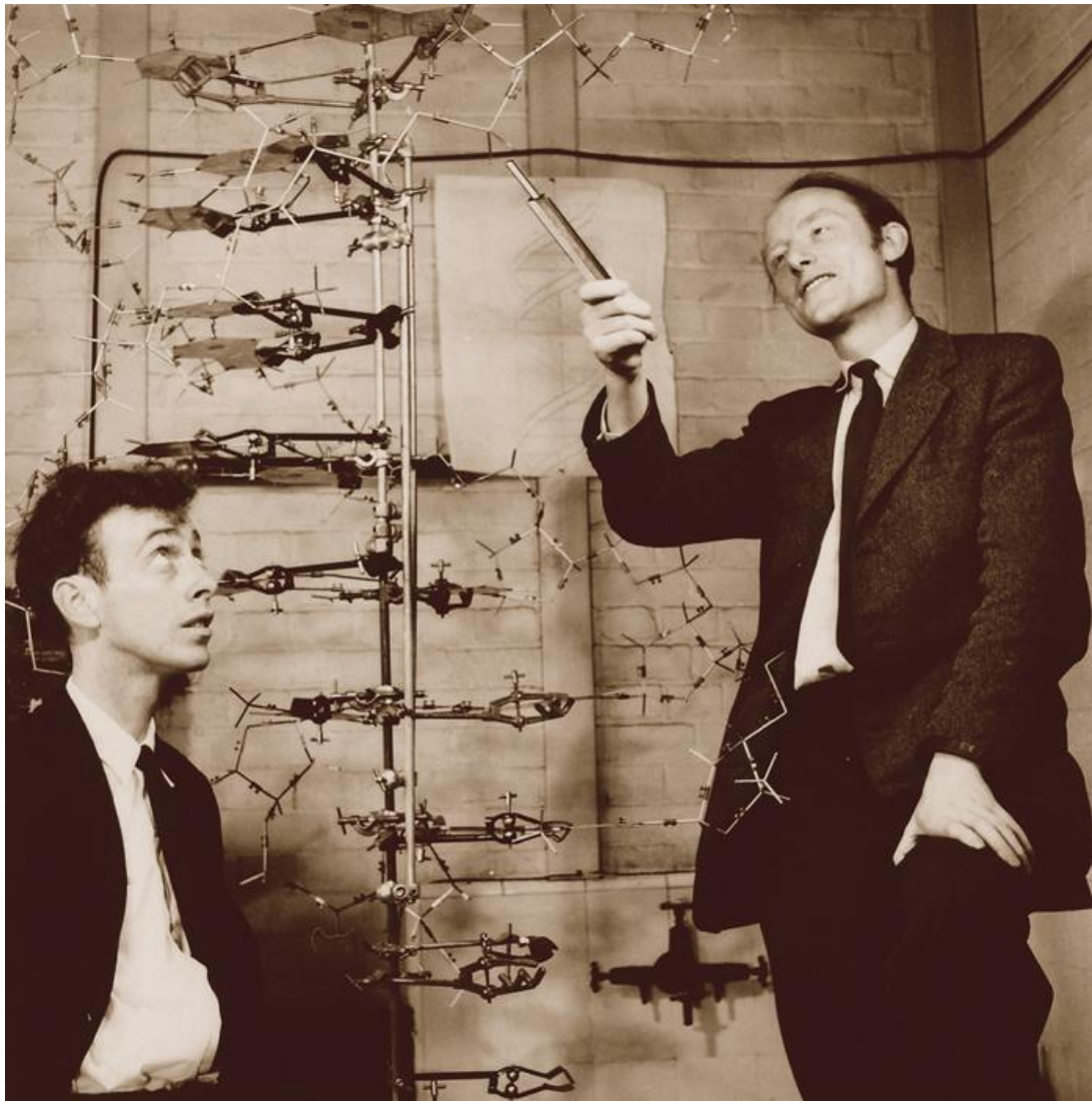
– Represents H bonds

- Watson and Crick's discovery built on the work of Rosalind Franklin and Chargaff's Rule.
  - Franklin's x-ray images suggested that DNA was a double helix of even width.
  - Chargaff's rules stated that A=T and C≡G.

The Double Helix DNA Model

After looking at Franklin and Chargaff's work, Watson and Crick constructed the first DNA model in (1953)

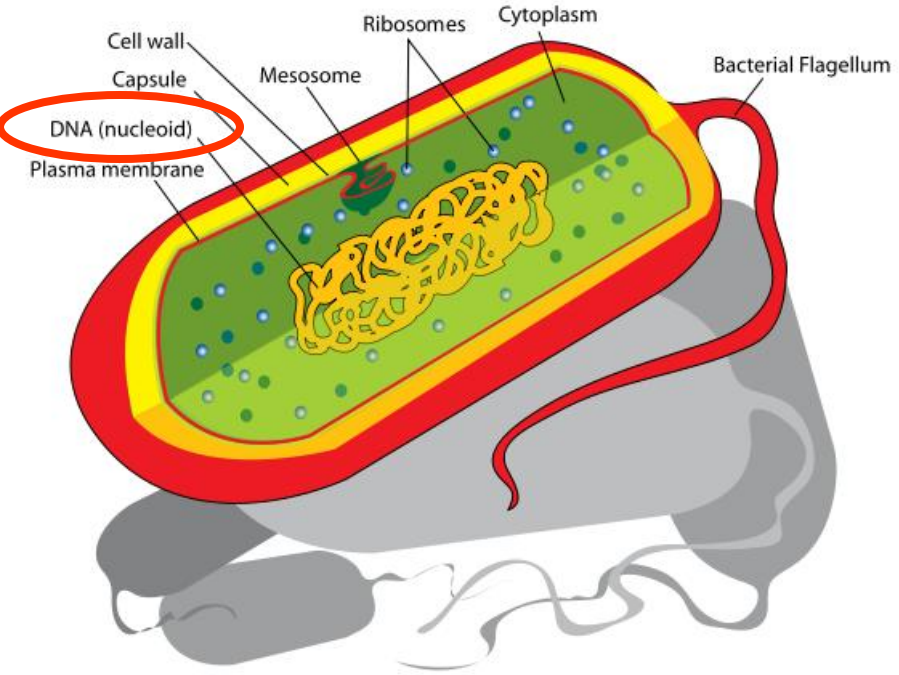
- They realized that DNA is a double helix that is made up of an alternating sugar (Ribose) and phosphate backbone with nitrogenous bases (A, T, C, G) on the inside connected by H bonds.

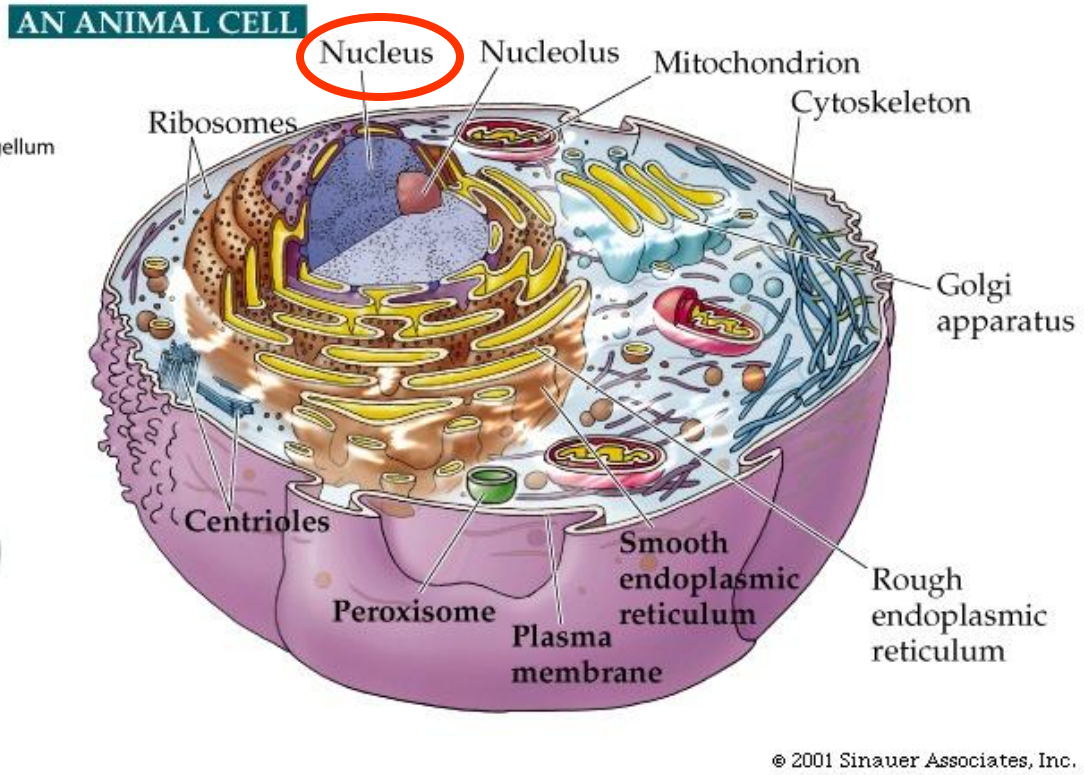


DNA is found in both eukaryotic and prokaryotic cells

Prokaryotic cells- DNA located in cytoplasm

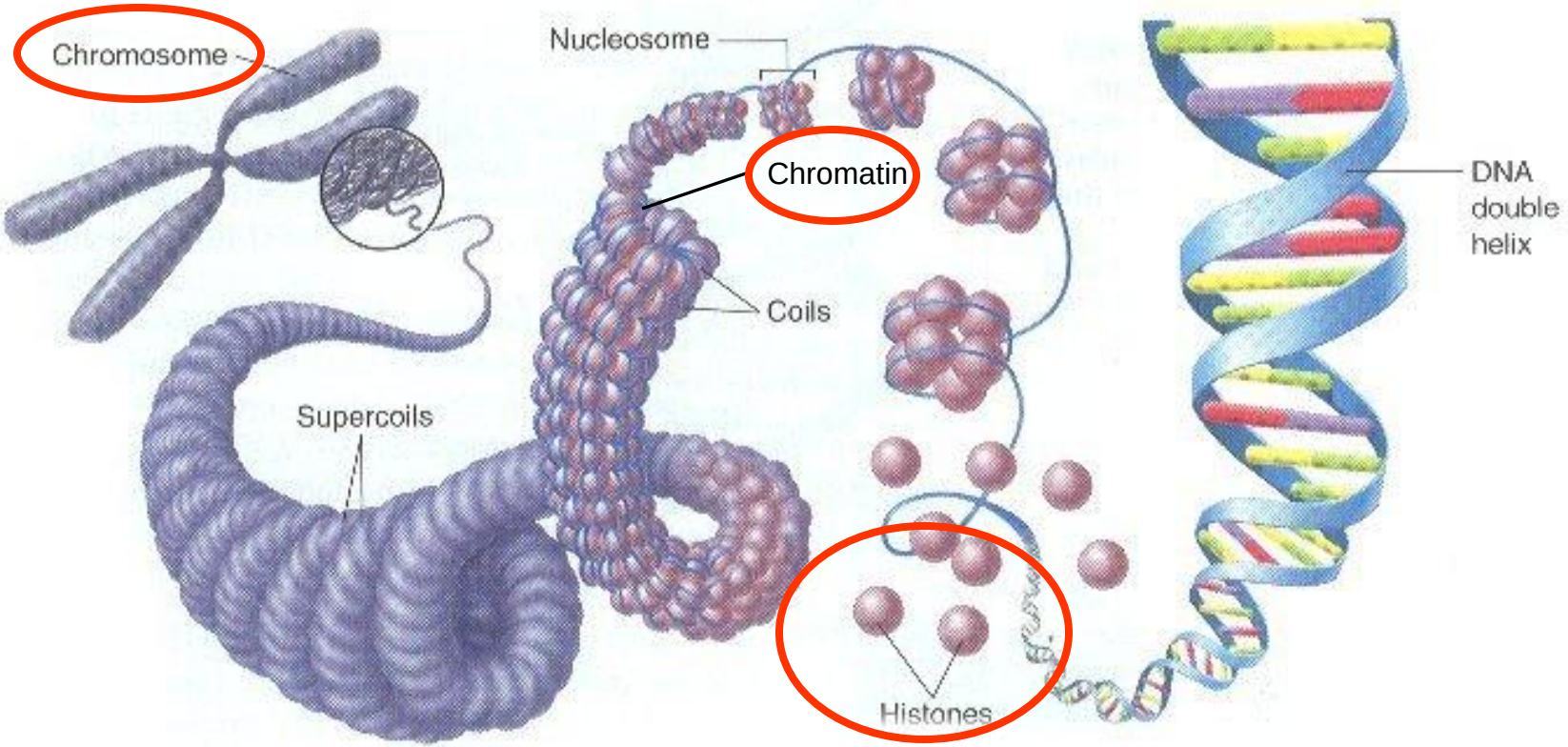
Eukaryotic cells- DNA located in cell nucleus





There are 2 forms of DNA:

1. Chromatin = loose combination of DNA and histones, which are proteins
   *It is loosely coiled DNA that looks like noodles
2. Chromosome = a single piece of tightly coiled condensed DNA containing genes
   *It looks like the letter “X”



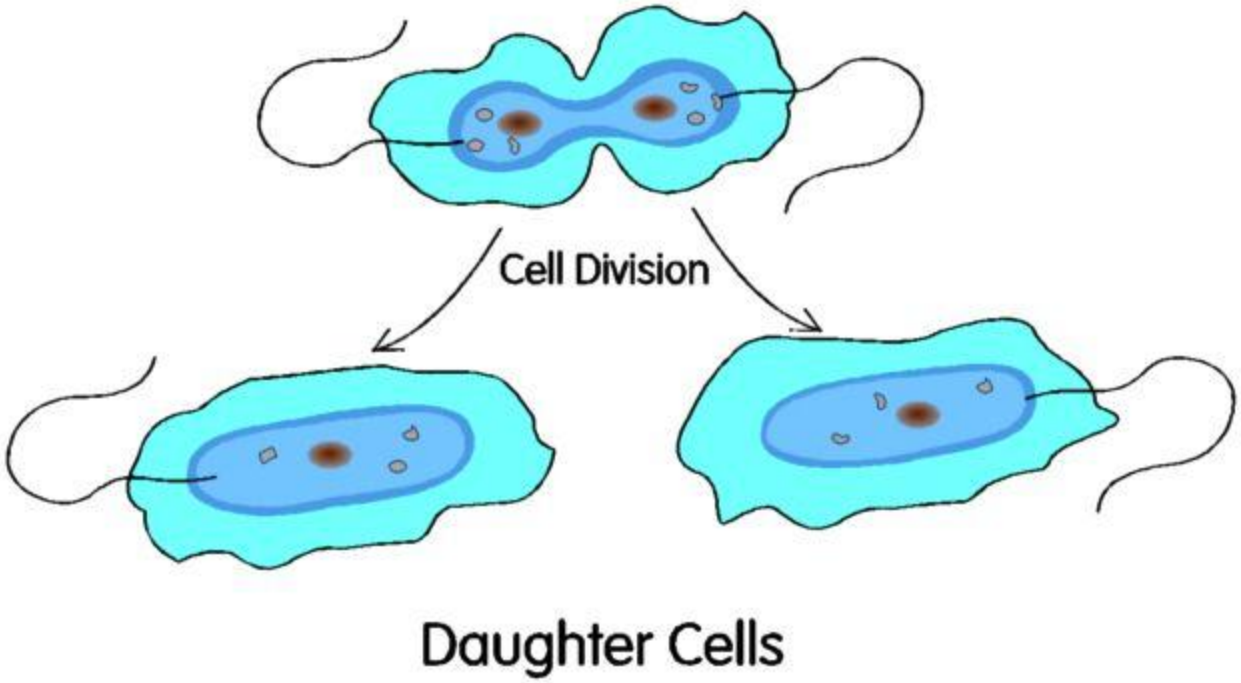
What is DNA Replication?

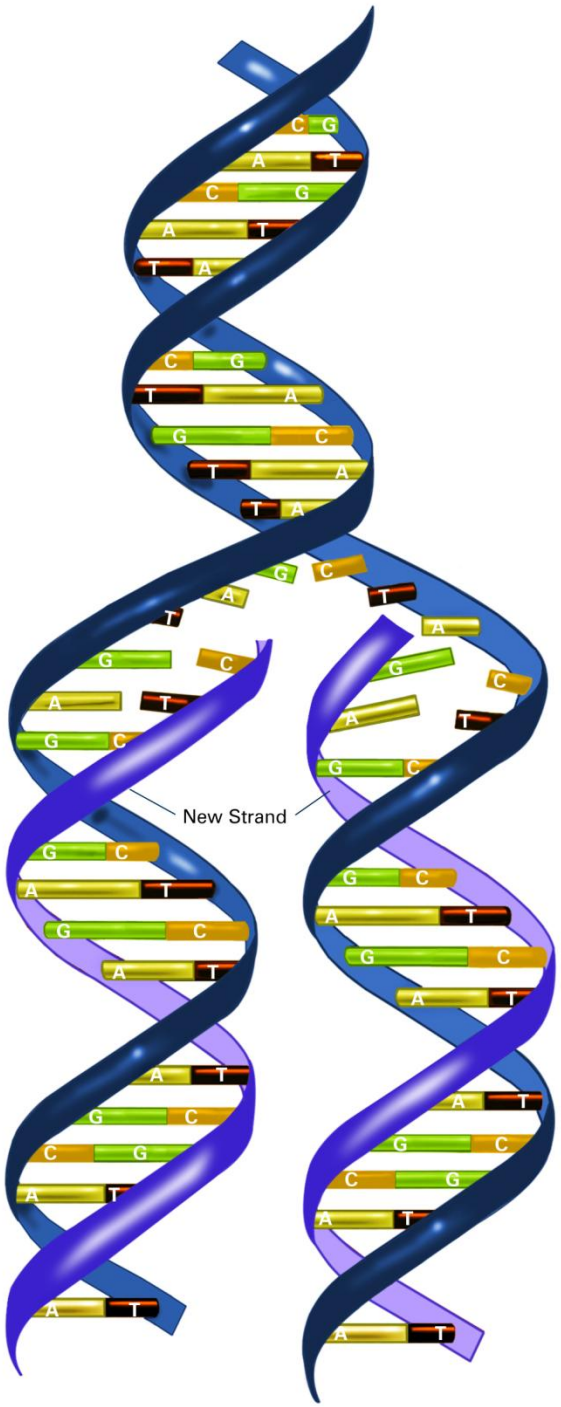
The process in which a cell copies its DNA

Why does a cell need to copy its DNA?

To prepare for cell division and to create more cells that contain identical strands of DNA

Example: Bacteria

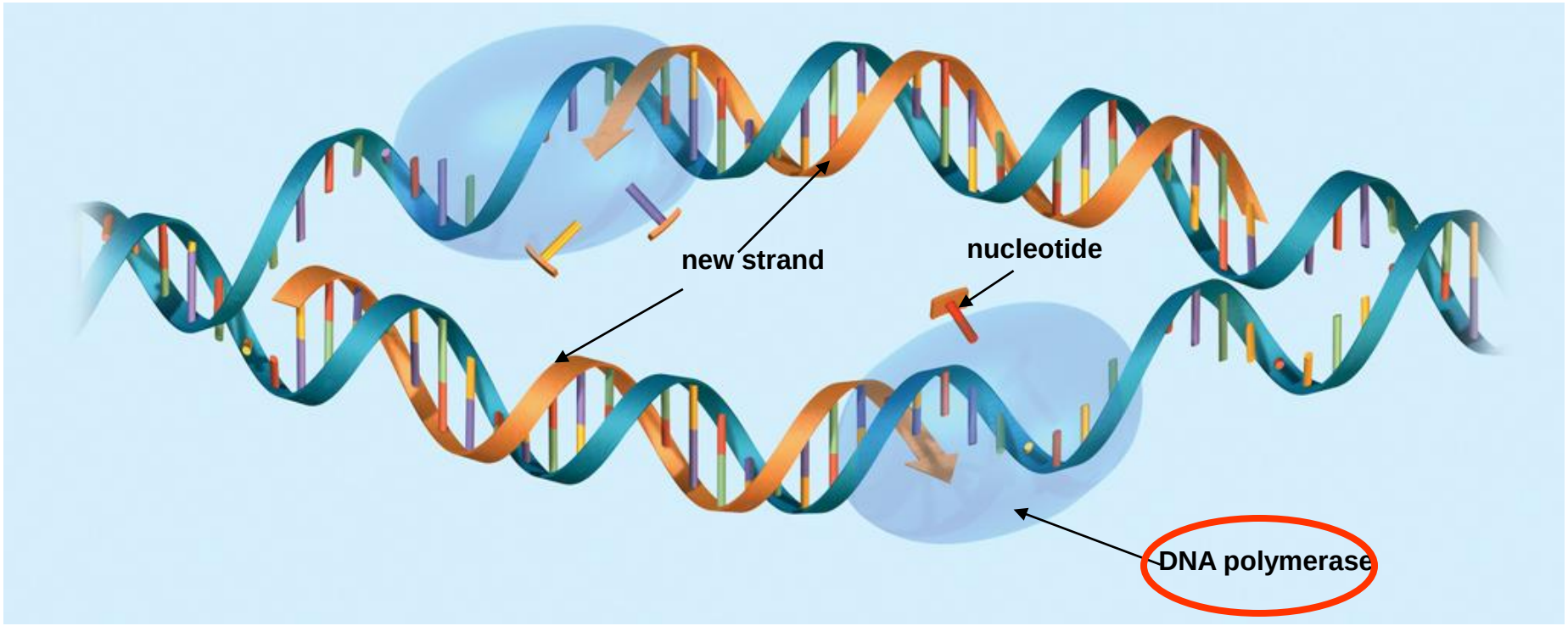




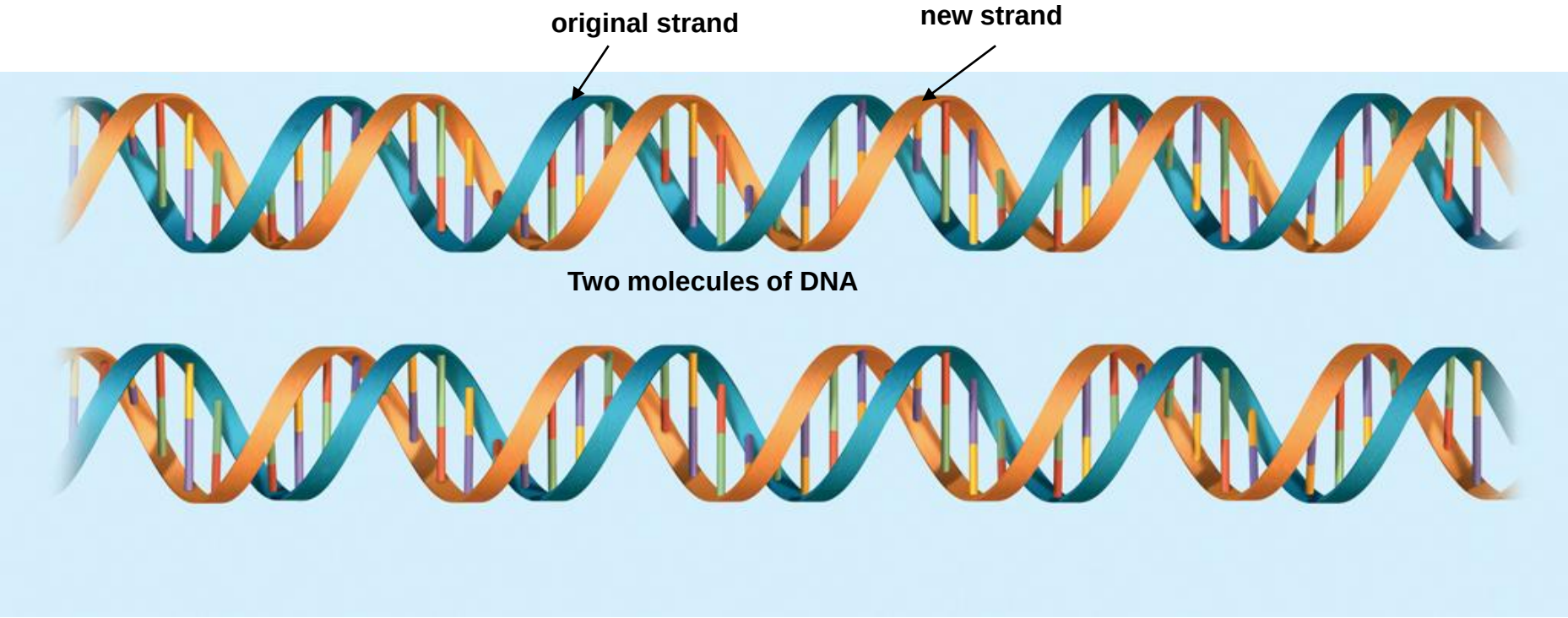
There are 4 steps to DNA Replication:

1. DNA Polymerase (enzyme) breaks H bonds between nucleotides to separate DNA into 2 strands. Each original strand of DNA serves as a template for a new strand.
2. Follow rules of base pairing to replace “missing” bases:
   A = T and C = G

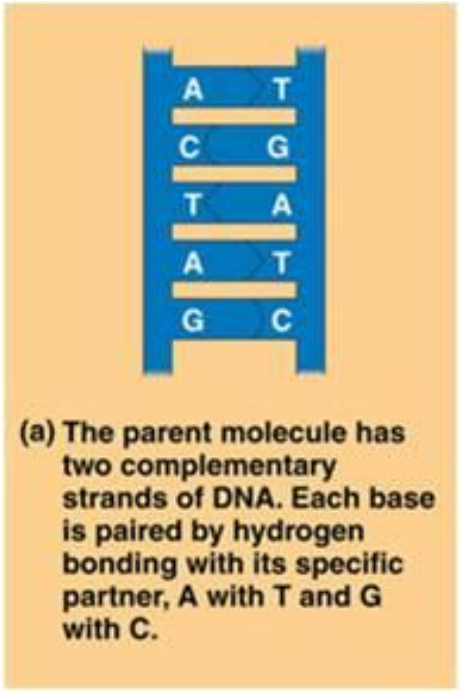
3. DNA Polymerase bonds the nucleotides together to reform the double helix and edits the DNA for mistakes. (The enzymes acts as “molecular scissors”, glue and an editor)



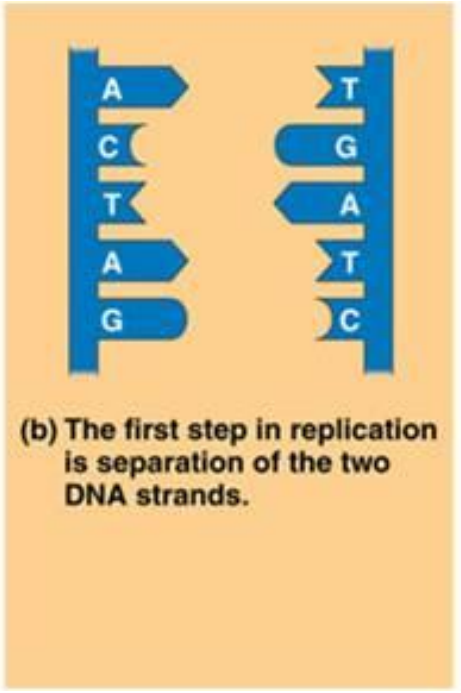
4. 2 new identical strands of DNA are produced. The DNA is semi conservative: original DNA strand paired with new DNA strand



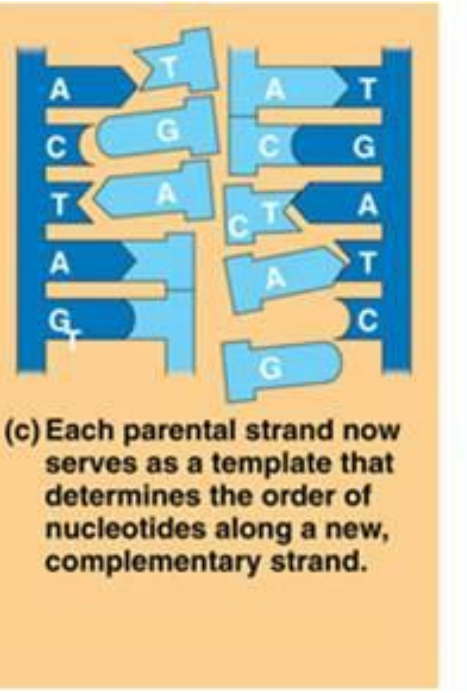
Summary of DNA Replication



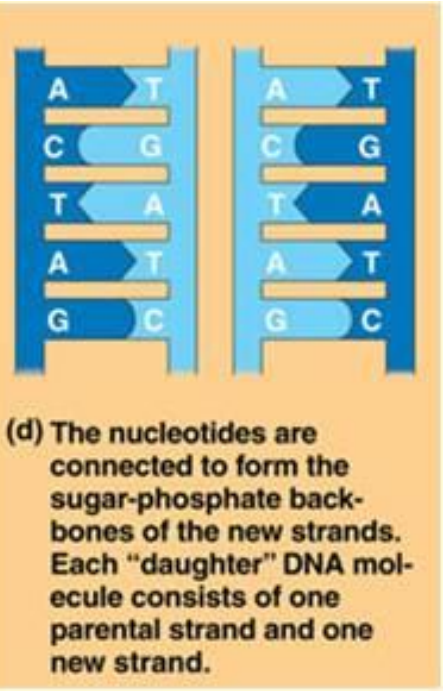
(a) The parent molecule has two complementary strands of DNA. Each base is paired by hydrogen bonding with its specific partner, A with T and G with C.



(b) The first step in replication is separation of the two DNA strands.

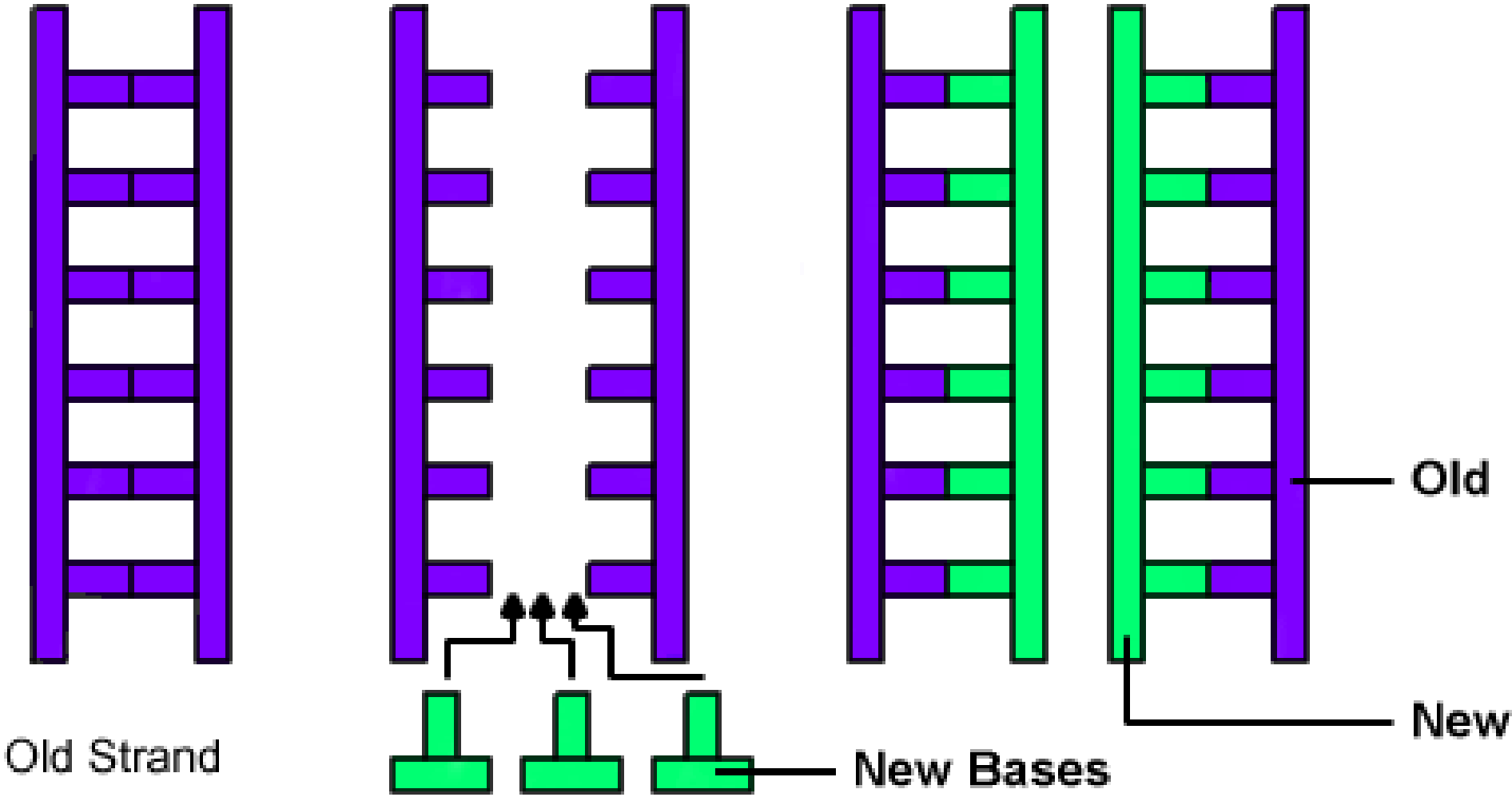


(c) Each parental strand now serves as a template that determines the order of nucleotides along a new, complementary strand.



(d) The nucleotides are connected to form the sugar-phosphate backbones of the new strands. Each "daughter" DNA molecule consists of one parental strand and one new strand.

DNA Replication in a Nut Shell



Double helix unzips
New bases (A,T,G,C) are added

Two new strands are created, each contain half of the original strand.