

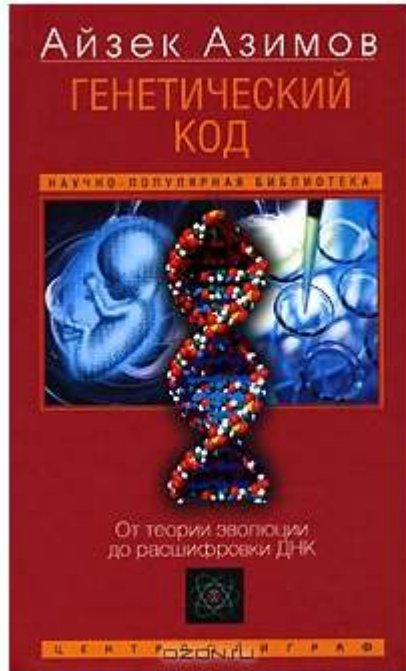
# **Molecular biology and Genetics**

Pavel Dobrynin

# What is biology?



# Recommended reading

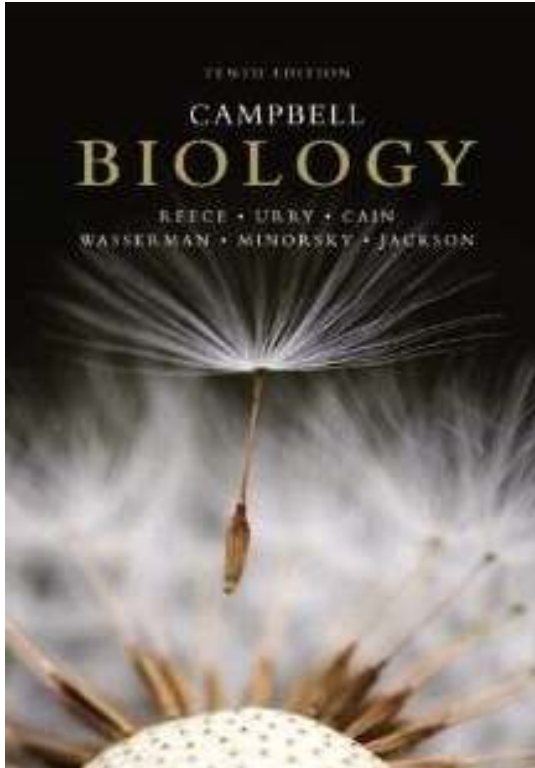


Генетический код. От теории эволюции до расшифровки ДНК

The Genetic Code

ISBN 5-9524-2230-6; 2006 г.

# Recommended reading

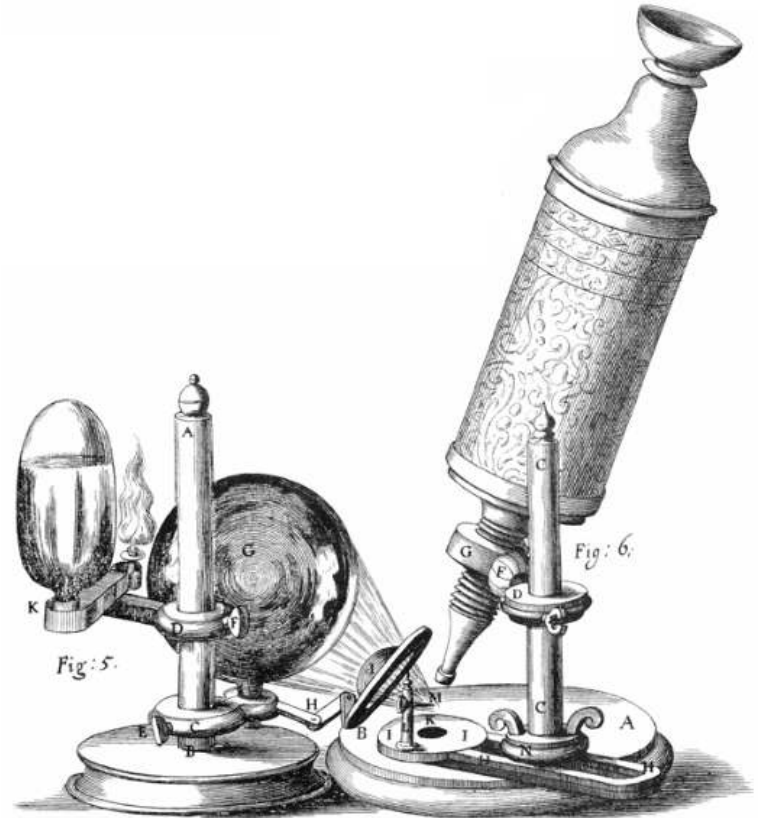


Campbell Biology (10th  
Edition)

ISBN-10: 0321775651

# Discovery of Cell

The cell was first discovered by Robert Hooke in 1665.



# Cell Theory

1. All living organisms are composed of one or more cells
2. The cell is the most basic unit of life.
3. All cells arise from pre-existing, living cells.

# Modern Interpretation of Cell Theory

All known living things are made up of one or more cells.

All living cells arise from pre-existing cells by division.

The cell is the fundamental unit of structure and function in all living organisms.

The activity of an organism depends on the total activity of independent cells.

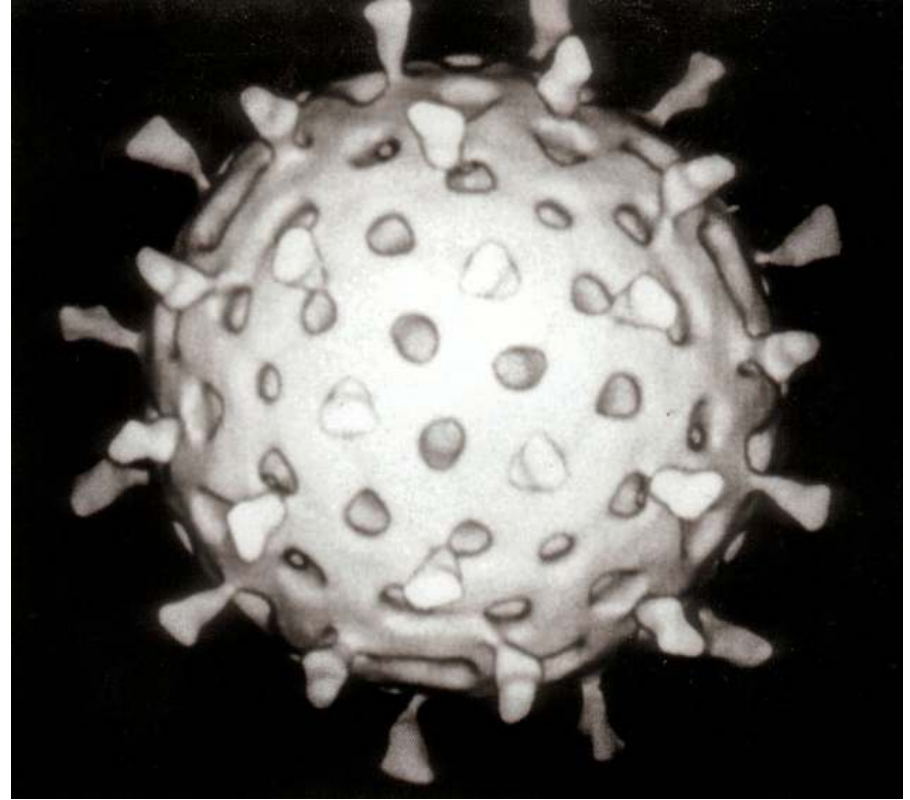
Energy flow (metabolism and biochemistry) occurs within cells.

Cells contain DNA which is found specifically in the chromosome and RNA found in the cell nucleus and cytoplasm.

All cells are basically the same in chemical composition in organisms of similar species

# Viruses

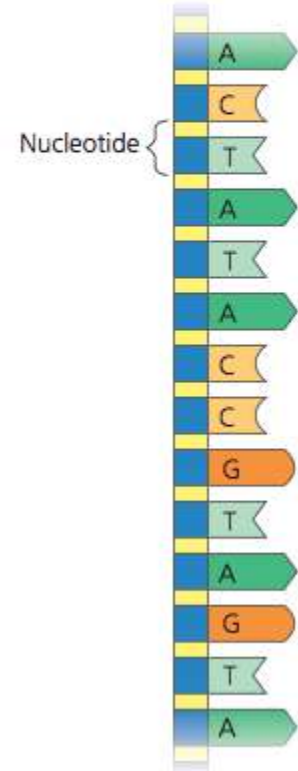
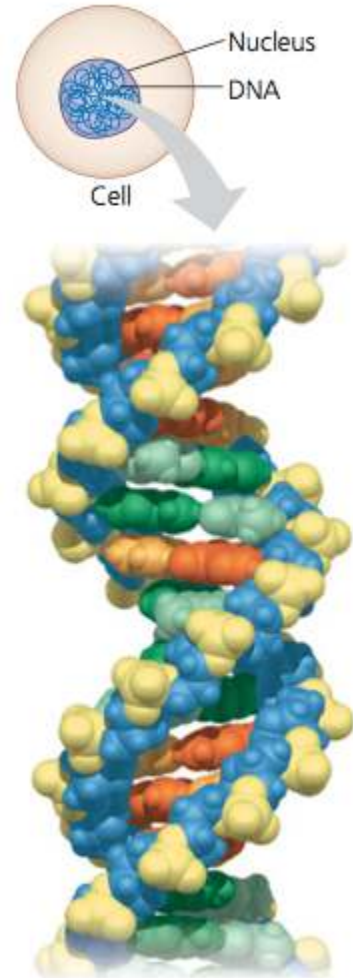
1. Small infectious agents
2. Replicate only in living cell
3. Infect all types of living organism





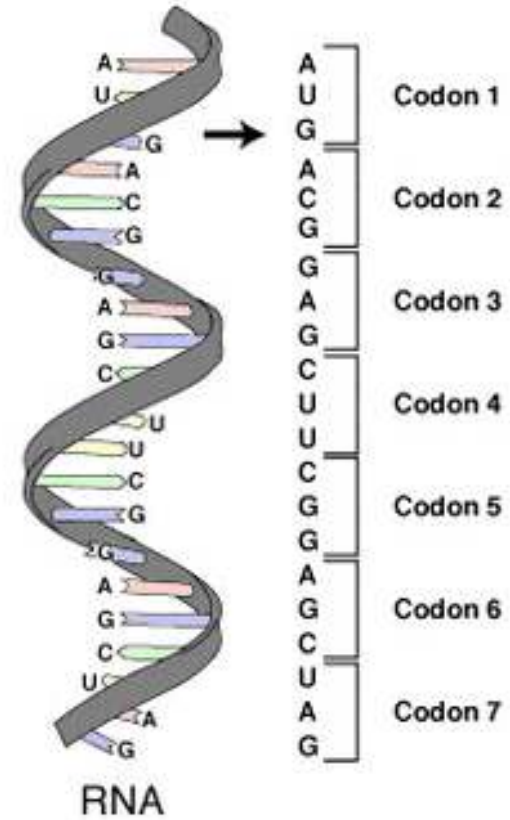
# DNA

- Deoxyribonucleic Acid
- double stranded
- bases: adenine, guanine, thymine and cytosine



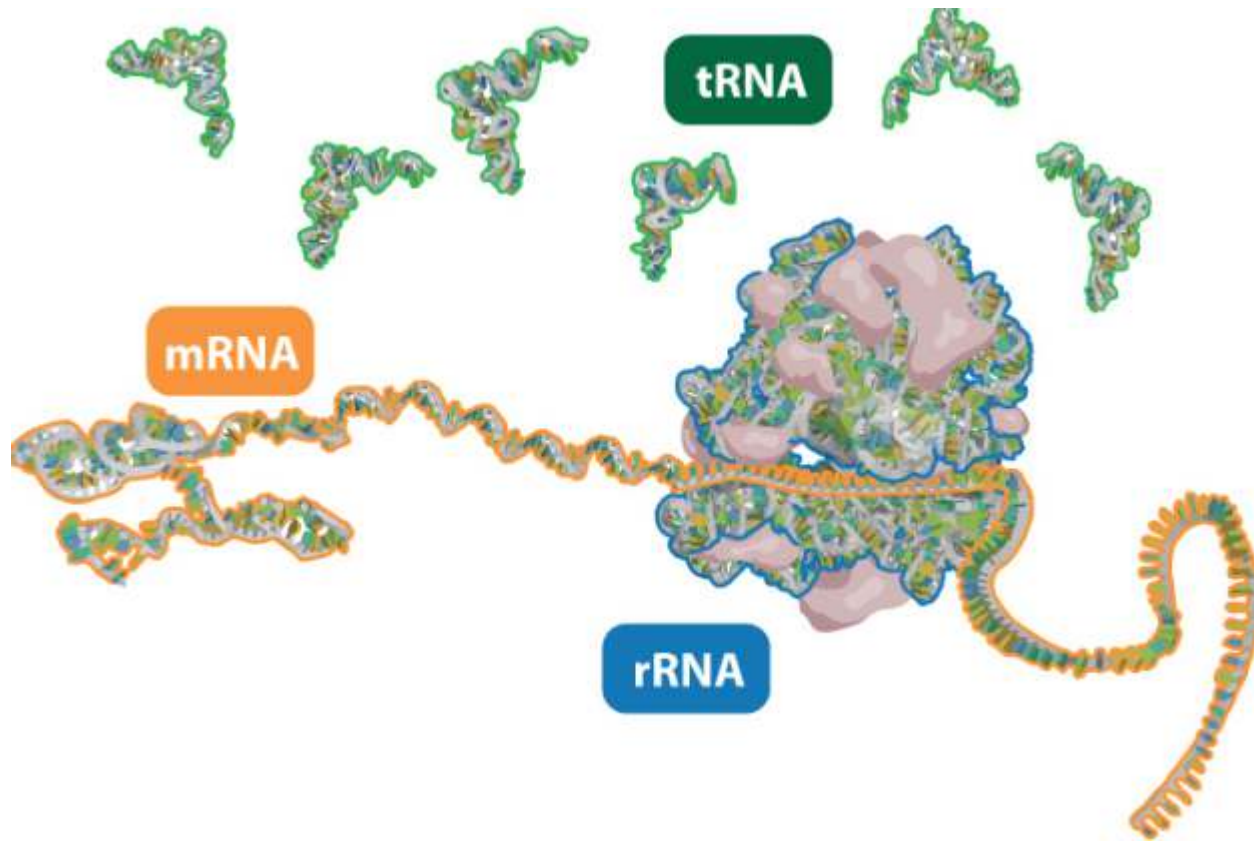
# Genetic Code

1. Sequence reading frame
2. Start/Stop codons
3. Degeneracy
4. Could be slightly different from one organism to another

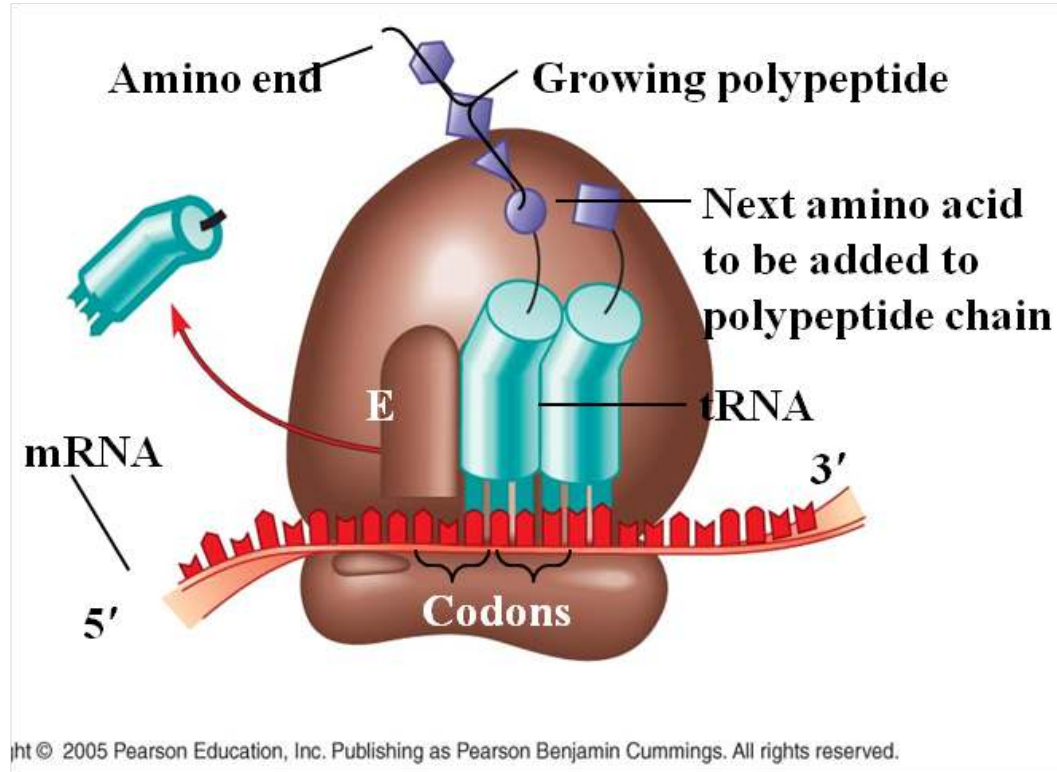


Ribonucleic acid

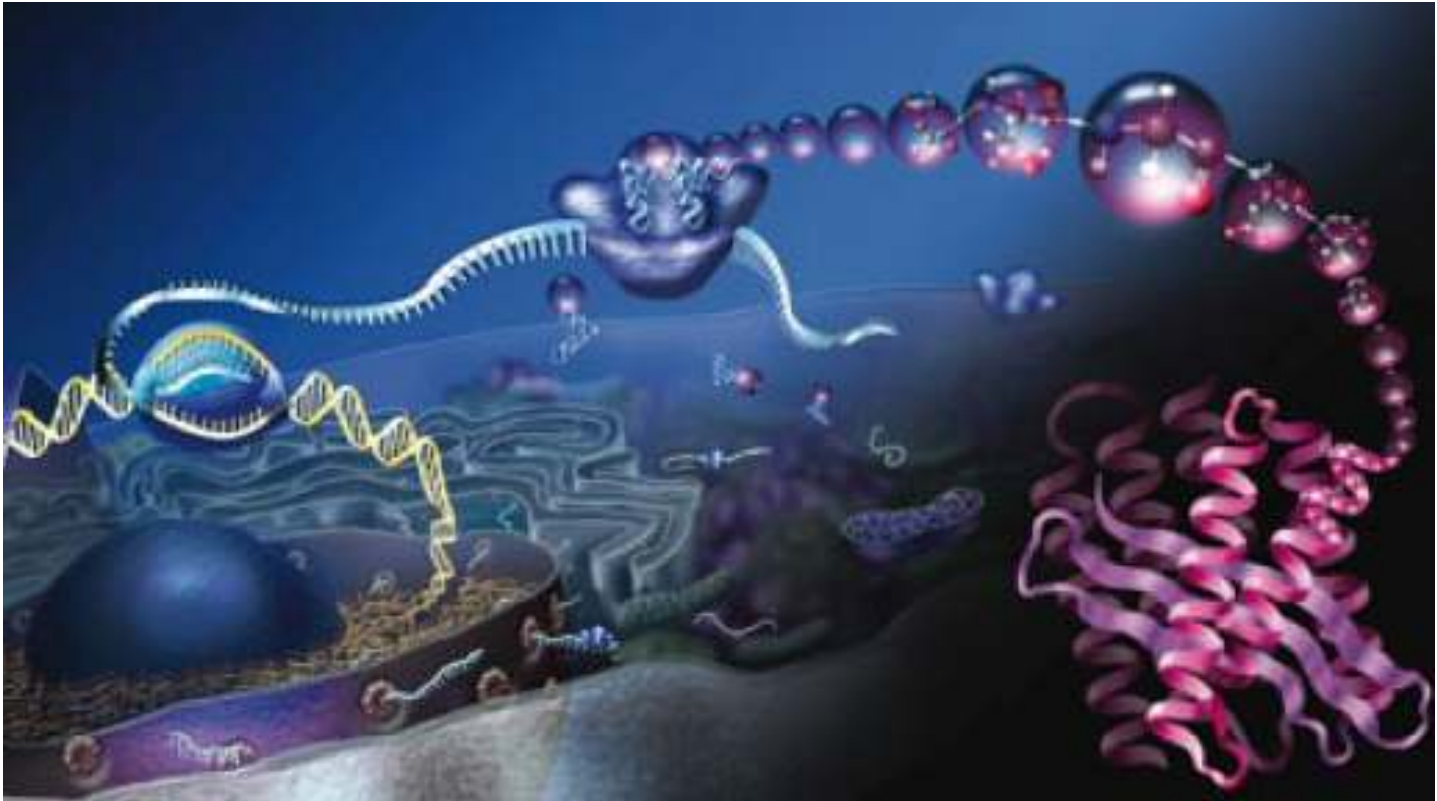
# RNA



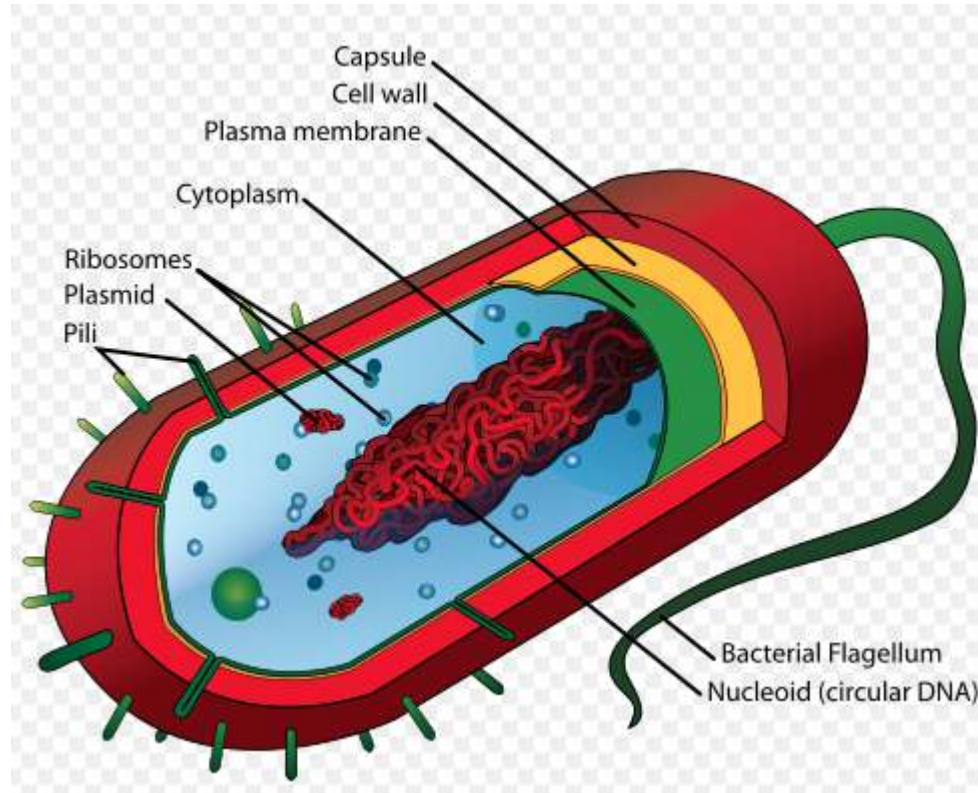
# RNA Translation



# Molecular biology

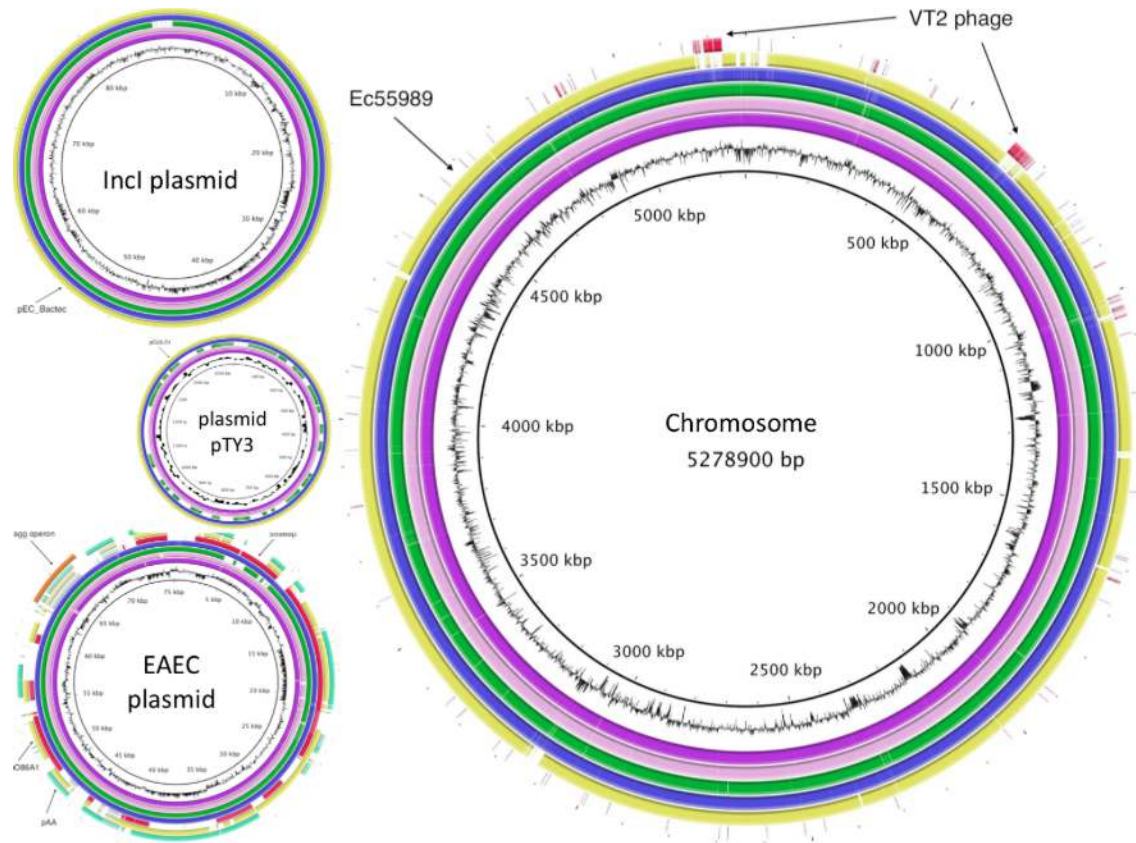


# Prokaryotic Cell



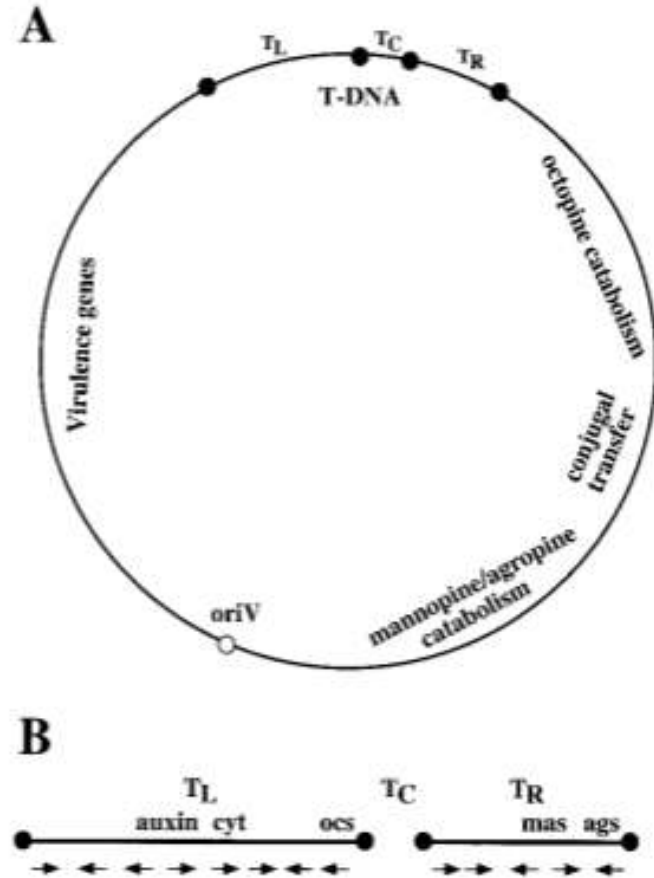


# Bacterial Genome



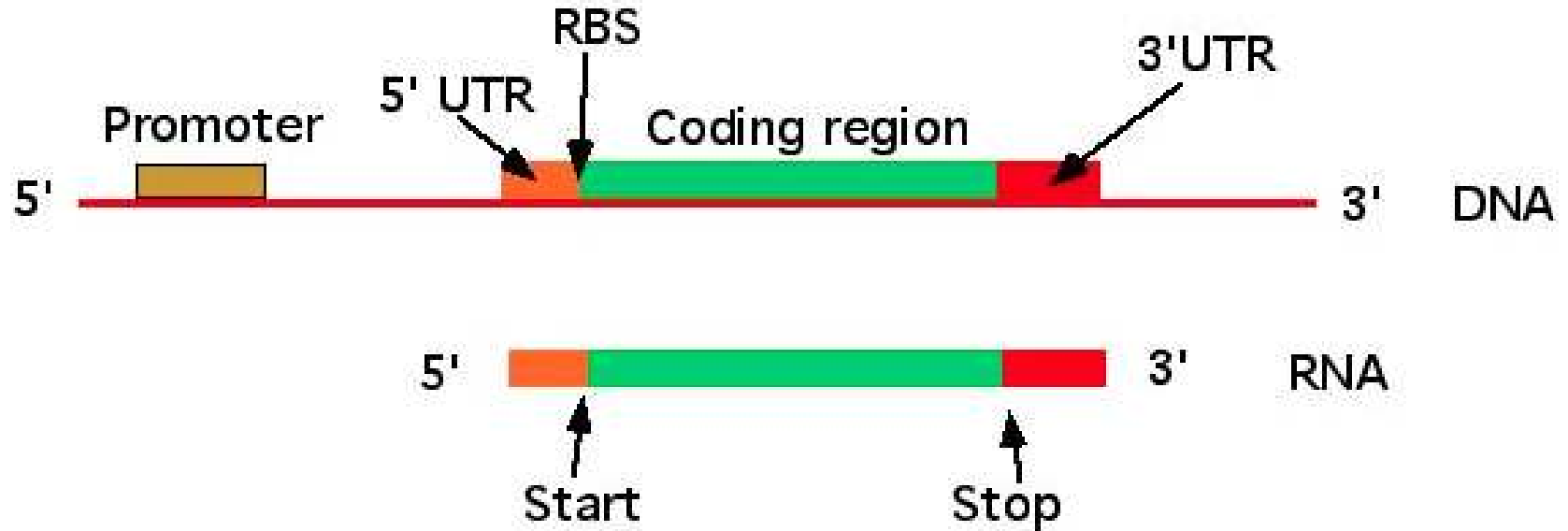
# GMO?

- A. Ti-plasmid
- B. Ti-region

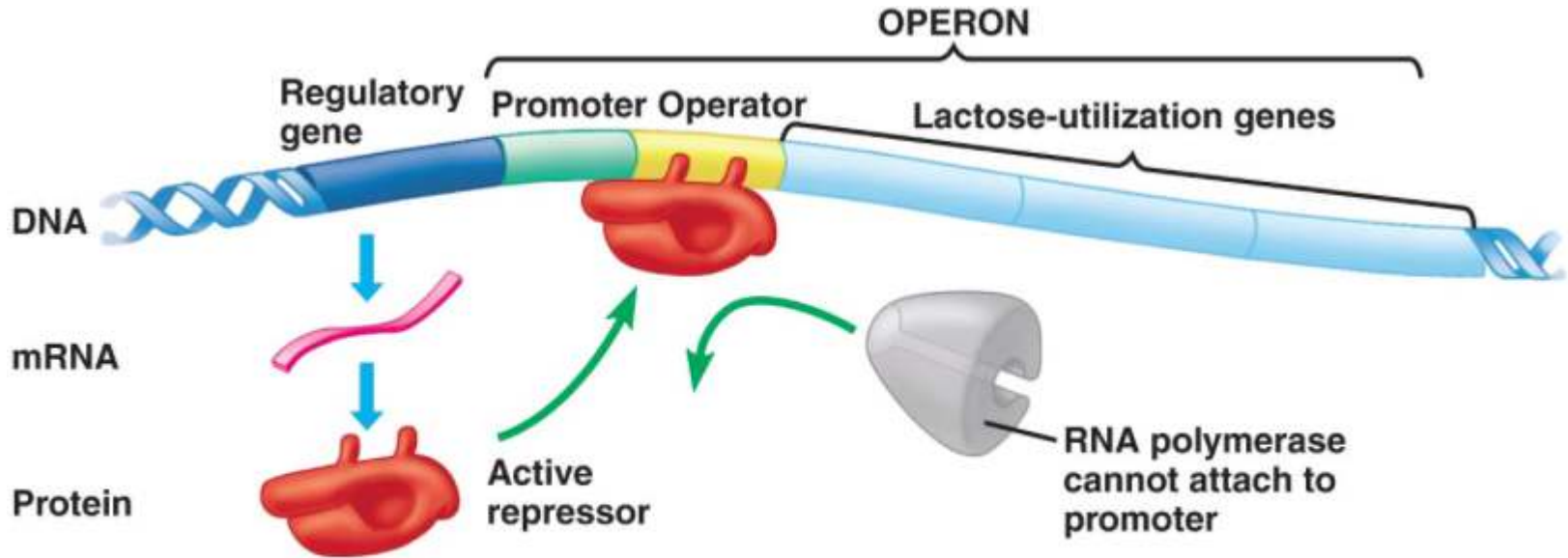




# Prokaryotic Gene Structure

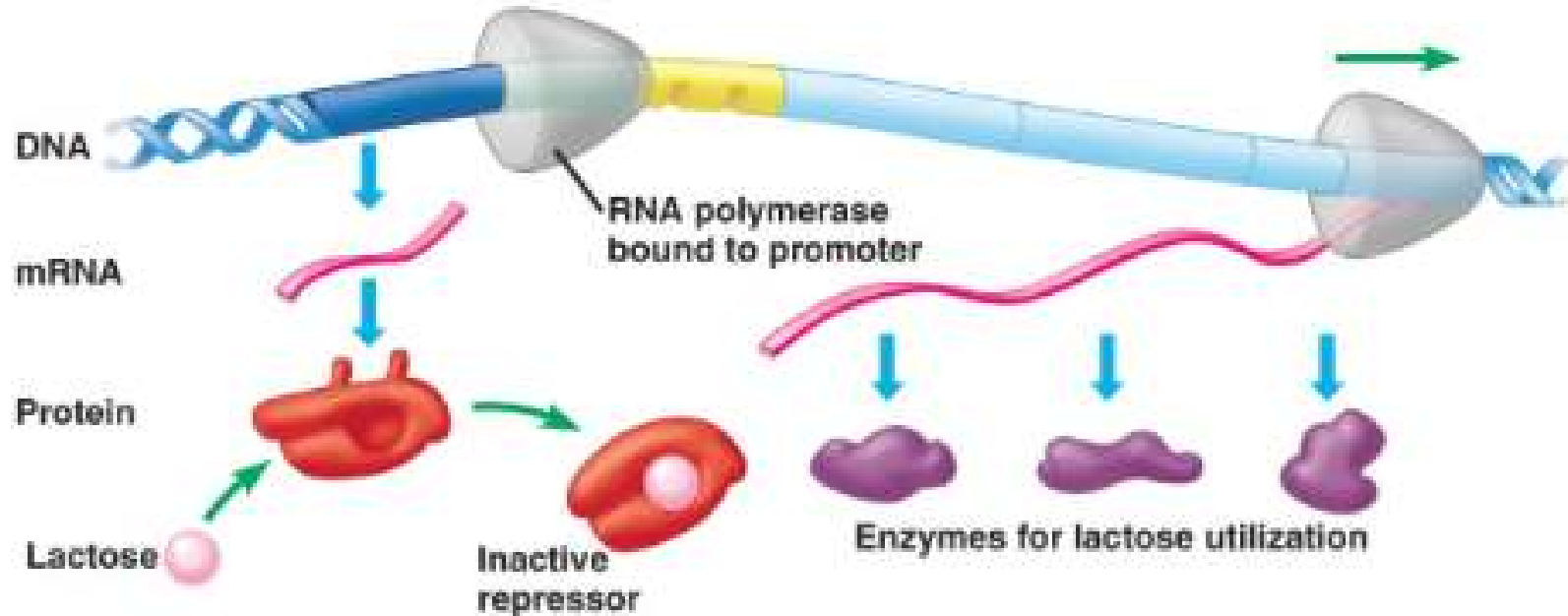


# Lac Operon Inactive



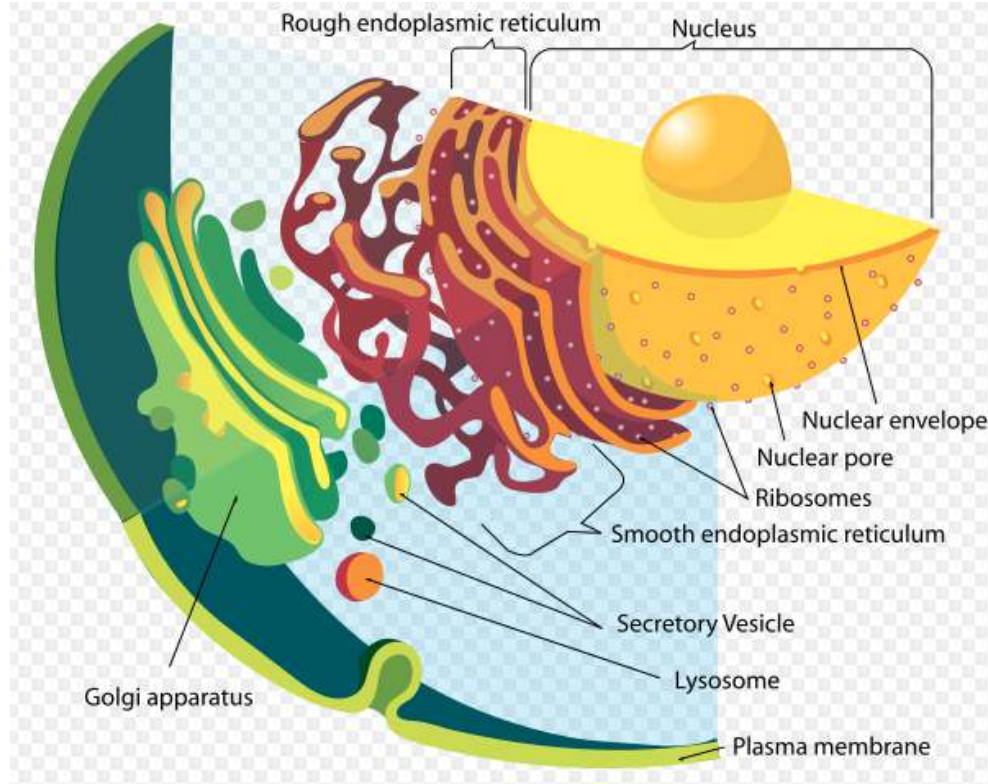
**Operon turned off (lactose absent)**

# Lac Operon Active

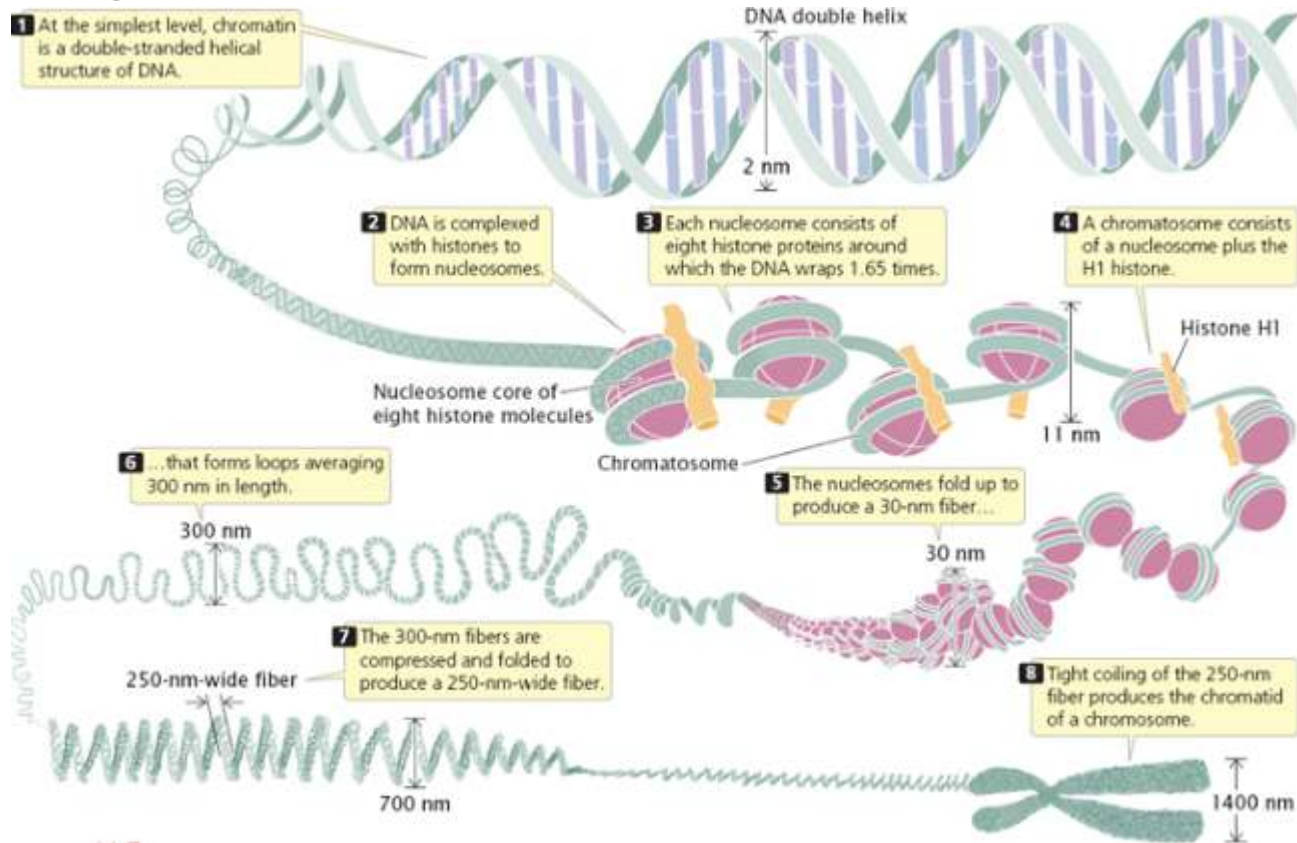


Operon turned on (lactose inactivates repressor)

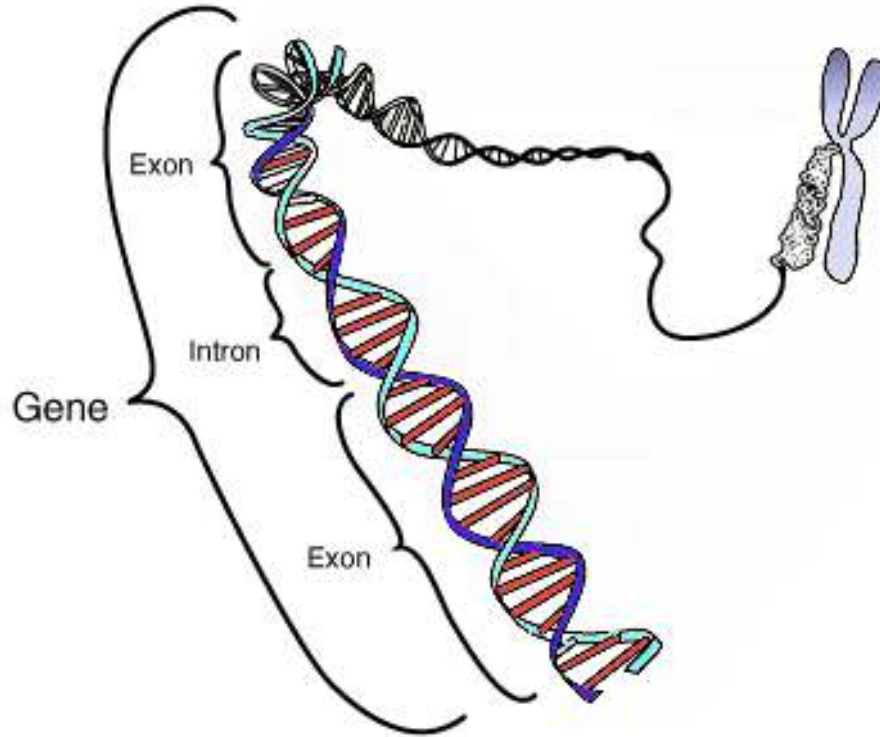
# Eukaryotic Cell Structure



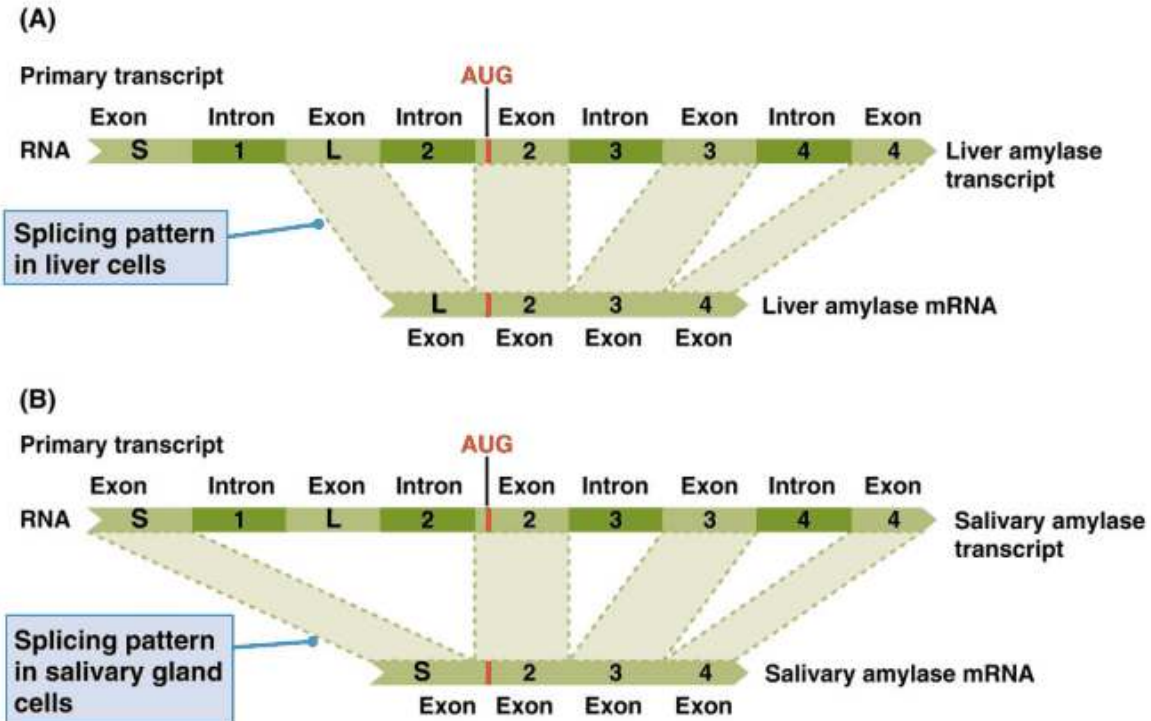
# Eukaryotic Genome



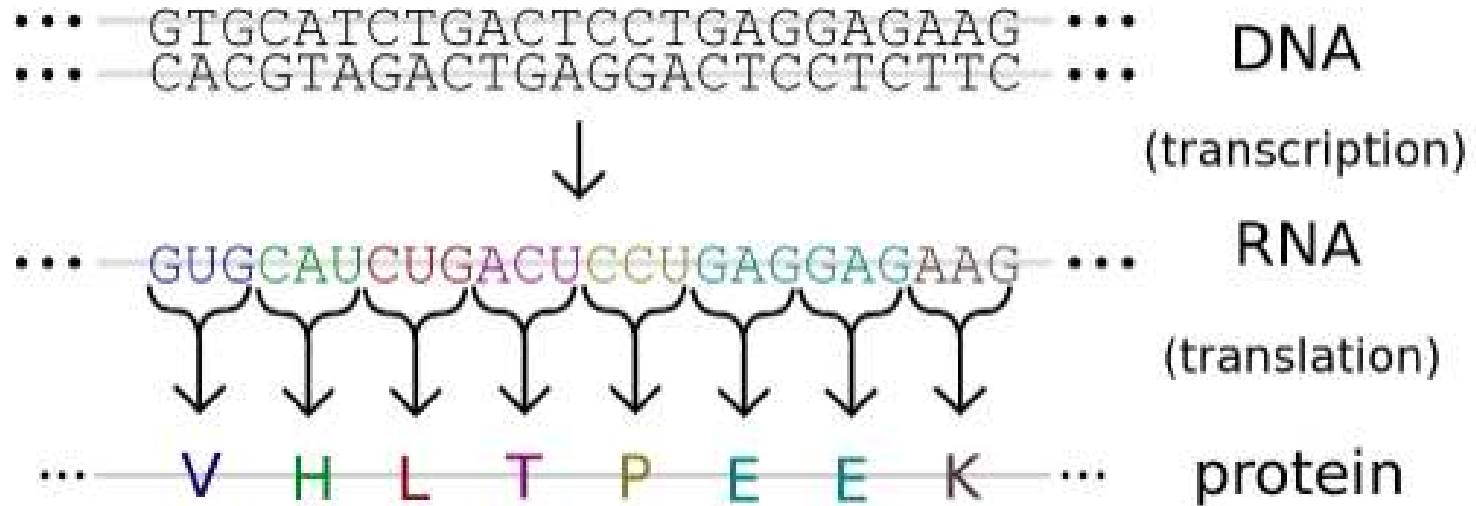
# Eukaryotic Gene Structure



# Splicing and Alternative Splicing

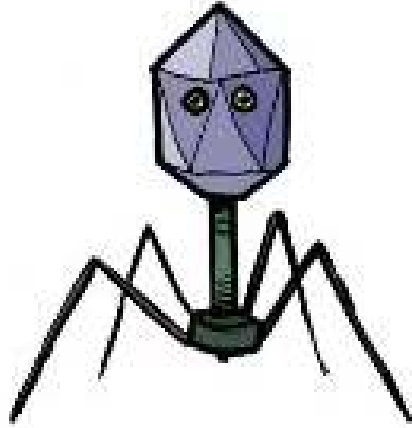


# Central dogma of molecular biology

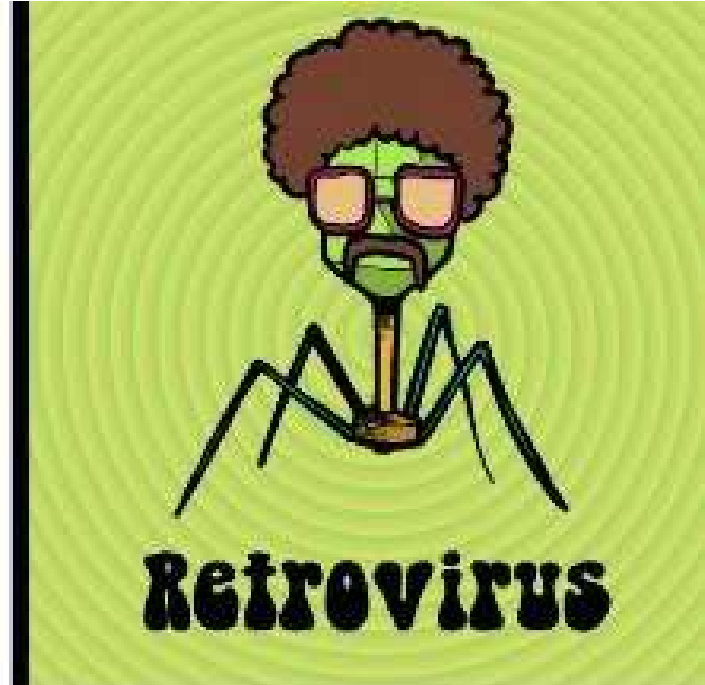




# Retroviruses

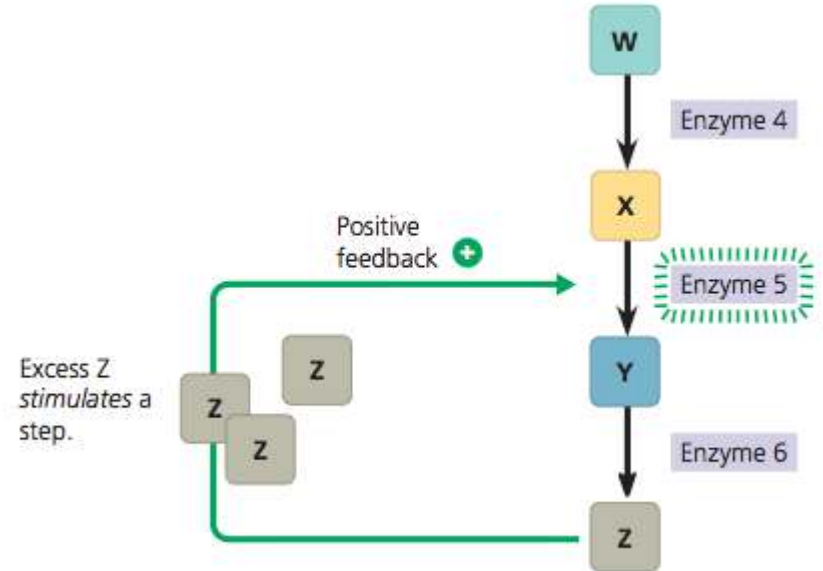
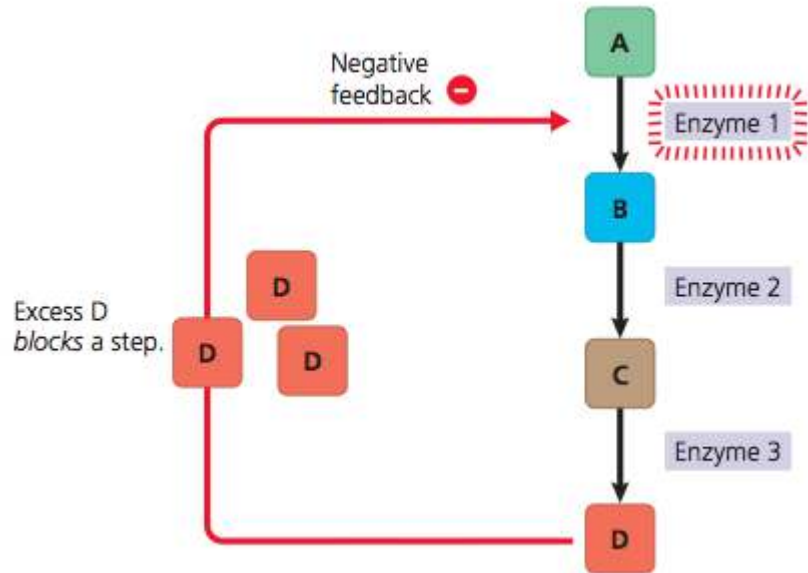


**Virus**

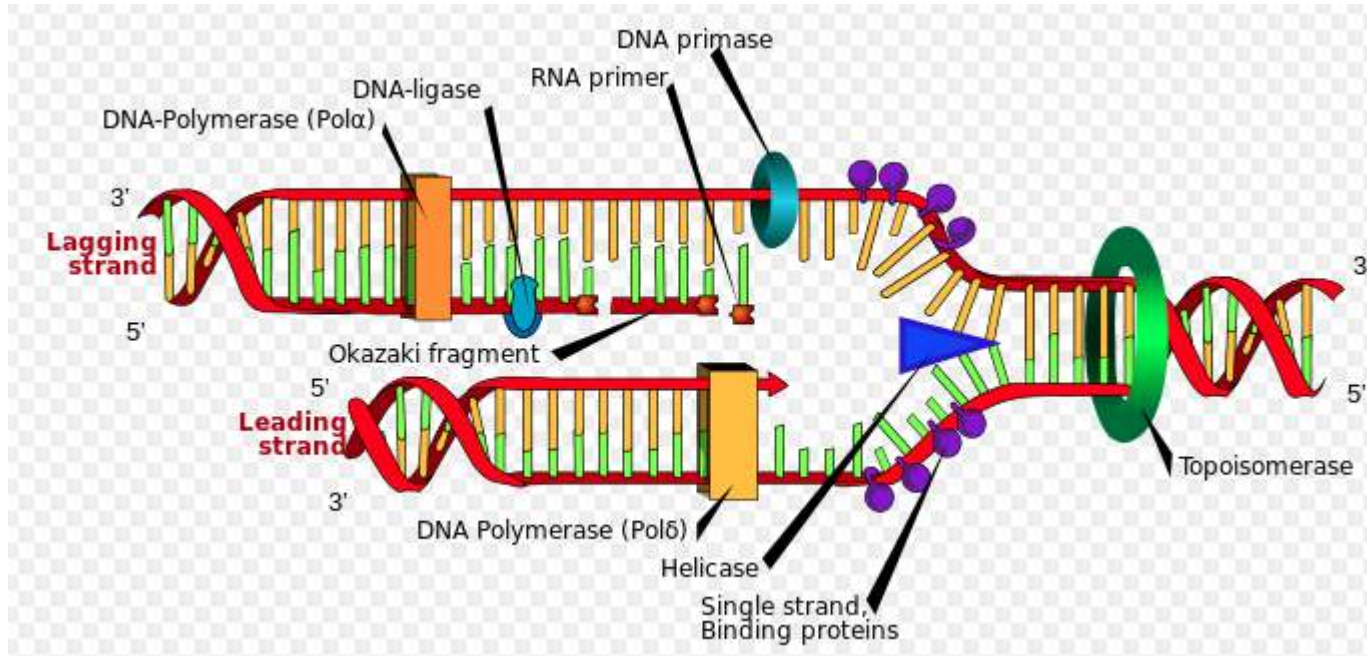


**RETROVIRUS**

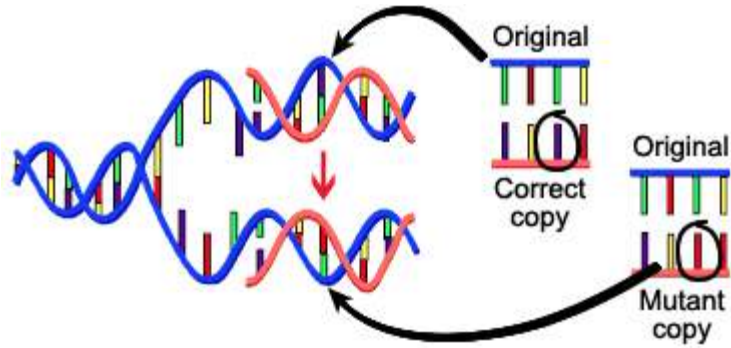
# Pathway examples



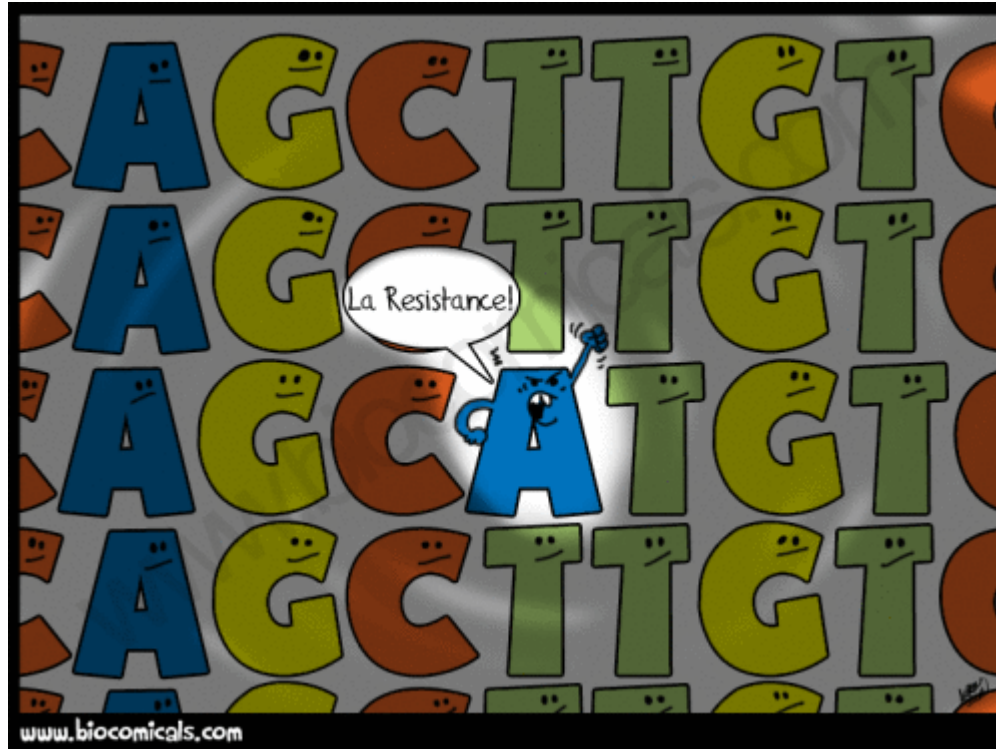
# DNA Replication

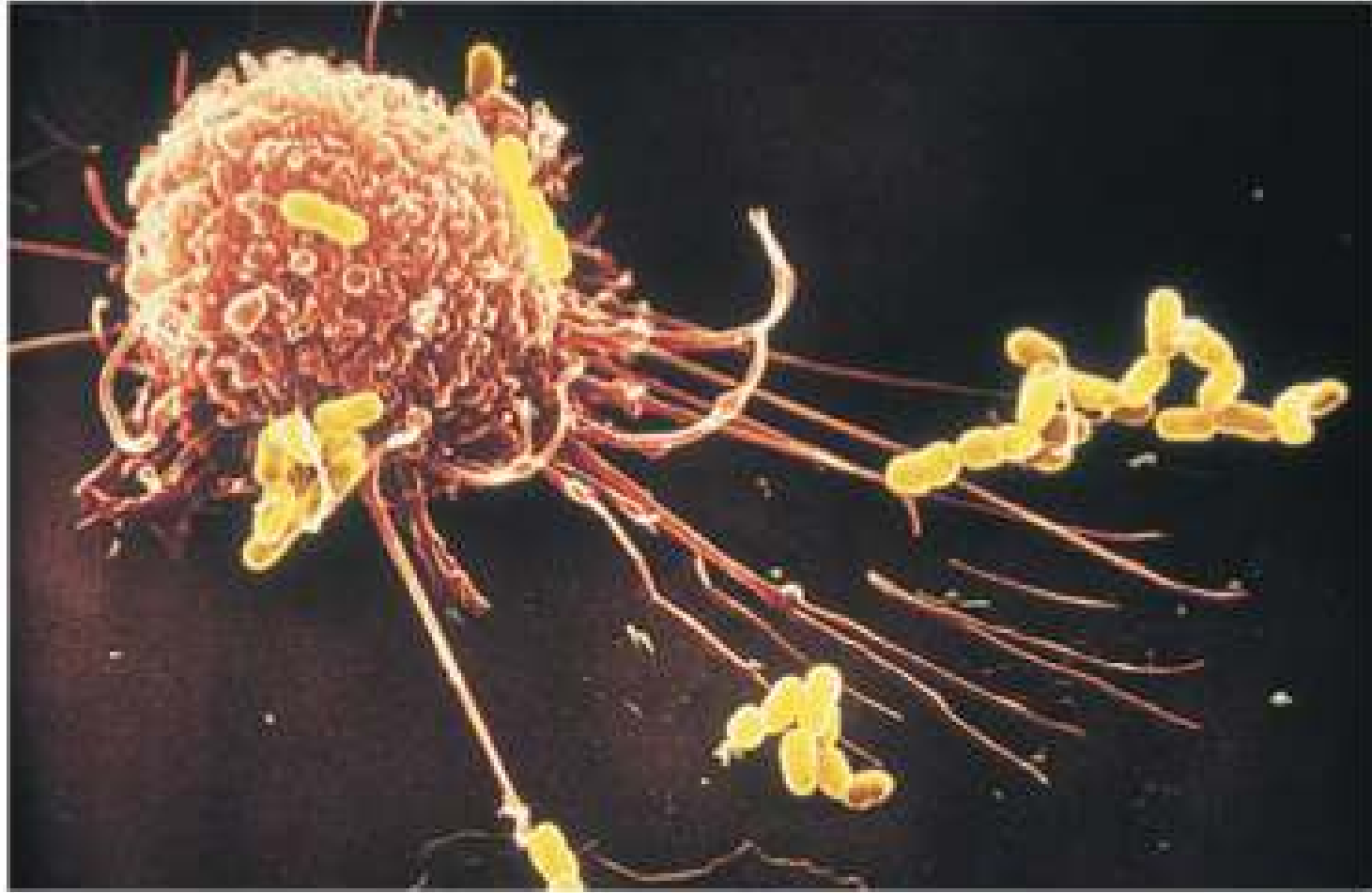


# Mutations



# Drug resistance

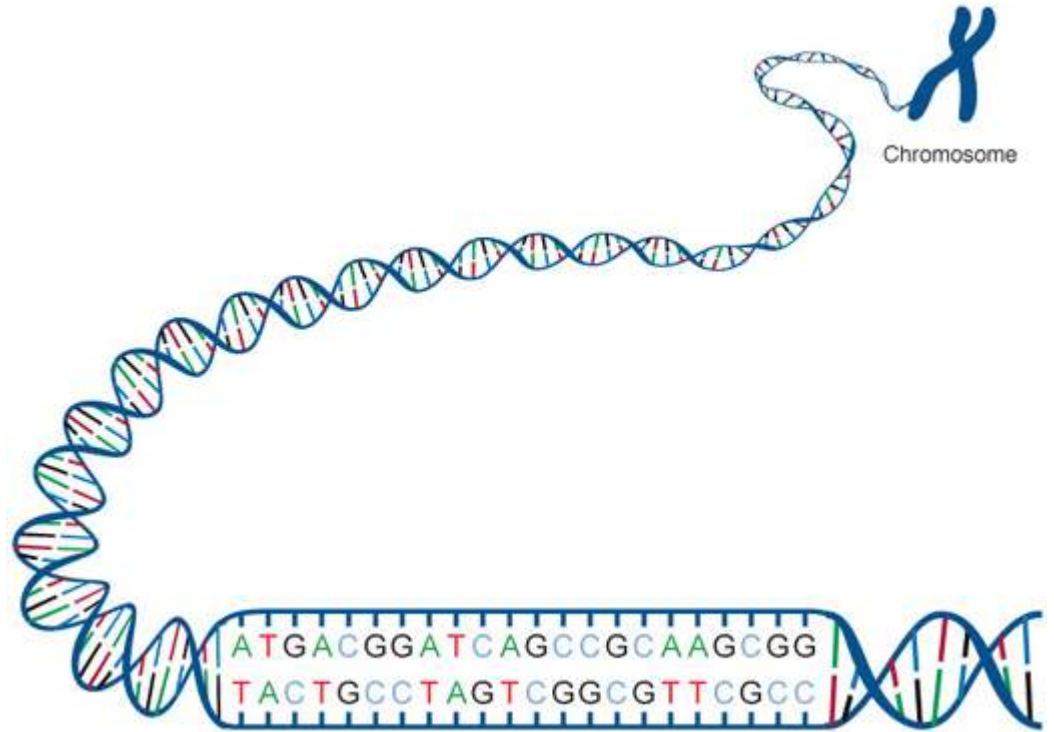




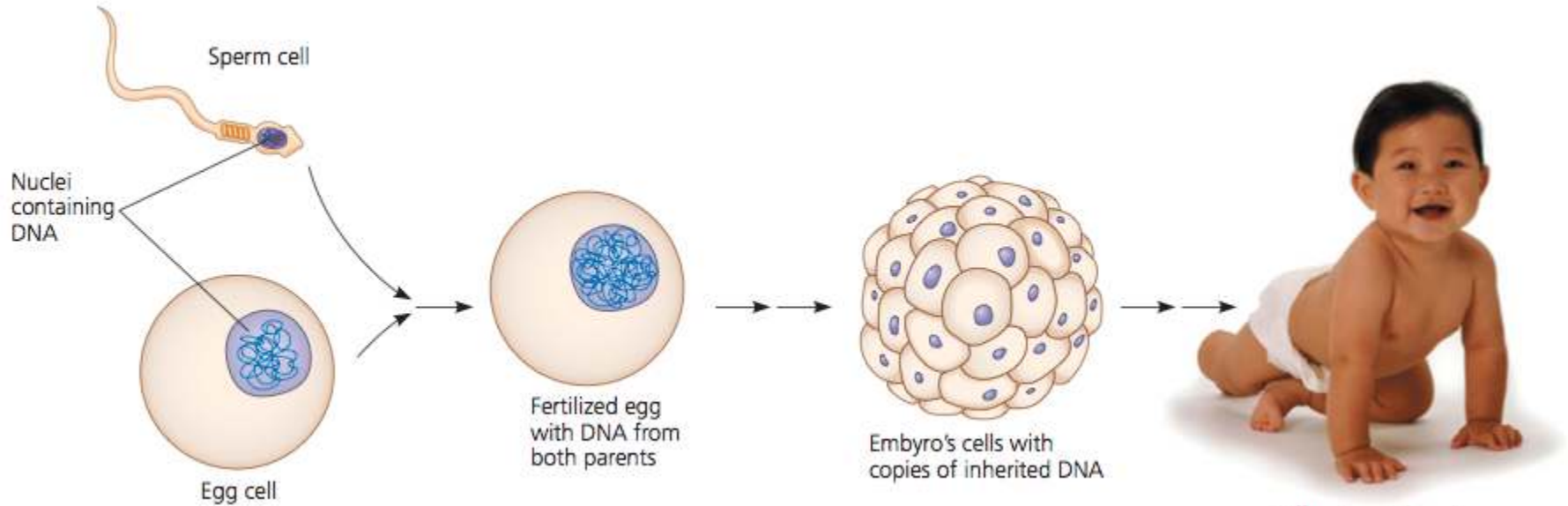
5 μm

# Genetics

Genetics is the study of genes, heredity, and variation in living organisms

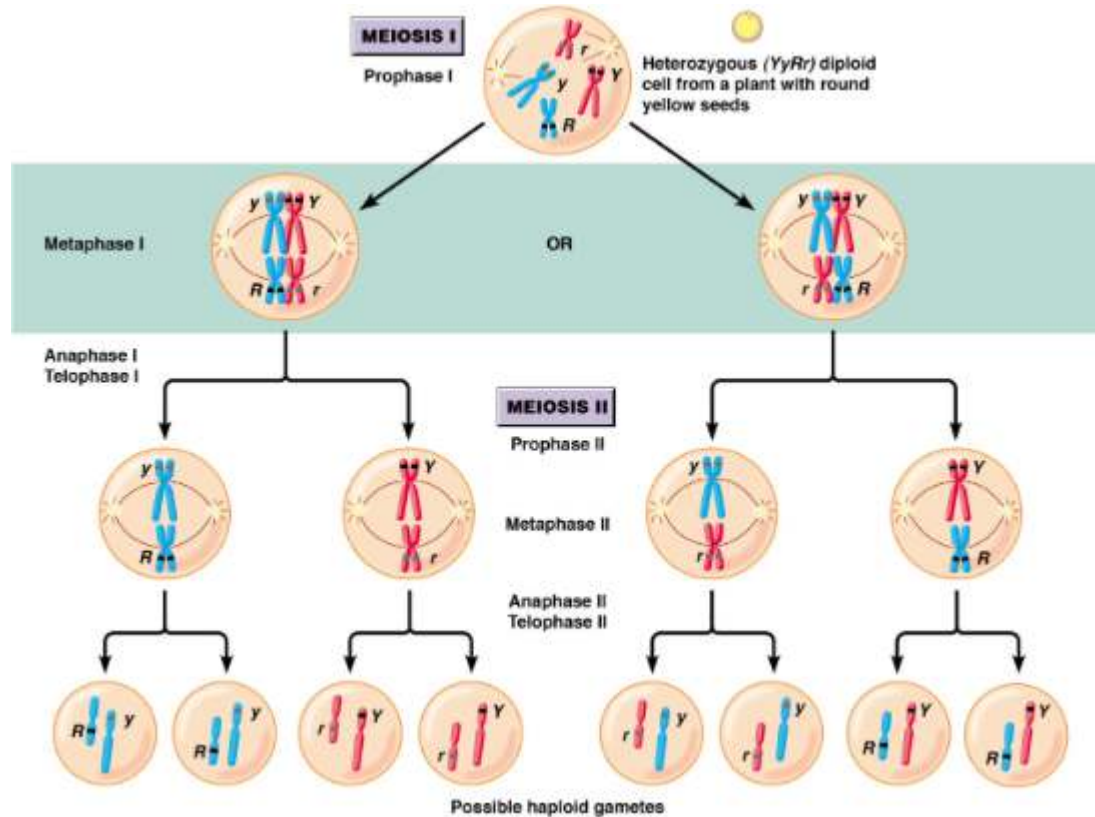


# Heredity

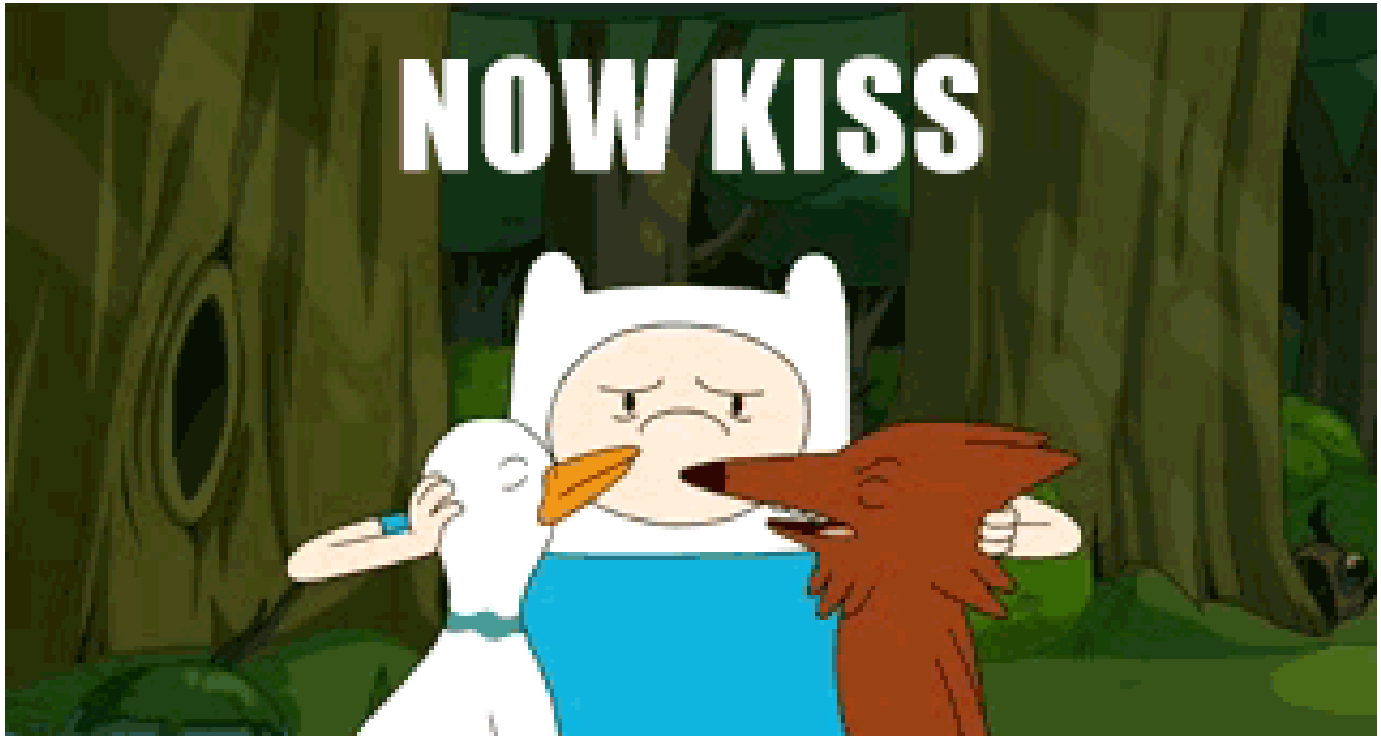


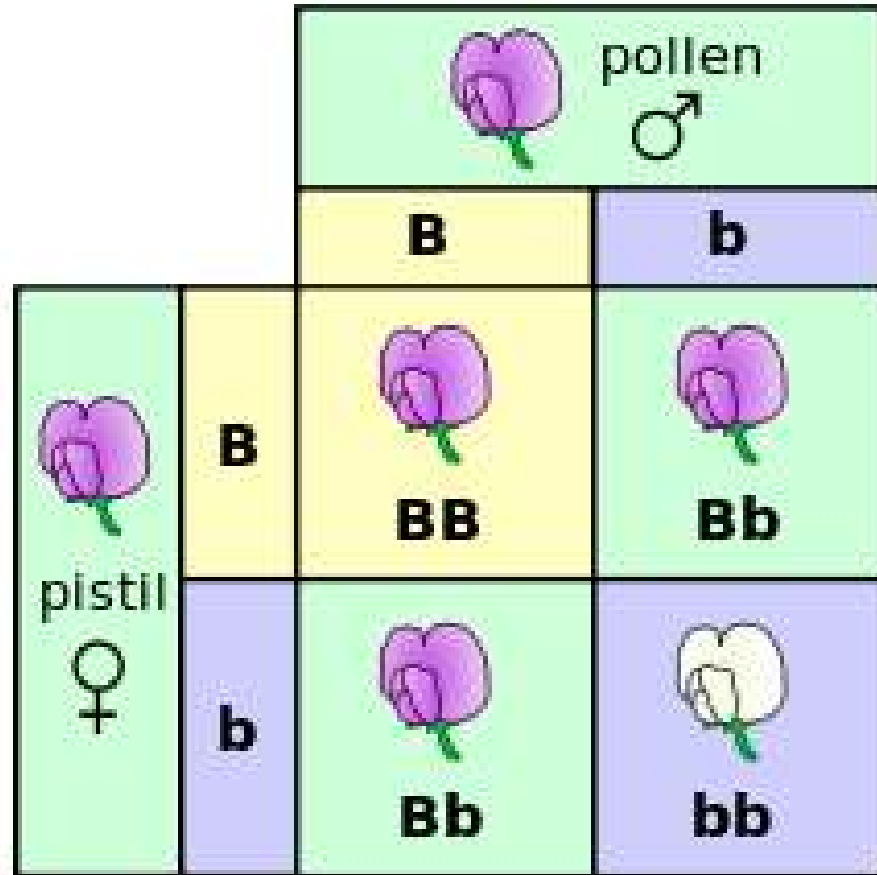


# Meiosis

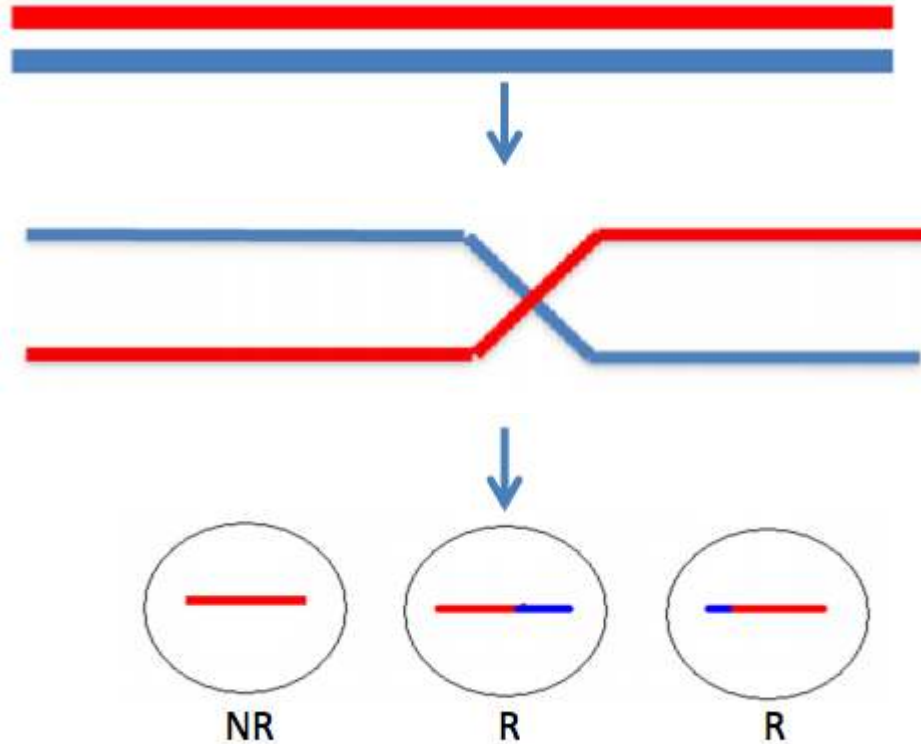


# Genetics in Action

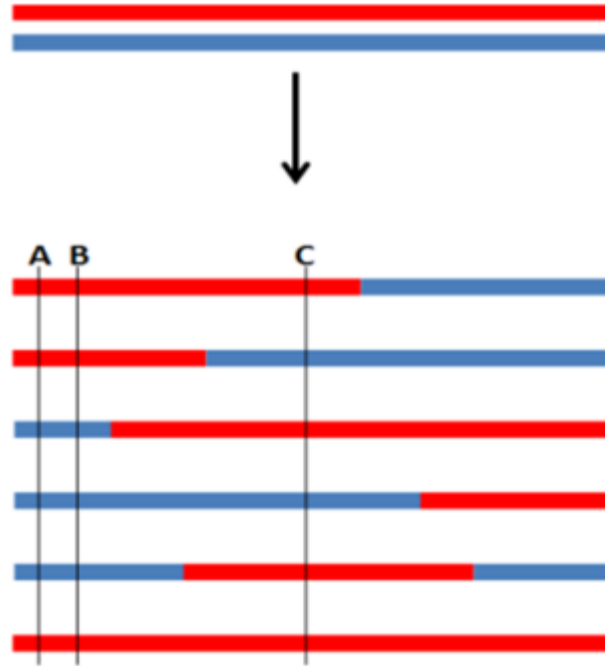




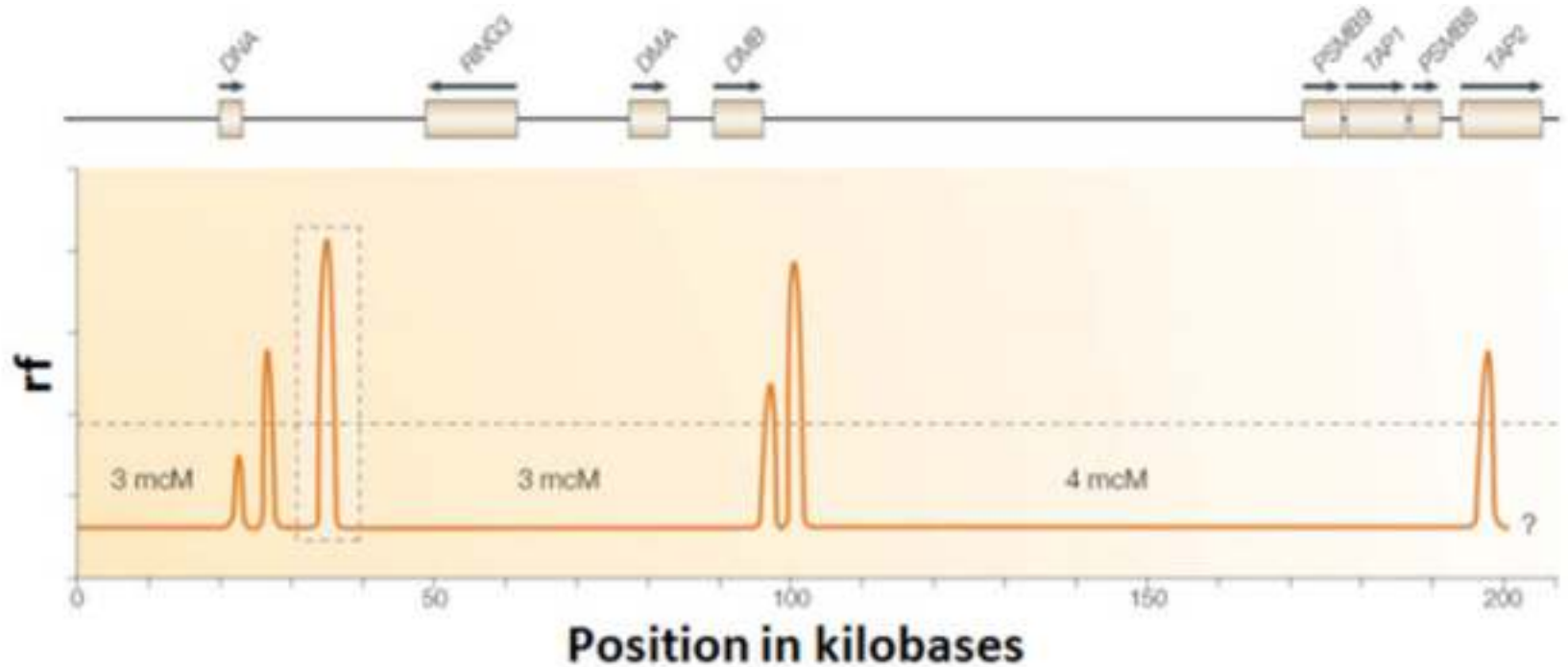
# Recombination



# Marker Linkage



# Recombination Frequencies



**Questions?**