

Molecular biology and Genetics

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Course Plan

Introduction

Genome structure

Central Dogma

Cell cycle

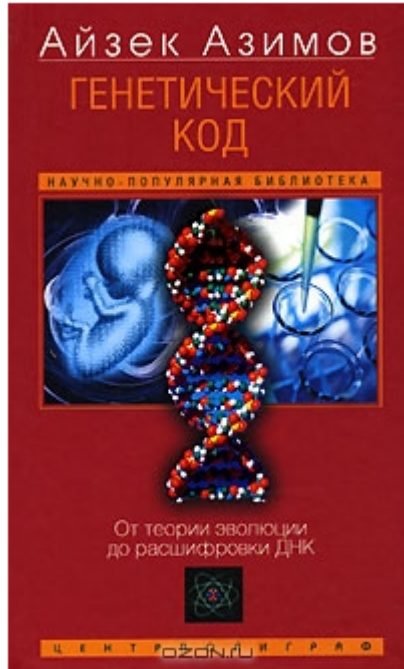
DNA repair

DNA recombination

What is biology?



Recommended reading

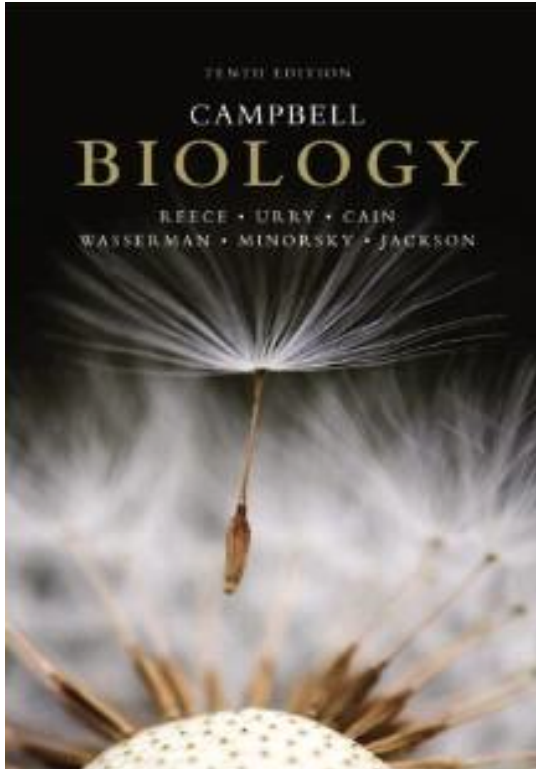


Генетический код. От теории эволюции до расшифровки ДНК

The Genetic Code

ISBN 5-9524-2230-6; 2006 г.

Recommended reading

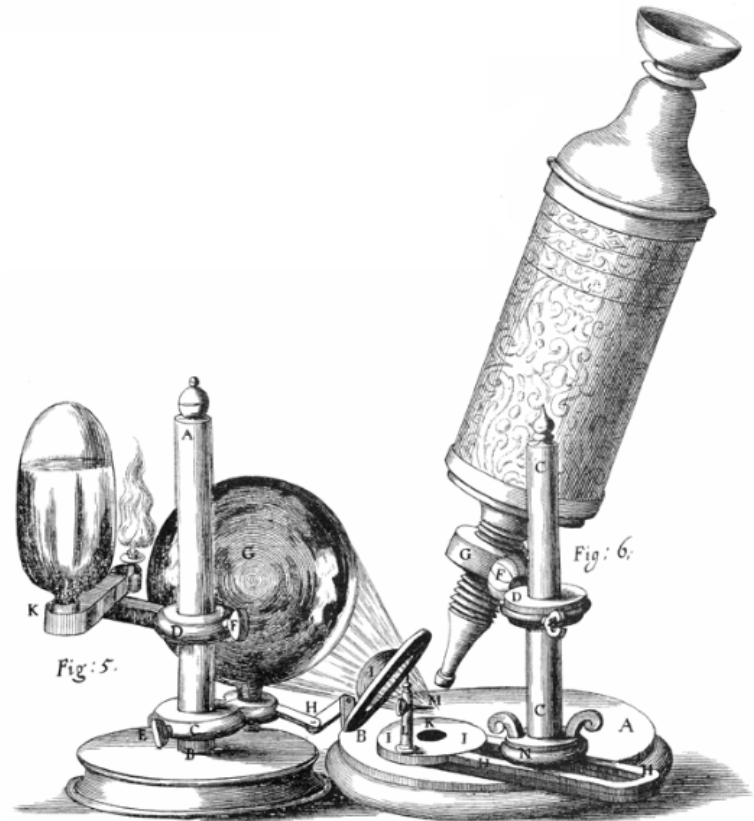


Campbell Biology (10th
Edition)

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 preexisting 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.

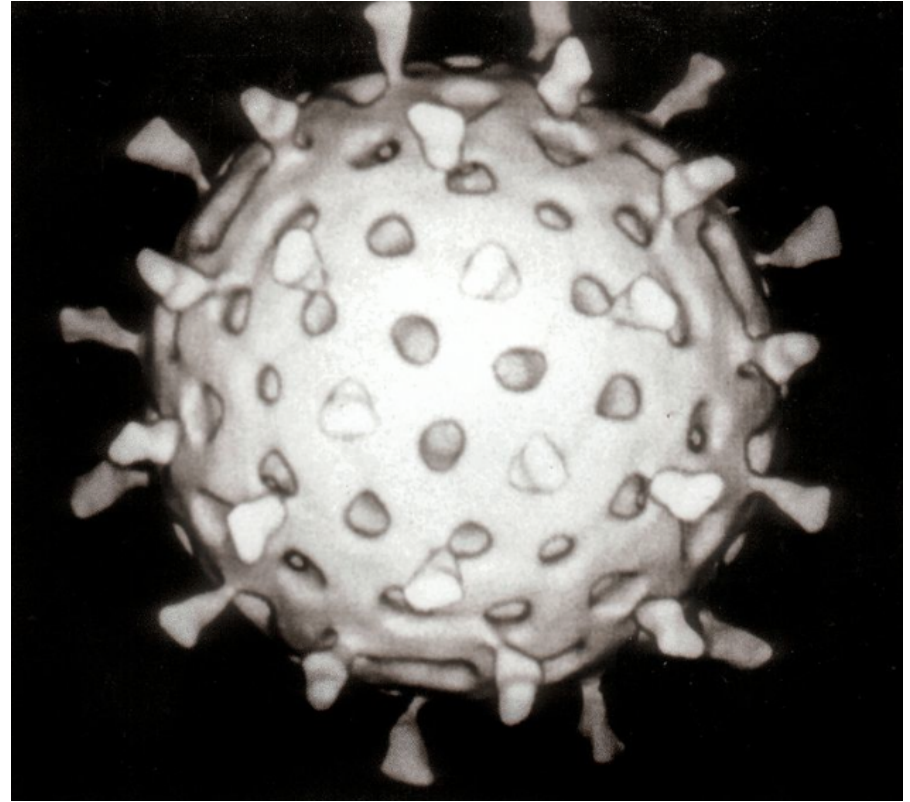
Energy flow (metabolism and biochemistry) occurs within cells.

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

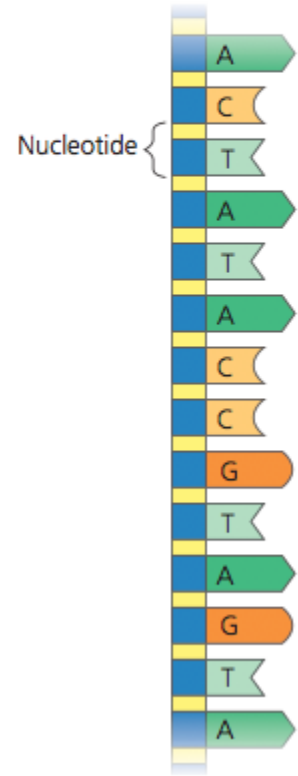
Viruses

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



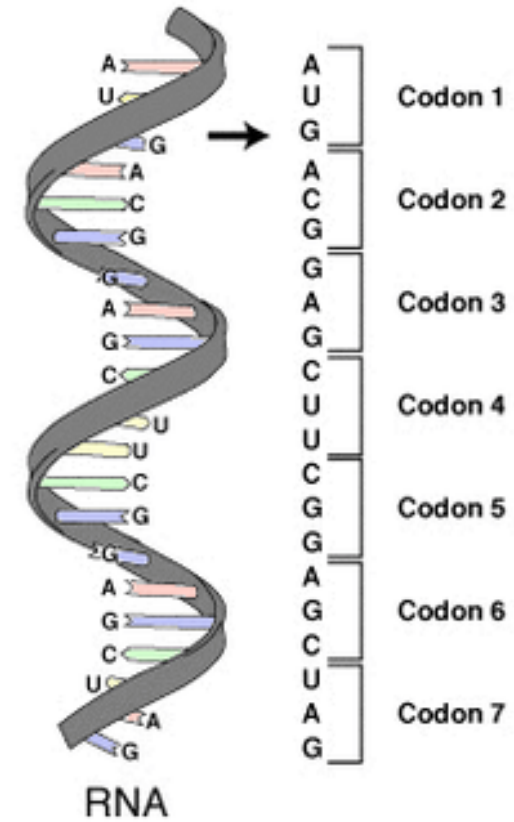
DNA

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

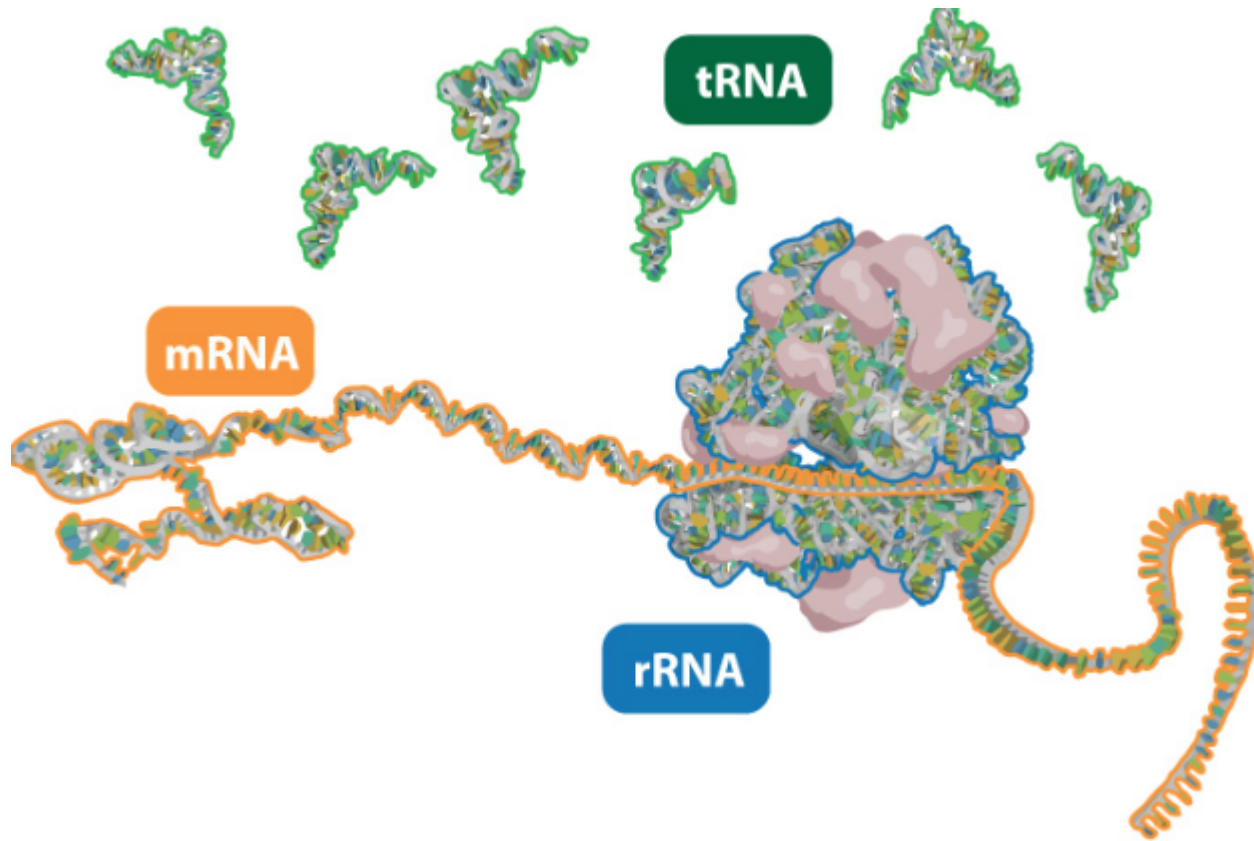


Genetic Code

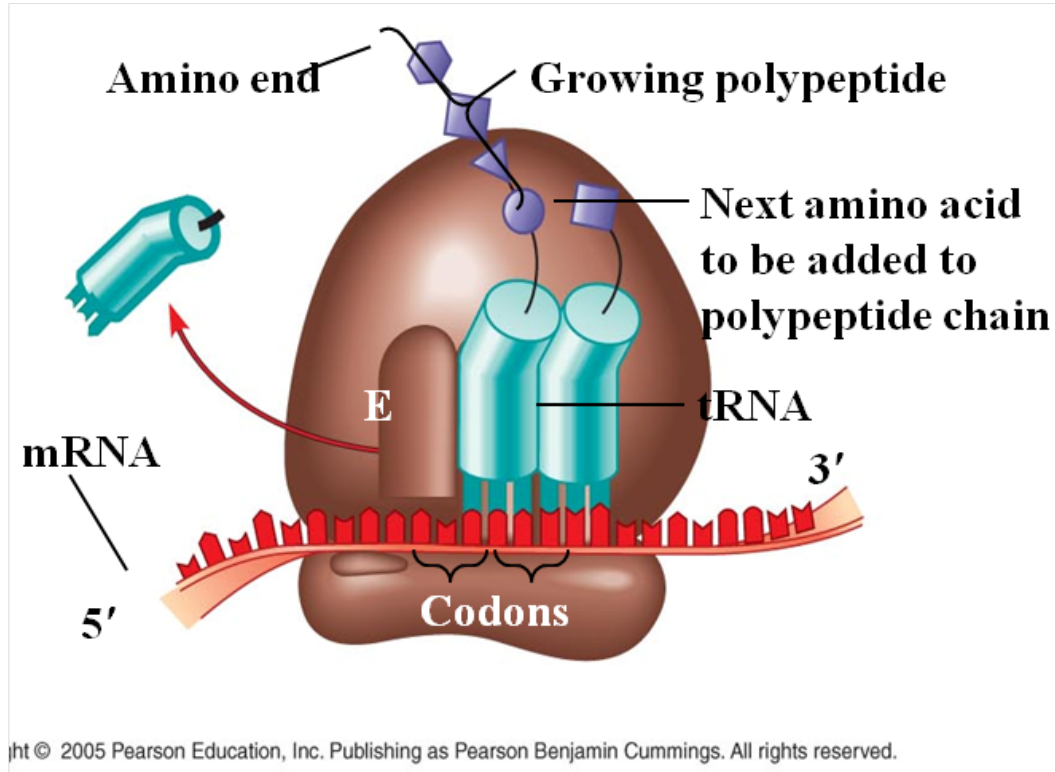
1. Sequence reading frame
2. Start/Stop codons
3. Degeneracy
4. Could be slightly different from one organism to another



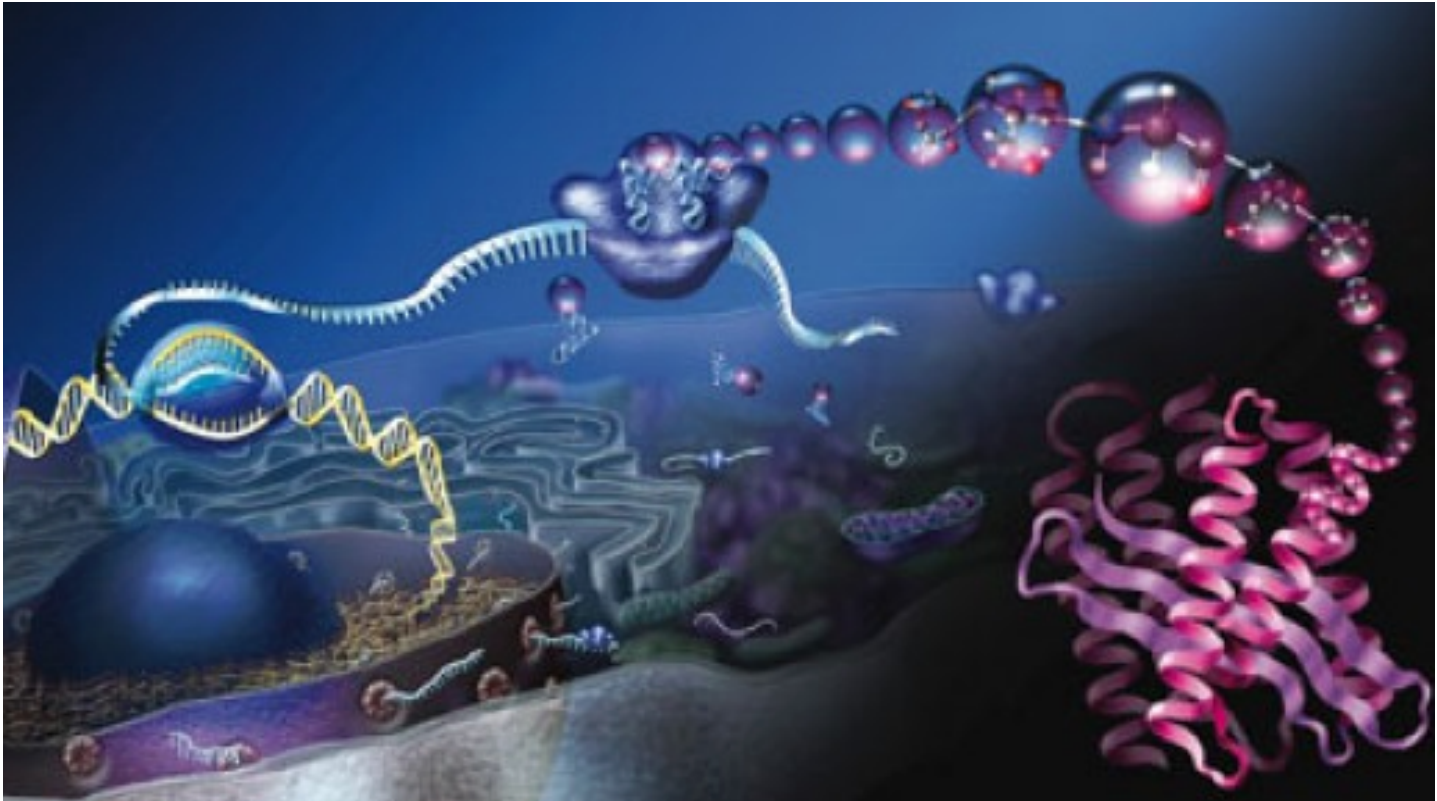
RNA



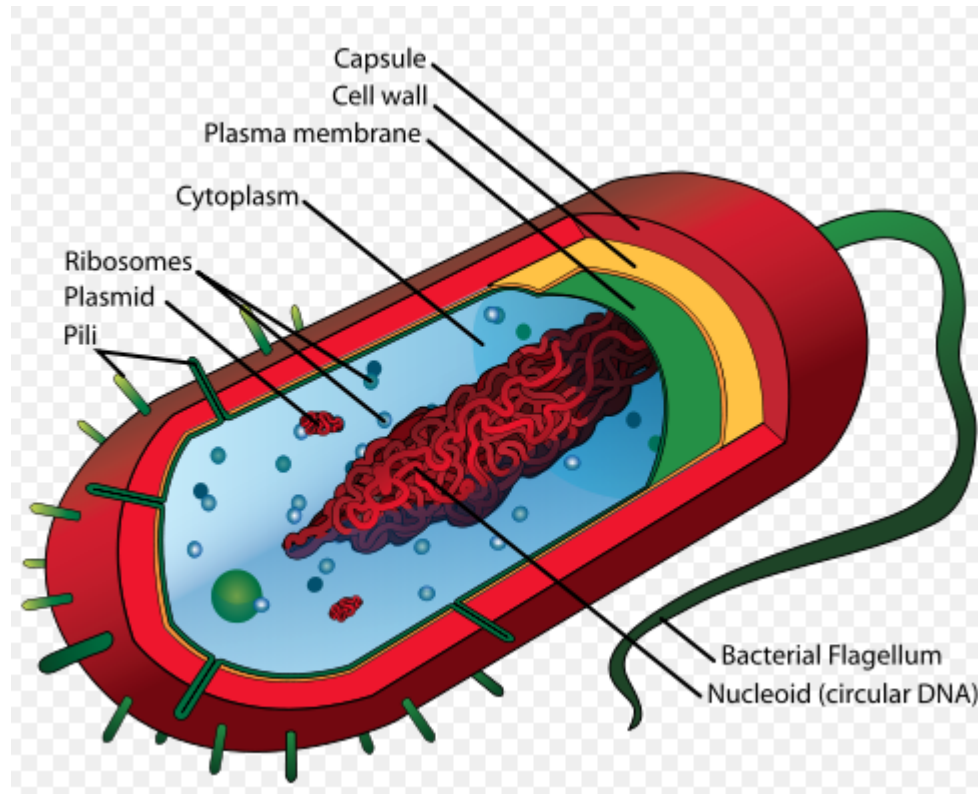
RNA Translation



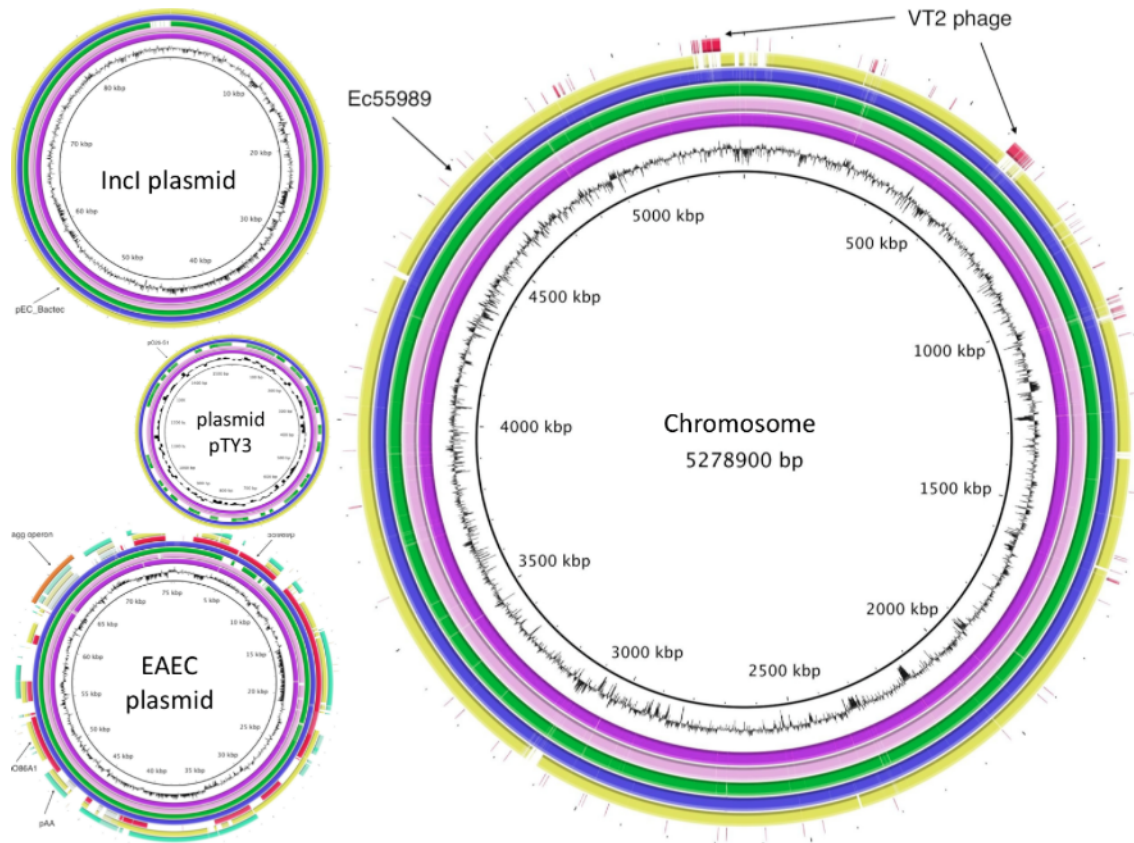
Molecular biology



Prokaryotic Cell

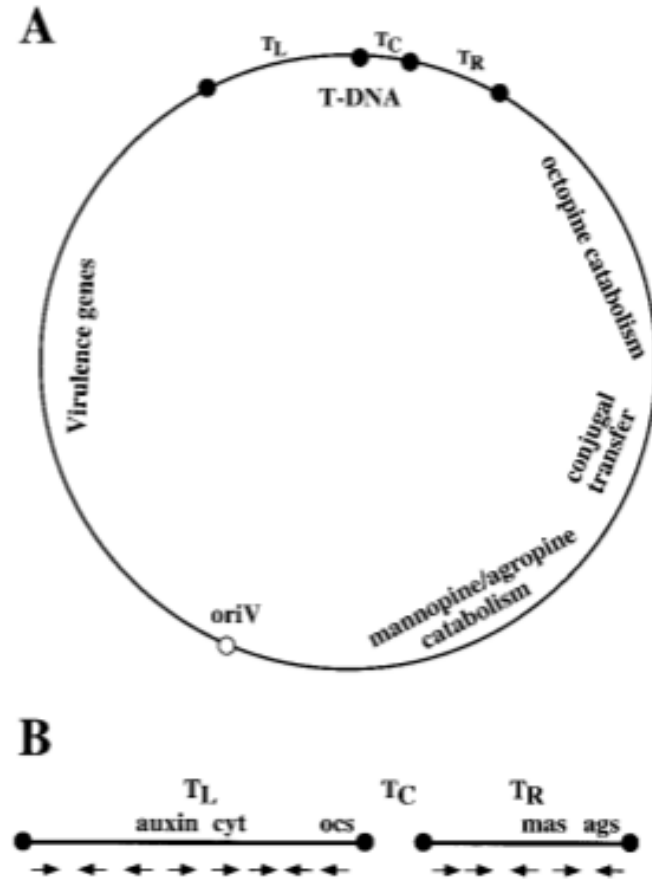


Bacterial Genome

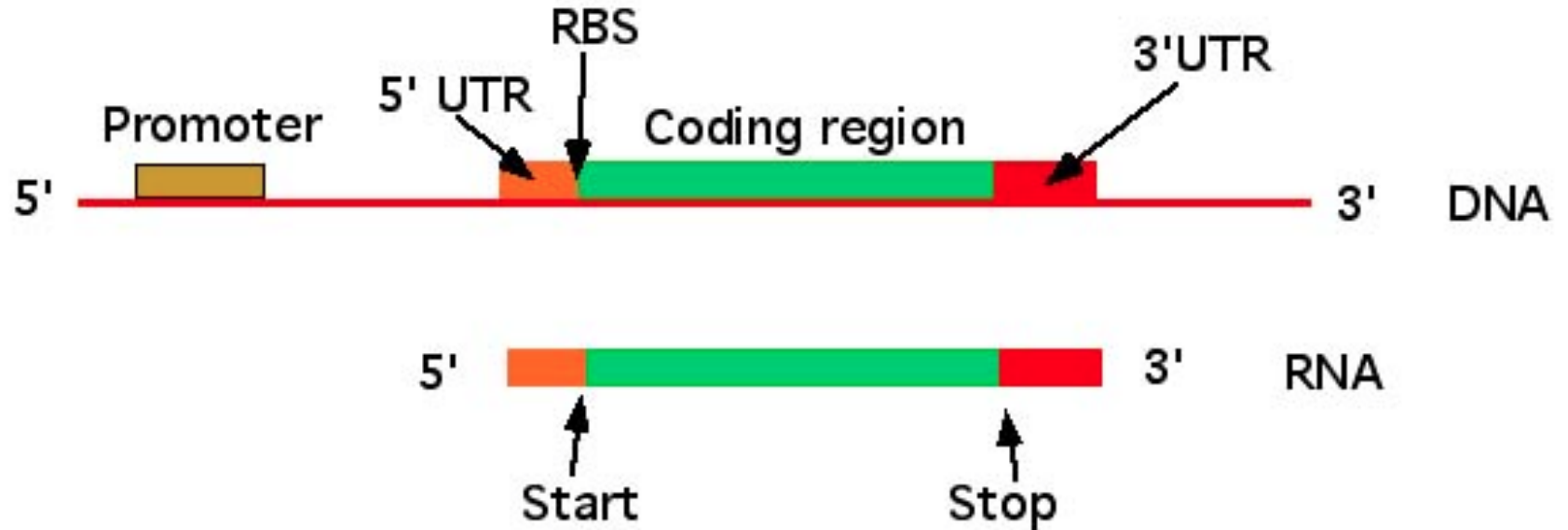


GMO?

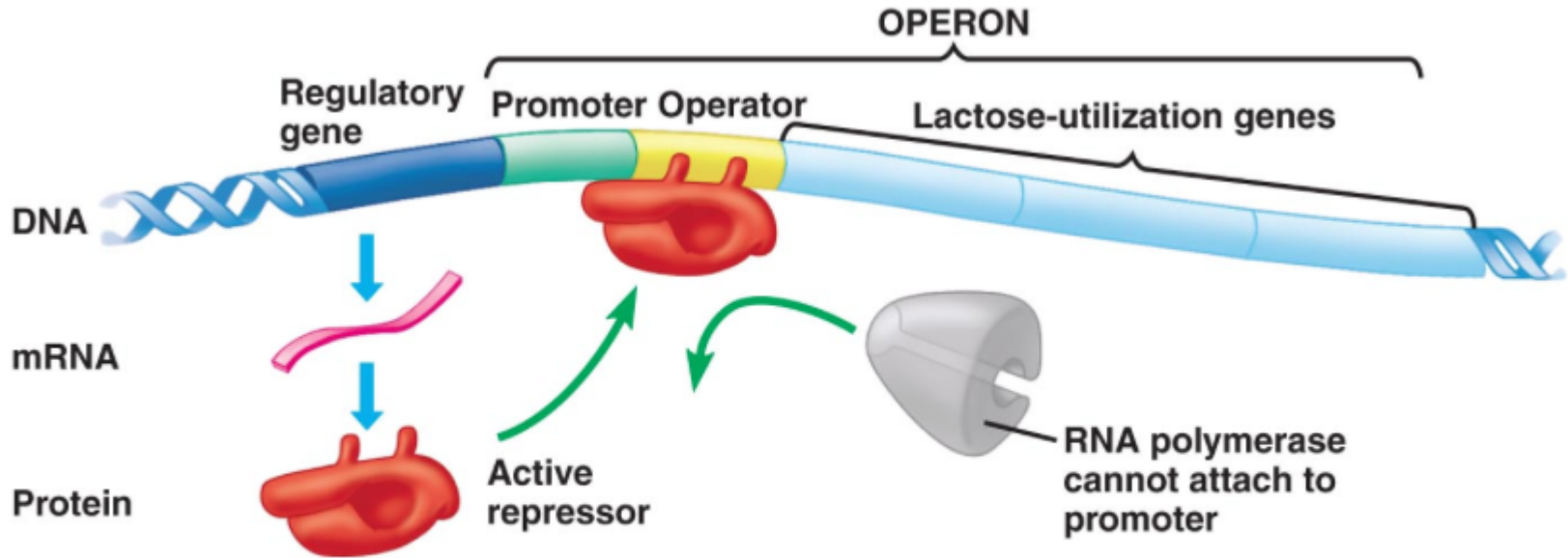
- A. Ti-plasmid
- B. Ti-region



Prokaryotic Gene Structure

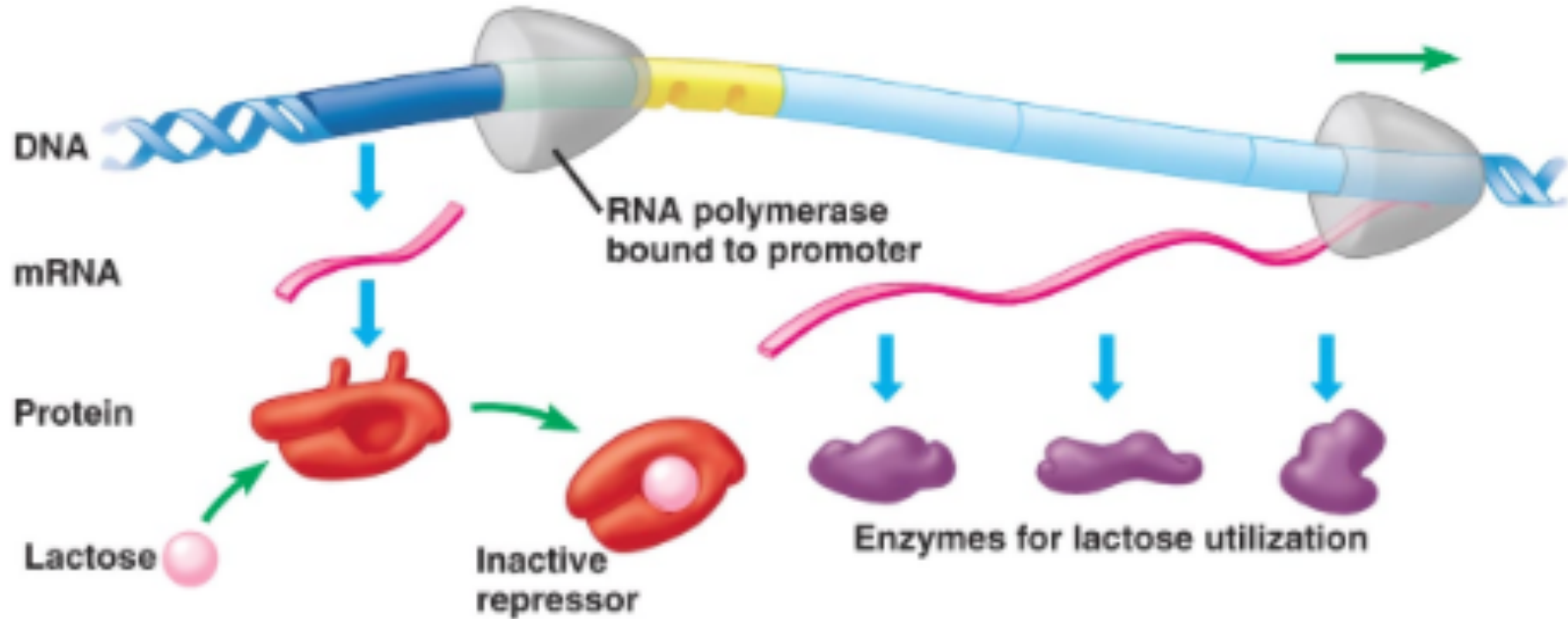


Lac Operon Inactive



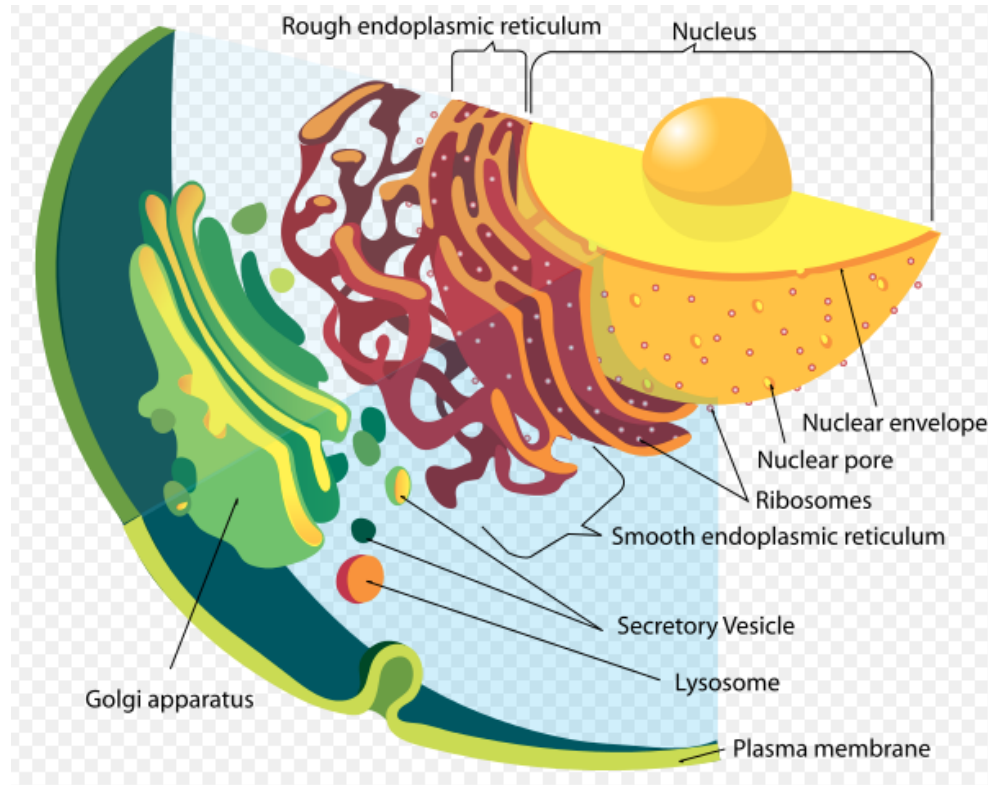
Operon turned off (lactose absent)

Lac Operon Active

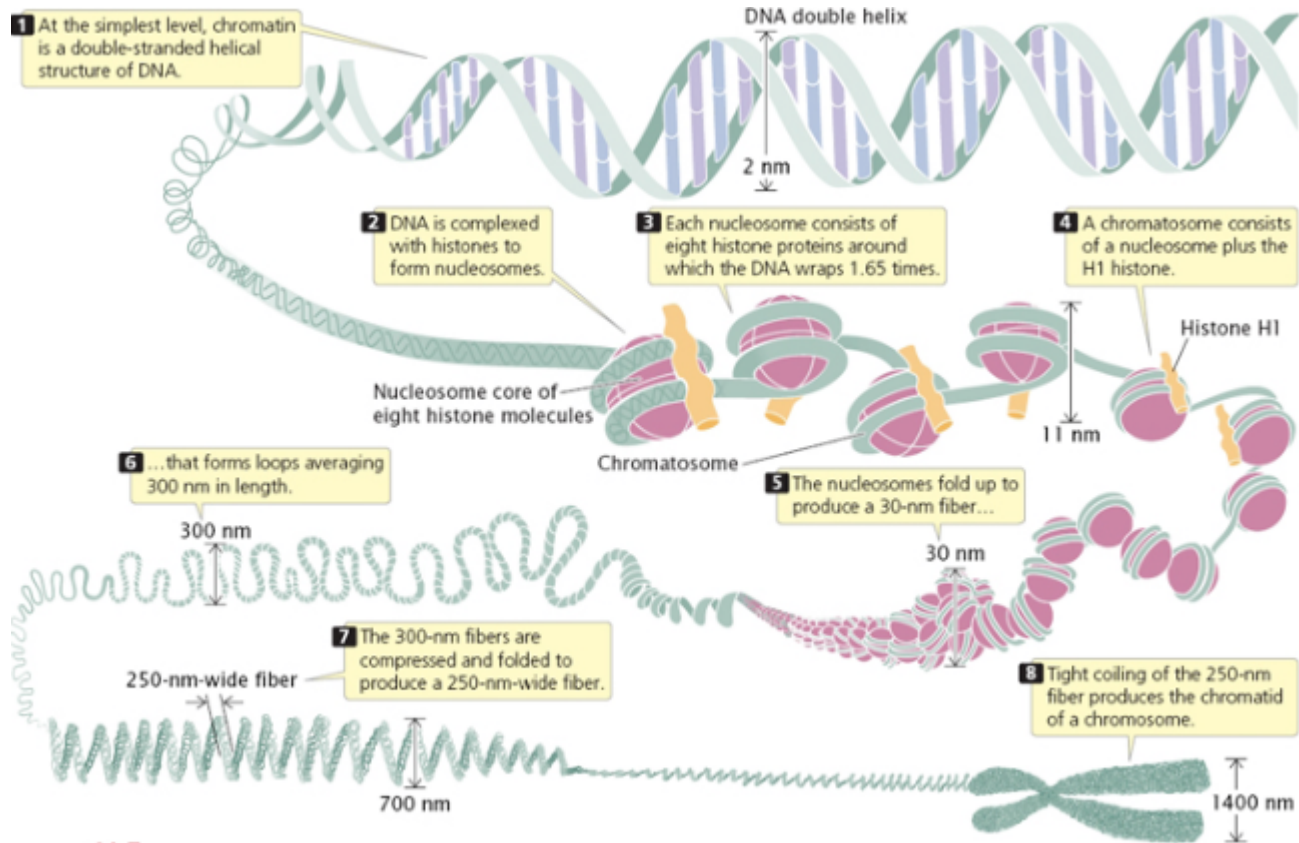


Operon turned on (lactose inactivates repressor)

Eukaryotic Cell Structure



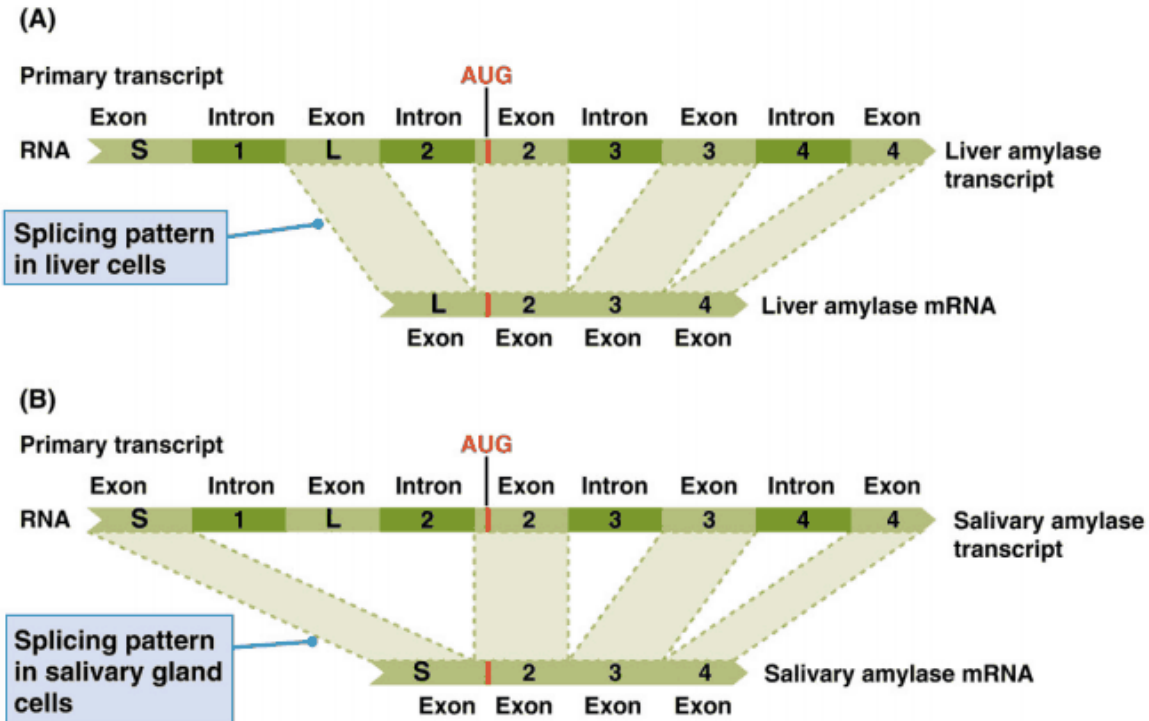
Eukaryotic Genome



Eukaryotic Gene Structure



Splicing and Alternative Splicing



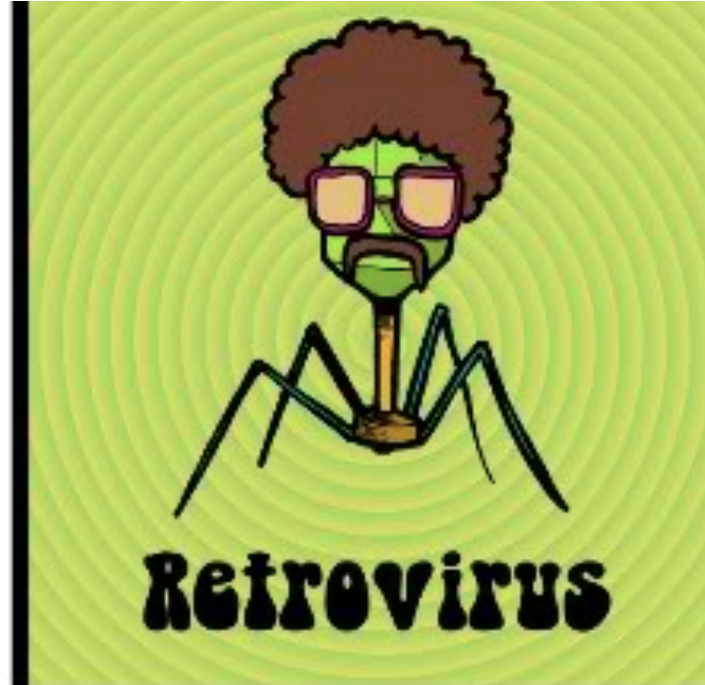
Central dogma of molecular biology



Retroviruses

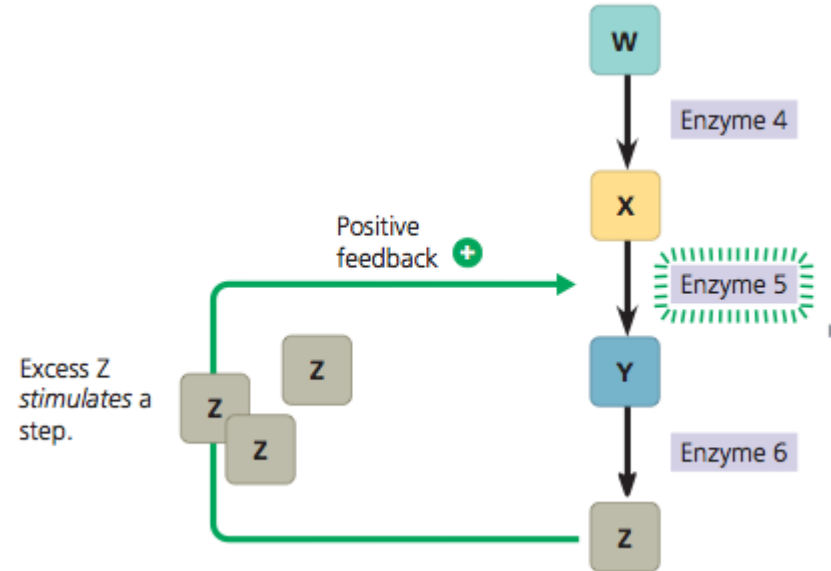
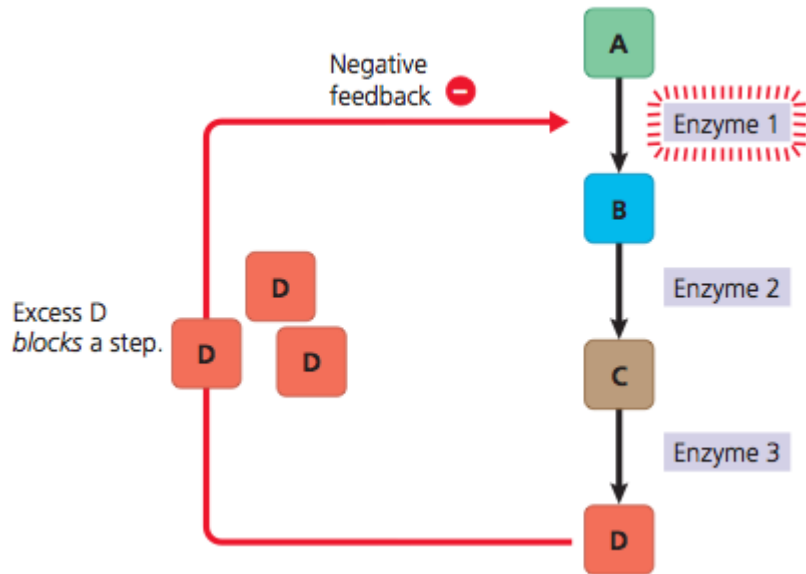


Virus

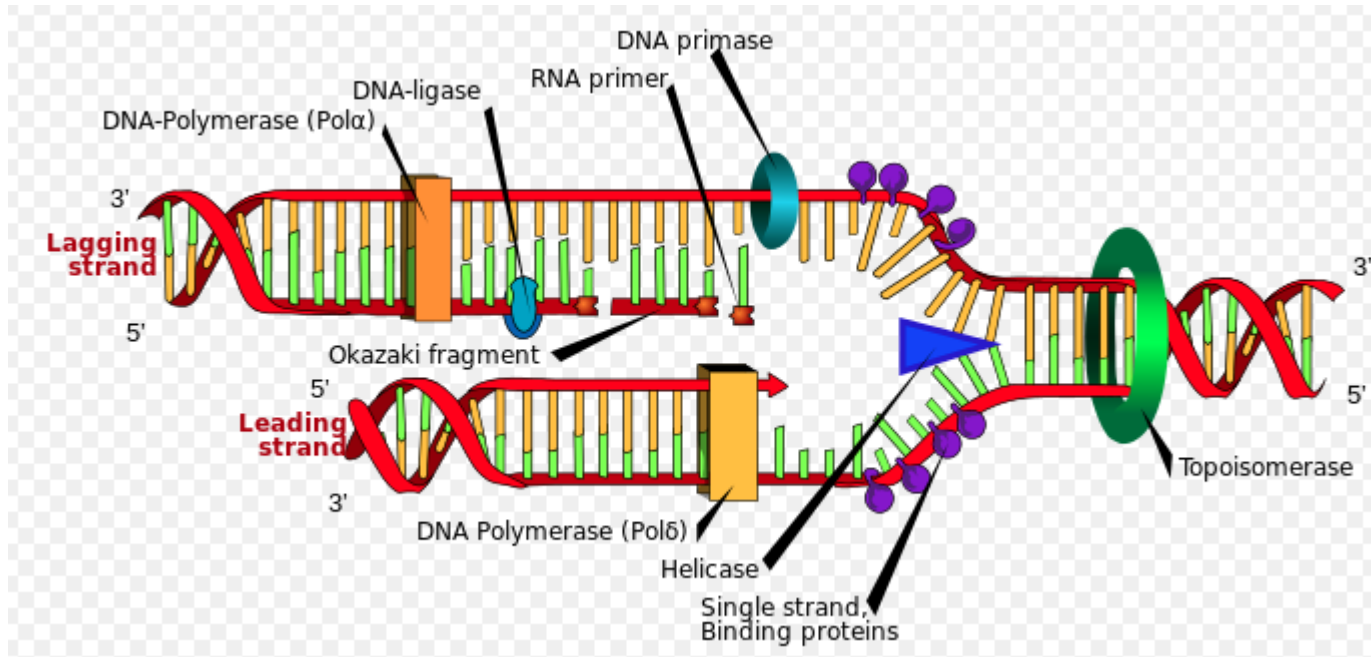


RETROVIRUS

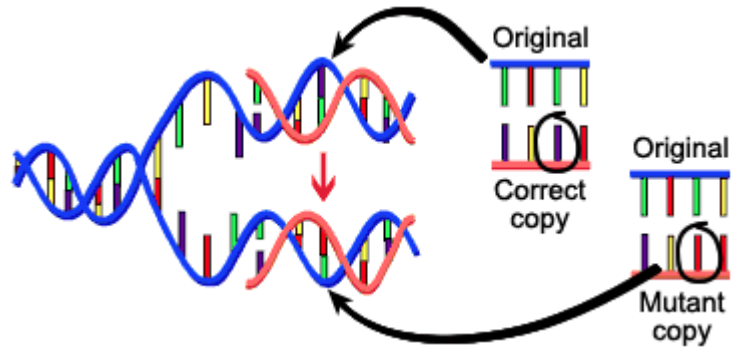
Pathway examples



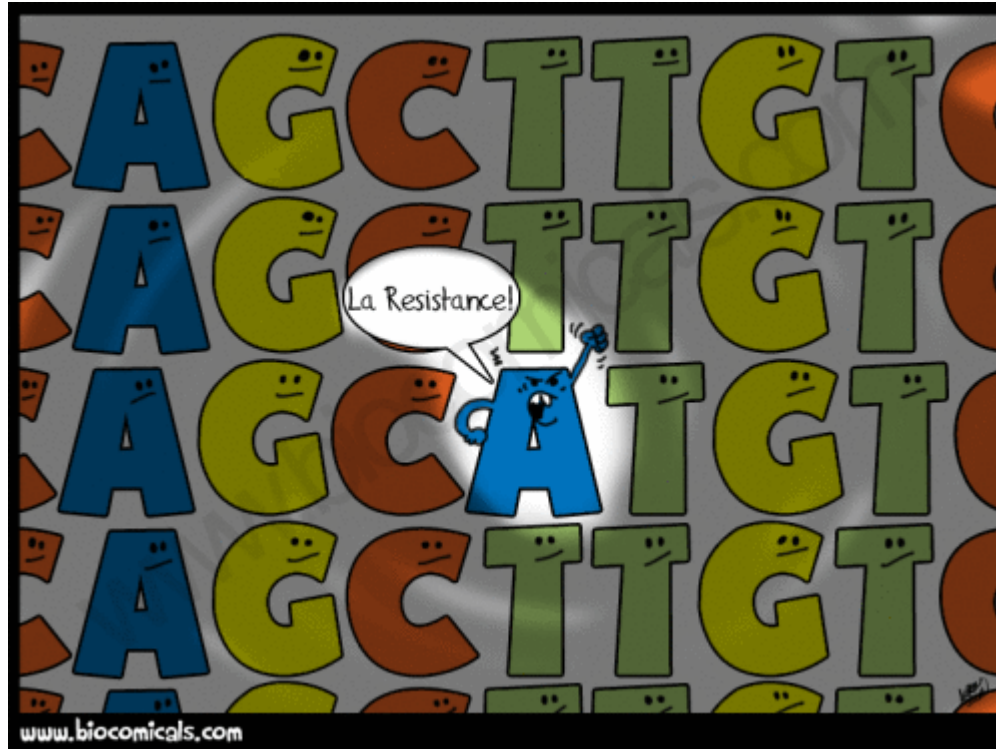
DNA Replication

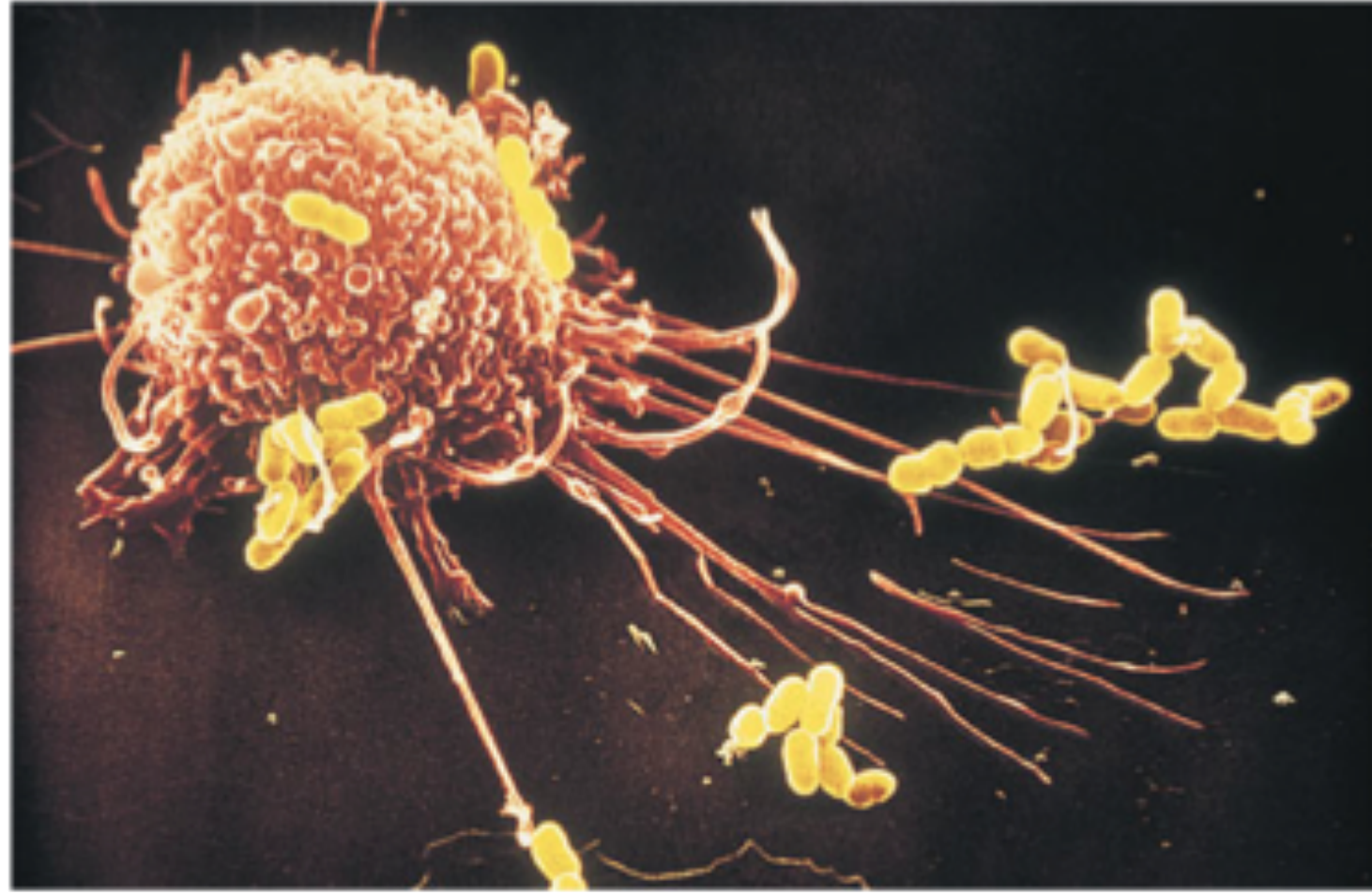


Mutations



Drug resistance

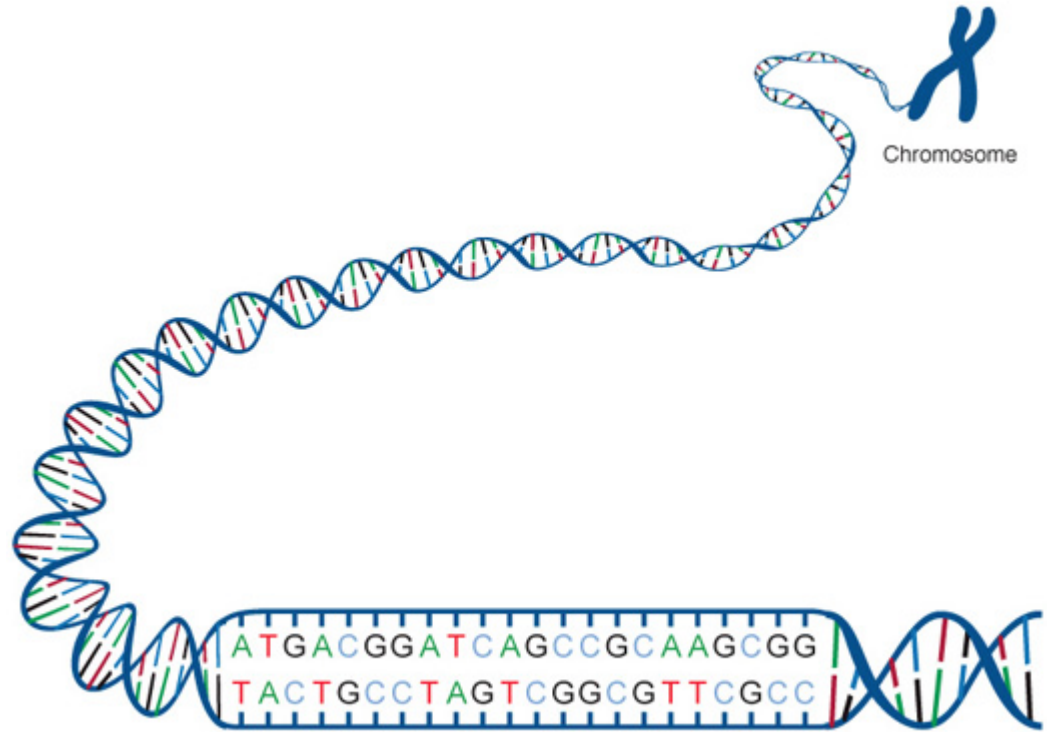




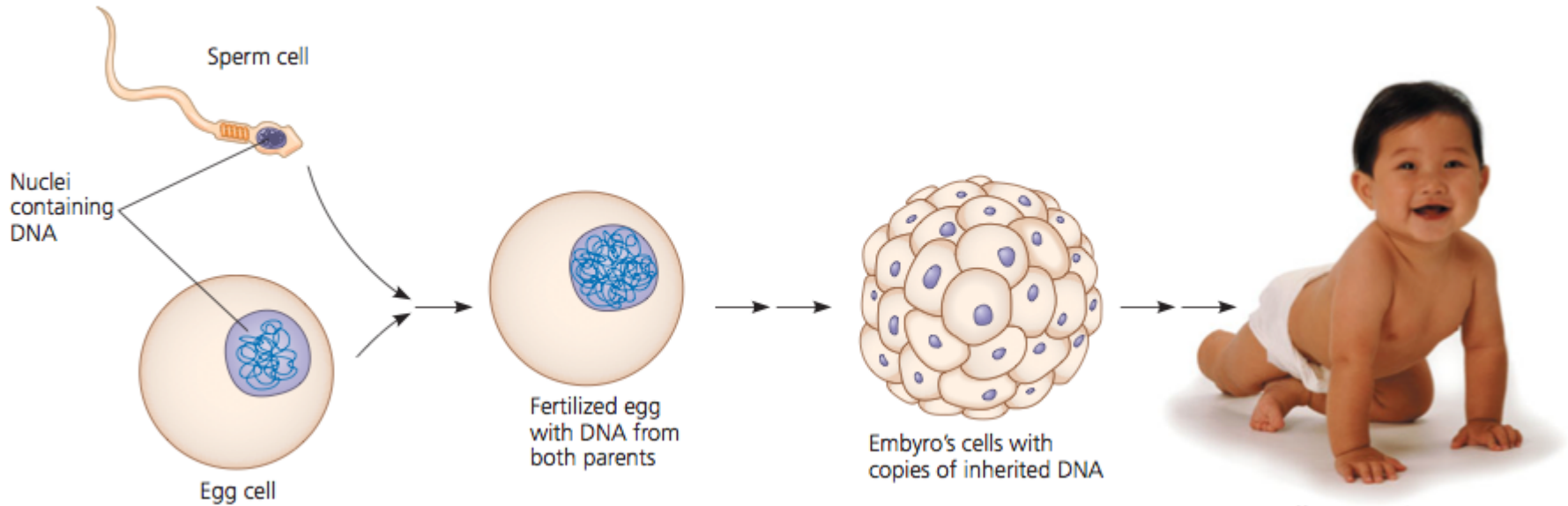
5 μm

Genetics

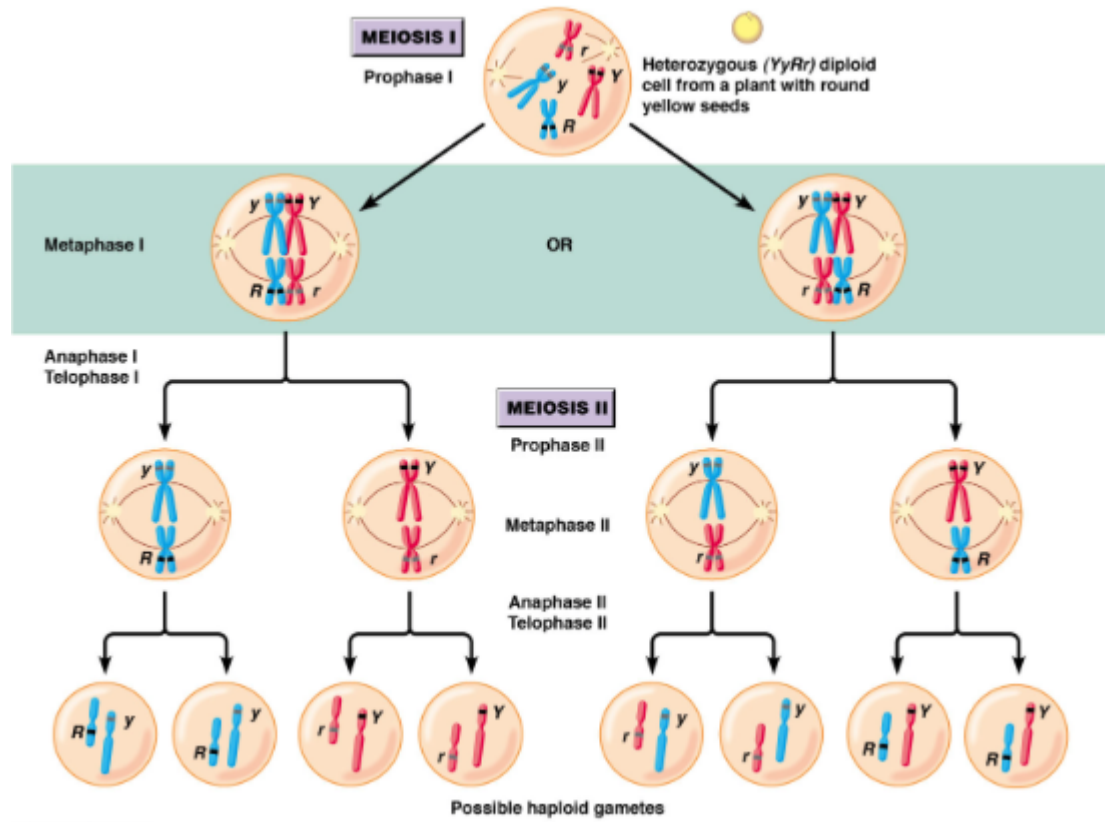
Genetics is the study of genes, heredity, and variation in living organisms



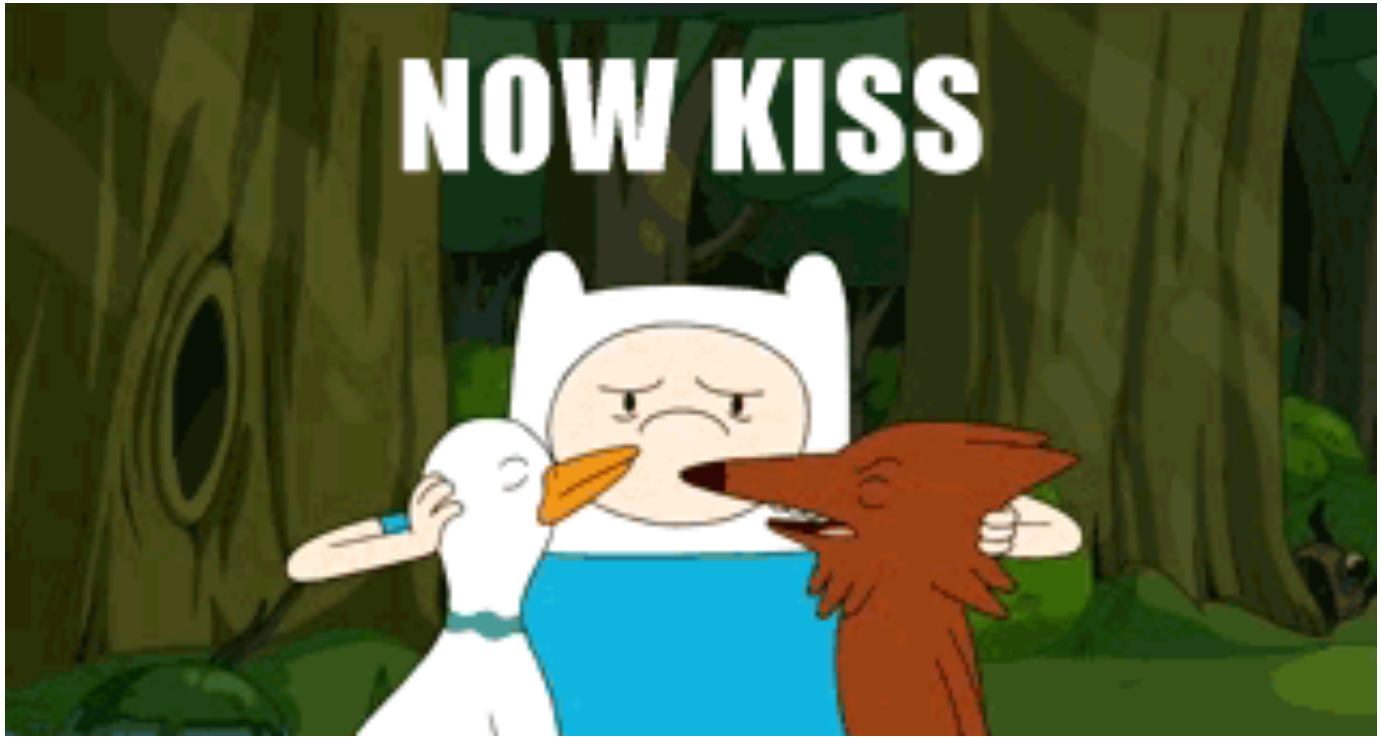
Heredity

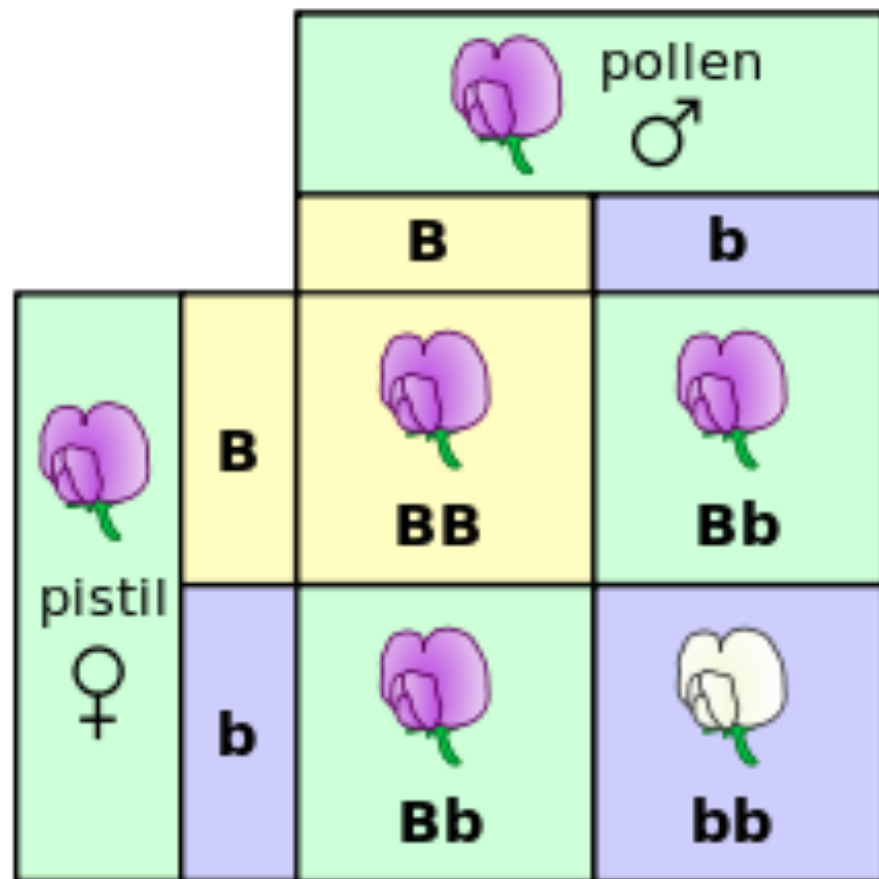


Meiosis

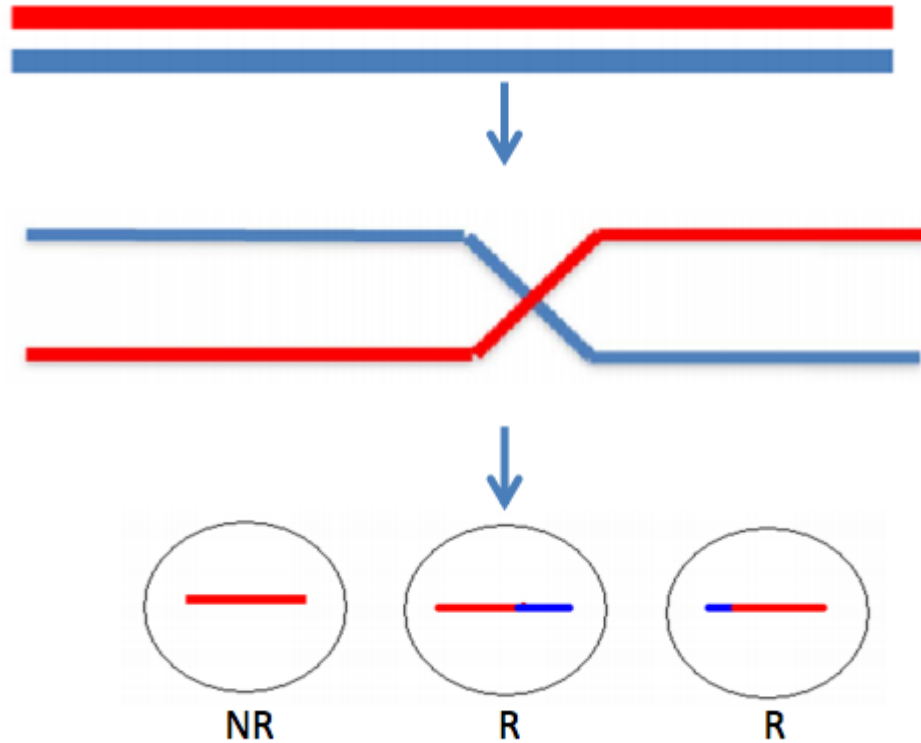


Genetics in Action

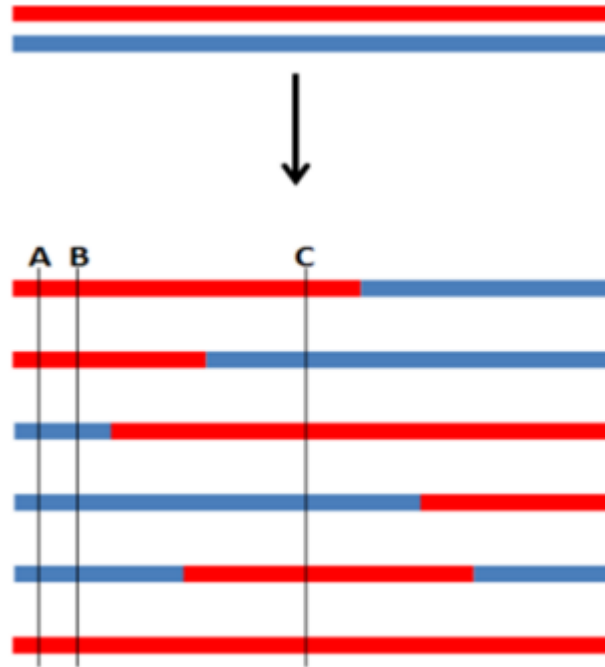




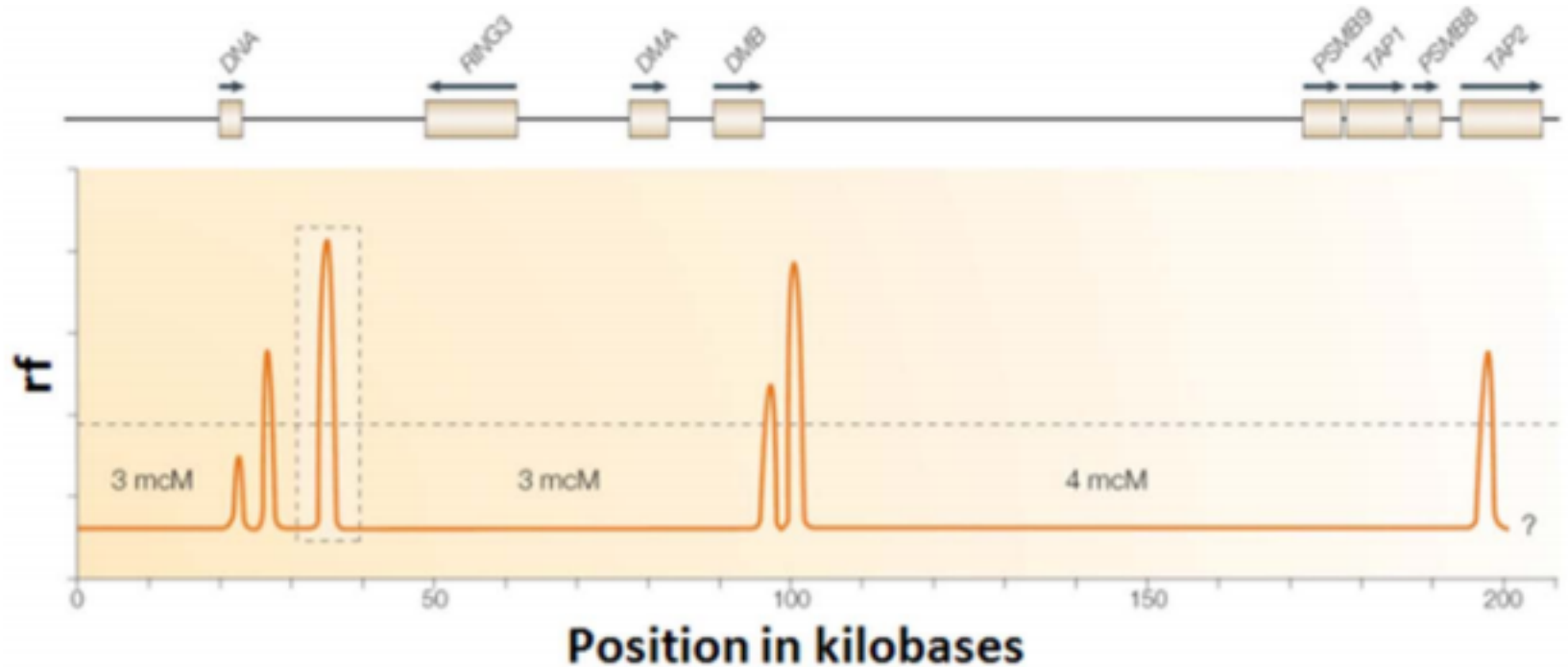
Recombination



Marker Linkage



Recombination Frequencies



Questions?