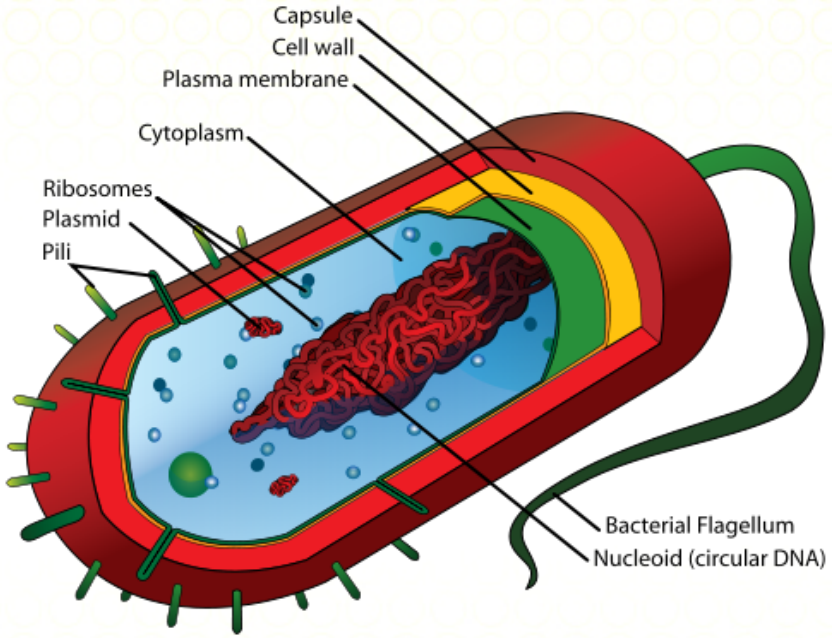
Chapter 2

Introduction to Genes and Genome

Prokaryotic Cell

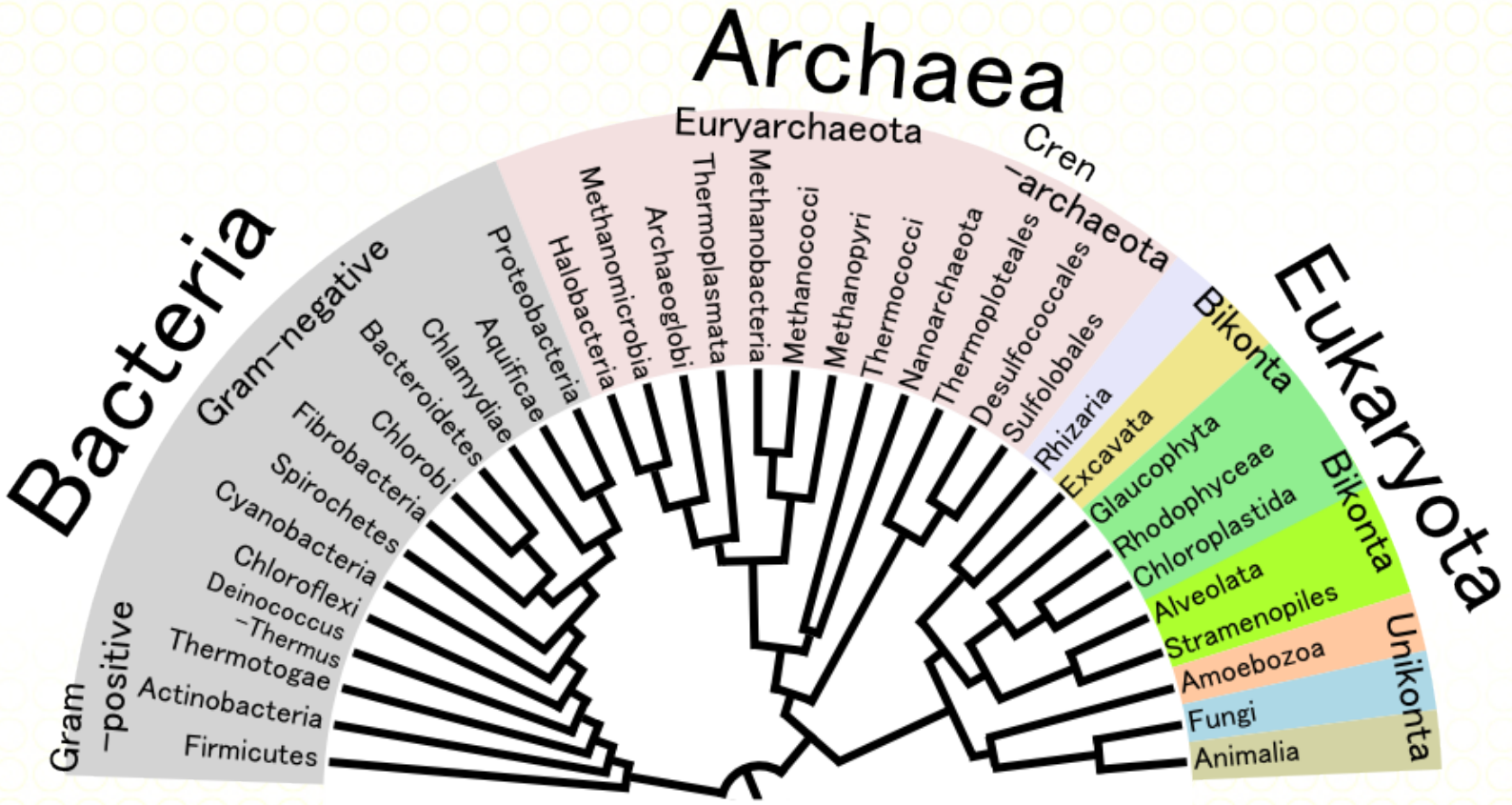
- From Greek words; pro (before) and karyon (shell/ nut)
- Mostly are unicellular
- 100nm-10 µm
- Organisms lack of nucleus or organelles
- Consist of 2 domains: bacteria and archaea



Comparison of prokaryotic and eukaryotic cells

	Prokaryotic cells	Eukaryotic cells
Cell Type	Eubacteria, Archaebacteria	Protists,Fungi, Animal and Plant cell
Size	100nm-10 micrometer	10-100micrometer
Structure	No nucleus, DNA located in the cytoplasm, Lack of organelles	DNA enclosed in a membrane-bound nucleus. Many organelles

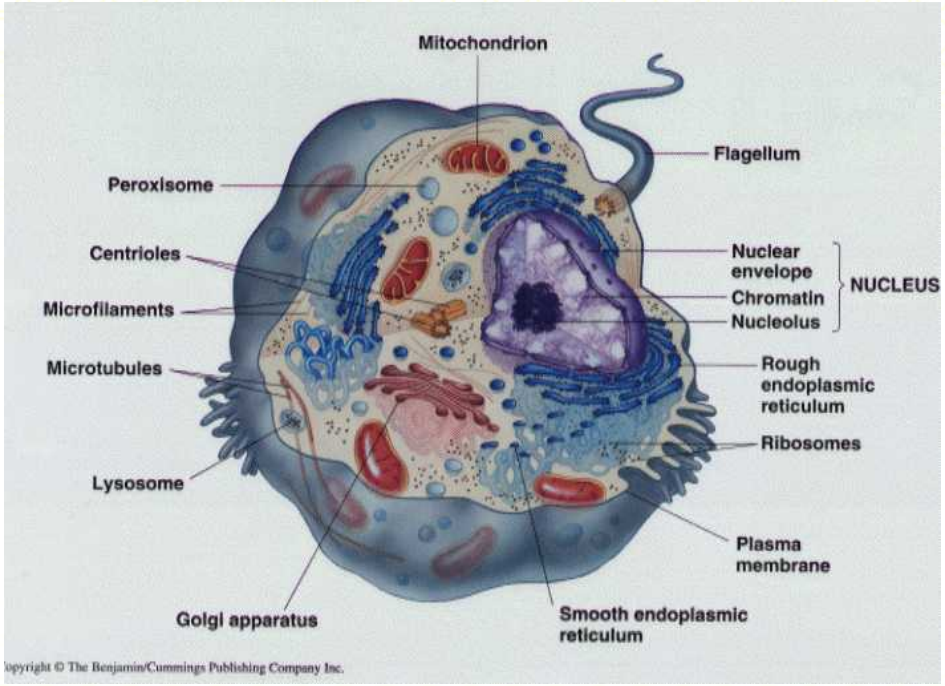
Diversity



Eukaryotic Cells

- Most cell contain complex structures enclosed within membranes such as mitochondria, chloroplasts and Golgi apparatus
- 10-100 µm

- Examples of organanisms:
  - Plant and animal cell
  - Fungus
  - Protist


Mitochondrion
Flagellum
Peroxisome
Centrioles
Nuclear envelope
Chromatin
Nucleolus
NUCLEUS
Microfilaments
Microtubules
Rough endoplasmic reticulum
Ribosomes
Lysosome
Plasma membrane
Golgi apparatus
Smooth endoplasmic reticulum
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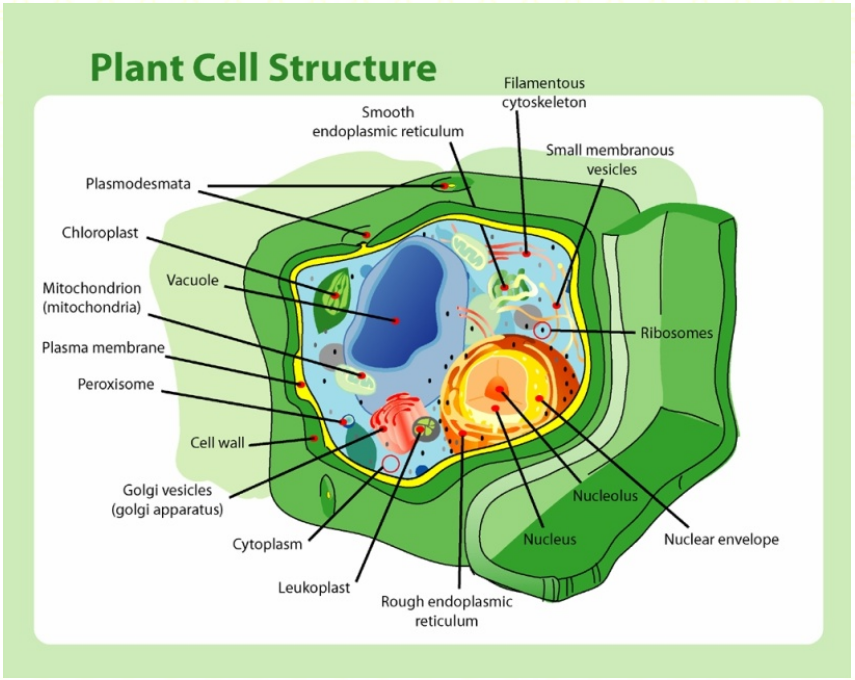

Plant Cell Structure
Filamentous cytoskeleton
Smooth endoplasmic reticulum
Small membranous vesicles
Plasmodesmata
Chloroplast
Vacuole
Mitochondrion (mitochondria)
Ribosomes
Plasma membrane
Peroxisome
Cell wall
Golgi vesicles (golgi apparatus)
Nucleolus
Cytoplasm
Nucleus
Nuclear envelope
Leukoplast
Rough endoplasmic reticulum

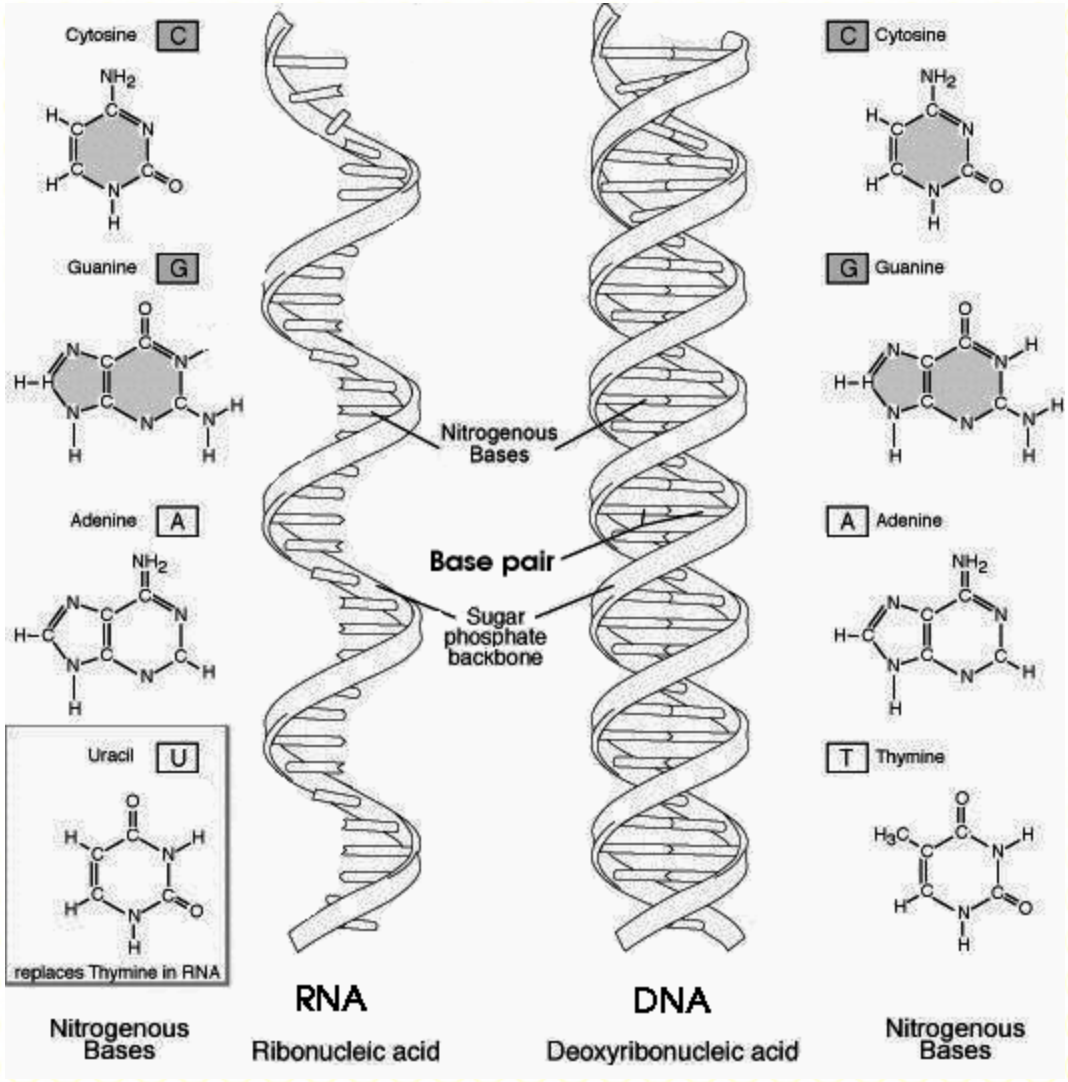
What is gene?

- A unit of heritance in live organism
- Genes hold the information to
  - Build and maintain an organism's cells
  - Pass genetic traits to offspring
- Resides on DNA segments
- Also called genetic materials
- Long-term storage of information

DNA component

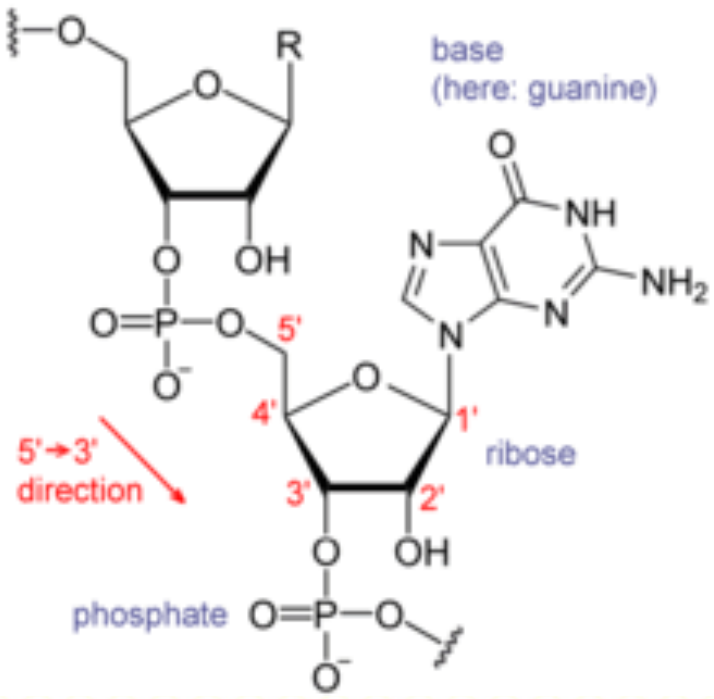
- Nucleotide consist of:
  - pentose sugar
  - phosphate molecule
  - nitrogenous base
    - 4 bases : A(adenine), T(thymine), G(guanine) and C(cytosine)
    - Nucleotides joint together to formed to form long strands called DOUBLE HELIX

Building block of DNA and RNA



RNA

- **Consist of :**
  - ribose sugar
  - Nitrogenous base (A,U,C,G)
  - Phosphate
- Centre of protein synthesis
- 3 types: mRNA, rRNA and tRNA



mRNA

mRNA

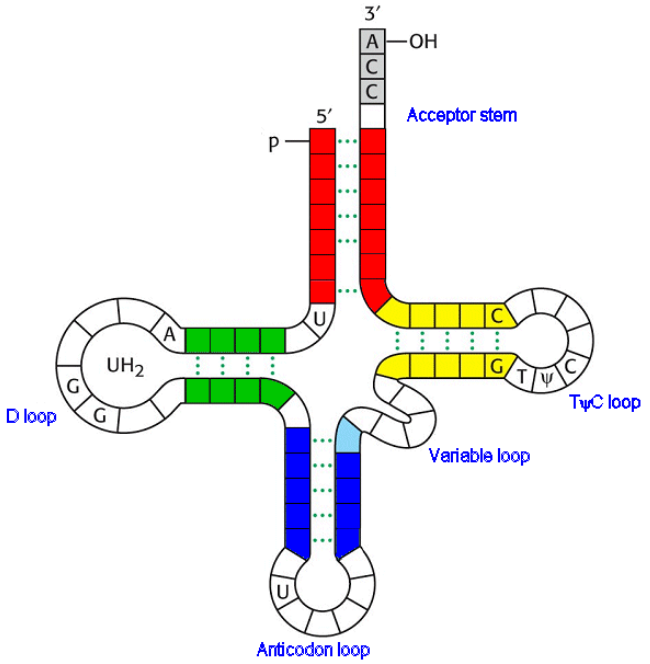
- Carry information of protein sequence to the ribosomes
- Contained codon (every 3 nucleotides) that correspond to one amino acid.
- Encode protein product

rRNA

- Component of ribosom
- Protein factory
- Decoding mRNA into amino acids
- Interacts with tRNA by providing peptidyl transferase

tRNA

- Transfers a specific active amino acid to polypeptide chain at the ribosomal site during translation
- Contained 3 base region called anticodon
- One tRNA molecule can be attached to only one type of amino acid



Differences of RNA and DNA

DNA	RNA
single-stranded	double-stranded
Pentose sugar	Ribose sugar
Adenine =Thiamine	Adenine=Uracil

Genetic Code

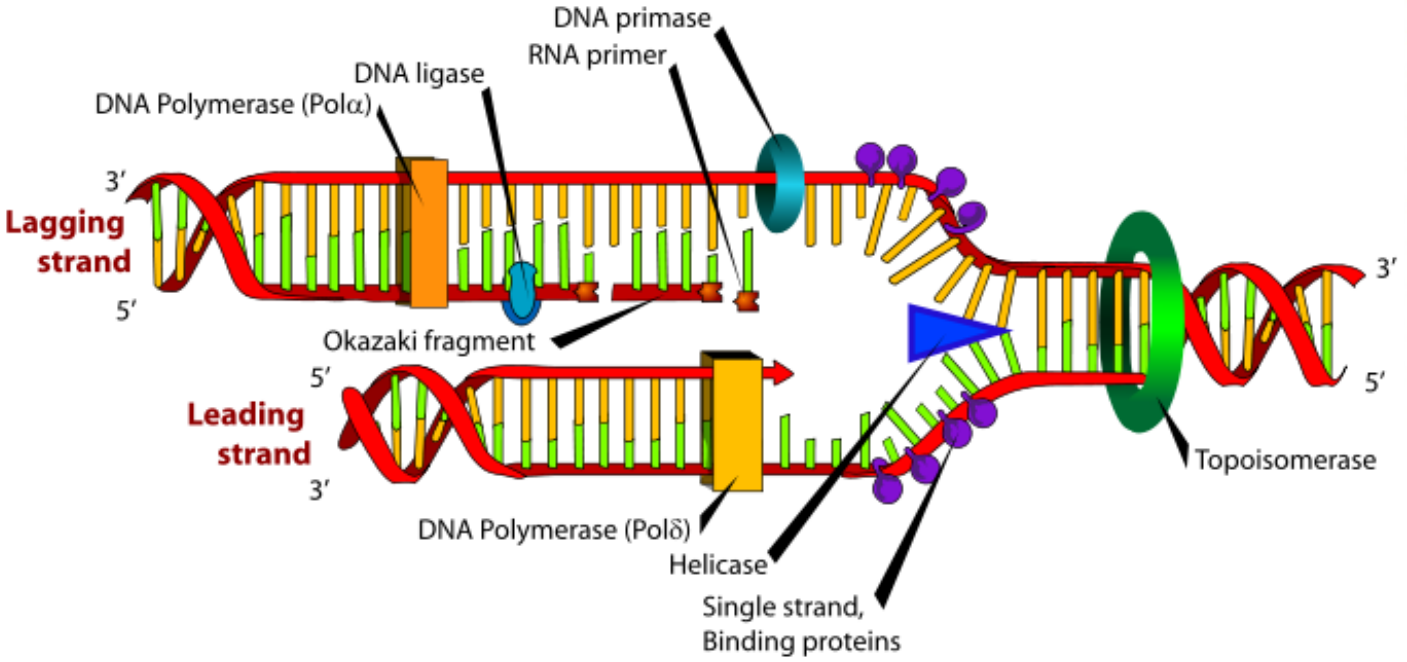
- Coded information of genetic material
- Process involved: Transcription and translation
- The code defines a series of codons and therefore produce amino acids
- Comprises of 64 triplet
- Start codon: AUG or metionine
- Stop codon: UAG, UGA andUAA
- Nonsense codon or termnation

Anticodon

- A unit made up of 3 nucleotides bases that correspond to the three bases of the codon on the mRNA.
- Each tRNA contains a specific anticodon triplet sequence that can base-pair to one or more codons for an amino acid.

DNA Replication

- Fundamental process occurring in all living organisms to copy the DNA
- Replication process from template (dsDNA) to produce complementary strand
- Therefore, two identical DNA molecules will produce from each template DNA
- Begins at specific locations in the genome, called origins
- *E. coli : dnaA* and ORC in yeast



•The **replication fork : S**tructure that forms within the nucleus during DNA replication

•The **leading strand template** is the template strand of the DNA double helix that is oriented in a 3' to 5' manner while 5’ to 3’ is the **lagging strand template**.