

# Basics of Microbiology

# Today's lecture

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- The Cell
- Genetic molecules
- Bacteria
- Enzyme reactivity

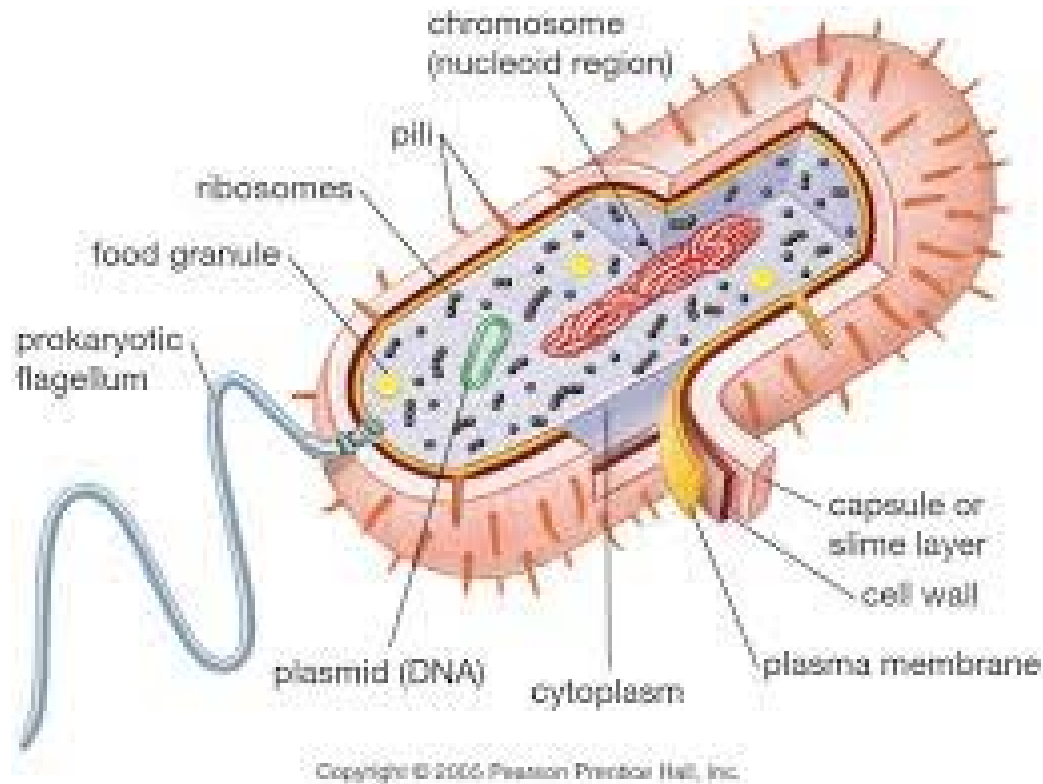
# The cell

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- A building block of life
- Distinct features of a cell
  1. capable of growth and reproduction
  2. highly organized and selectively restrict what crosses their boundaries
  3. composed of major elements (C, N, O, S) that are chemically reduced
  4. self-feeding

# The cell

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- Cell membrane
- Cell wall
- Cytoplasm
- Chromosome
- Ribosome
- Enzyme

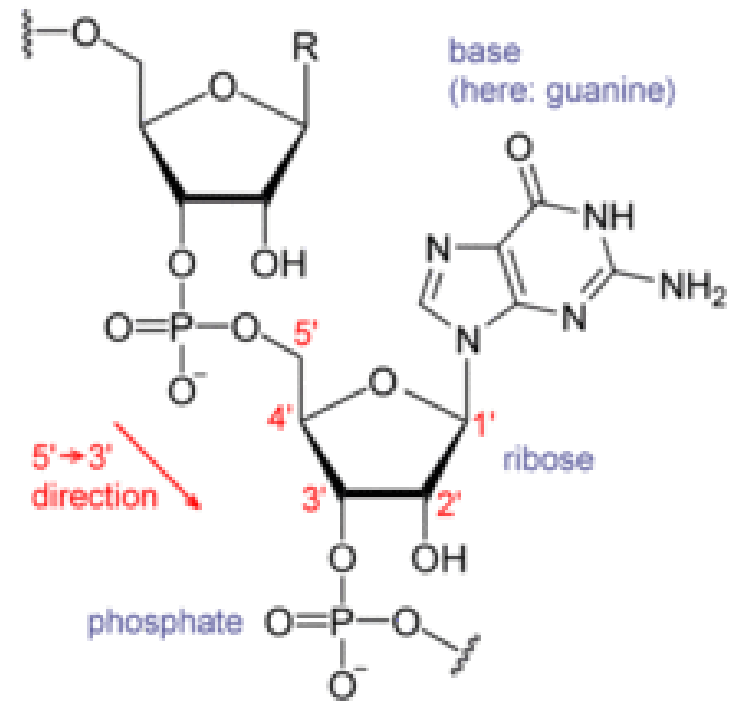
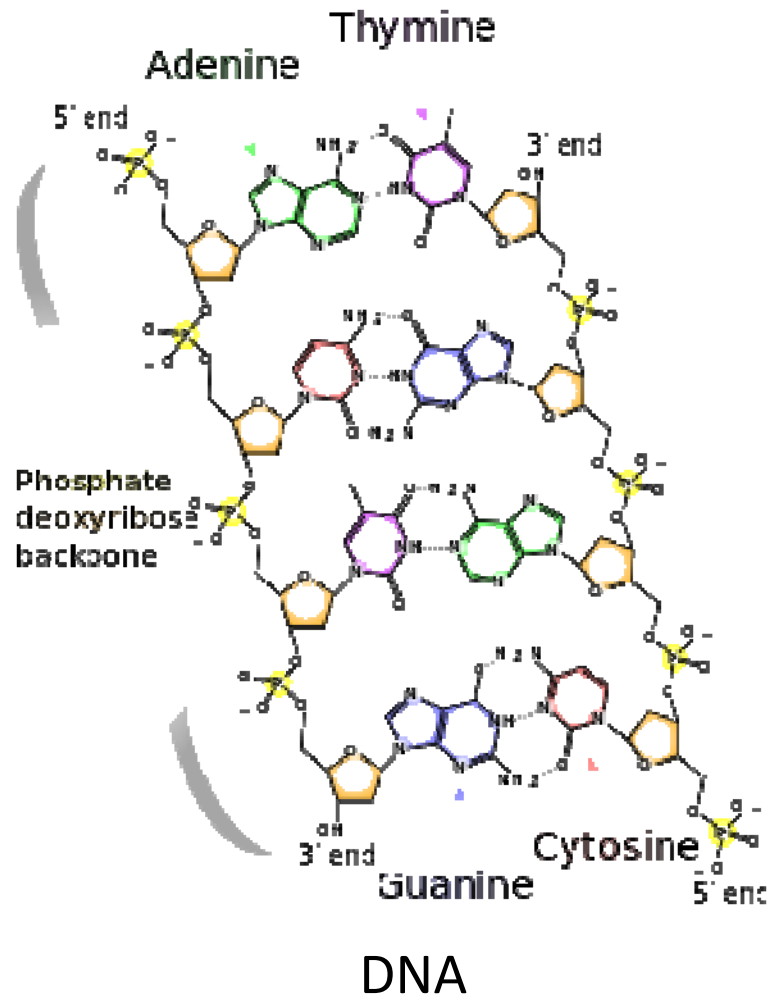
Prokaryotic cell

# Genetic molecules

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	<b>DNA (deoxyribonucleic acid)</b>	<b>RNA (ribonucleic acid)</b>
Sugar	deoxyribose	ribose
Strand	double-stranded	single-stranded
Base	adenine (A), thymine (T), guanine (G), cytosine (C)	adenine (A), uracil (U), guanine (G), cytosine (C)

# Genetic molecules

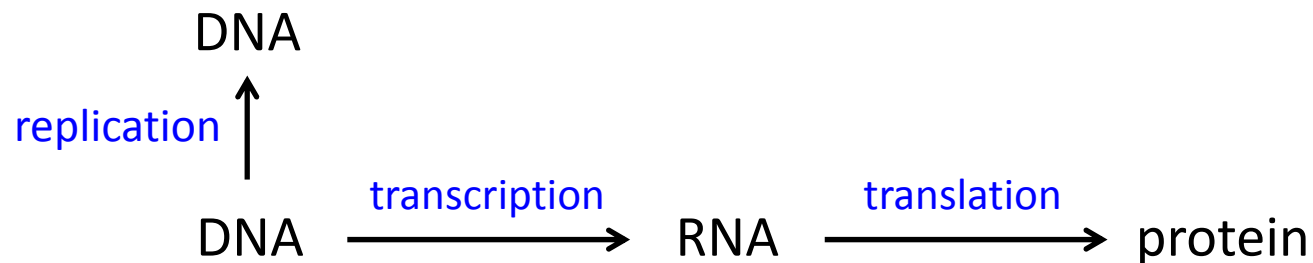


RNA

# Genetic molecules

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- DNA: Long-term storage of genetic information; transmission of genetic information to other cells and new organisms
- RNA: Transfer the genetic code from the DNA to ribosomes to make proteins



# Taxonomy and phylogeny

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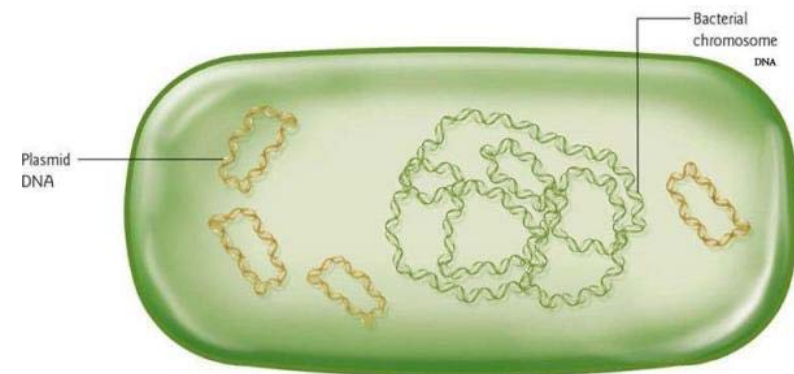
- Taxonomy: classification based on observable physical properties of organisms (phenotype)  
ex) appearance, dye or strain characteristics, ability of chemical transformation
- Phylogeny: classification based on genetic characteristics (16S rRNA)



# Bacteria

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- Ubiquitous
- Can transform a great variety of inorganic and organic pollutants
- Plasmids – horizontal gene transfer
- 0.5 – 2  $\mu\text{m}$  size  
→  $\sim 10^{12}$  cells/g

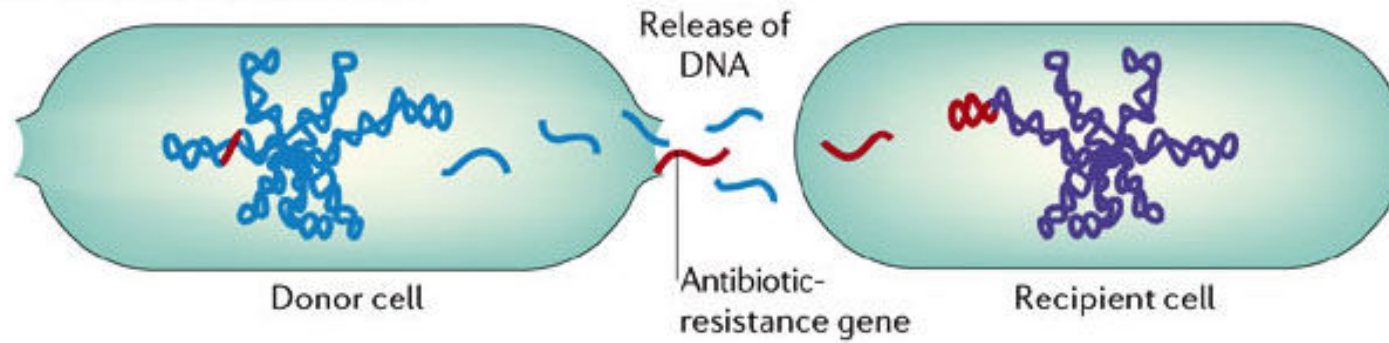


# Horizontal gene transfer

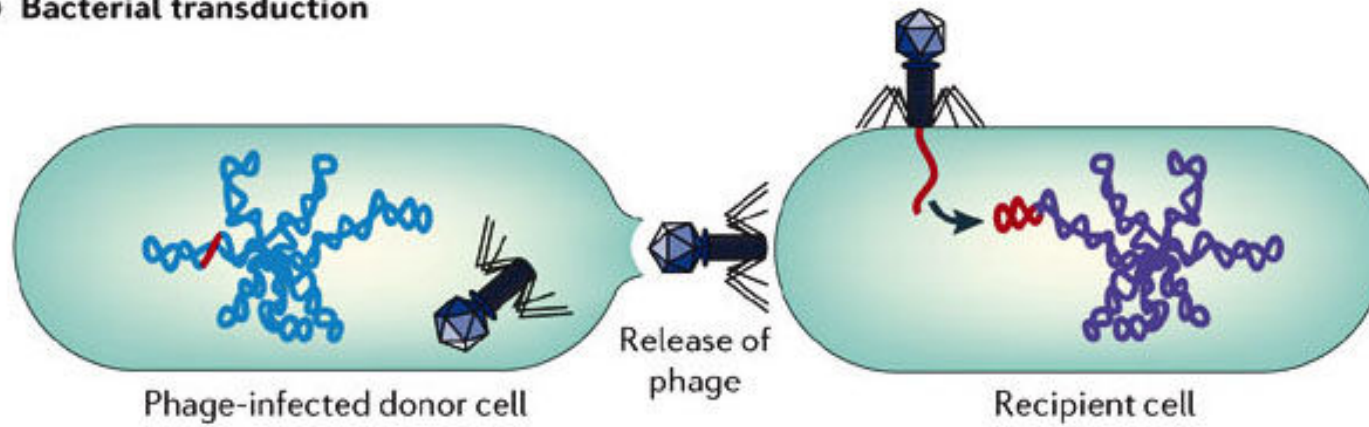
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- Movement of genetic material between organisms other than by vertical transmission of DNA
  - cf) Vertical gene transfer: from parent to offspring
- Mechanisms
  - Transformation: direct uptake and incorporation of exogenous genetic material
  - Transduction: introduction of foreign DNA into a cell by a virus
  - Conjugation: transfer of genetic material between bacterial cells by direct cell-to-cell contact or by a bridge-like connection

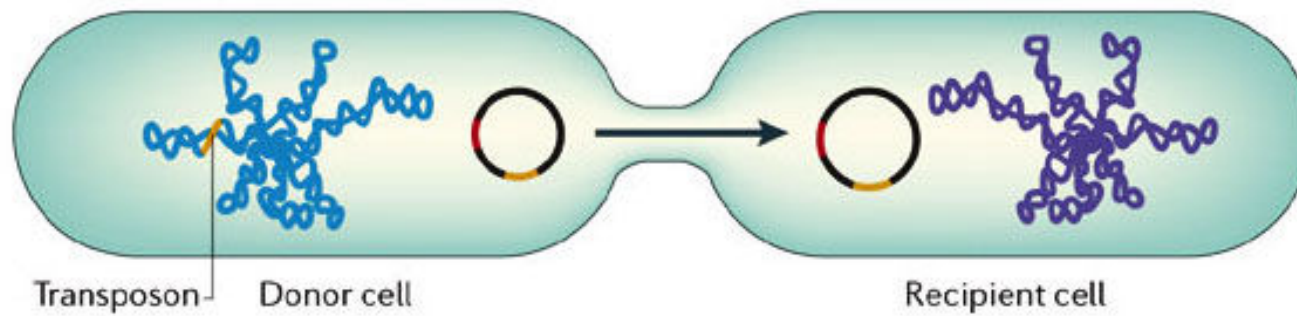
**a Bacterial transformation**



**b Bacterial transduction**



**c Bacterial conjugation**



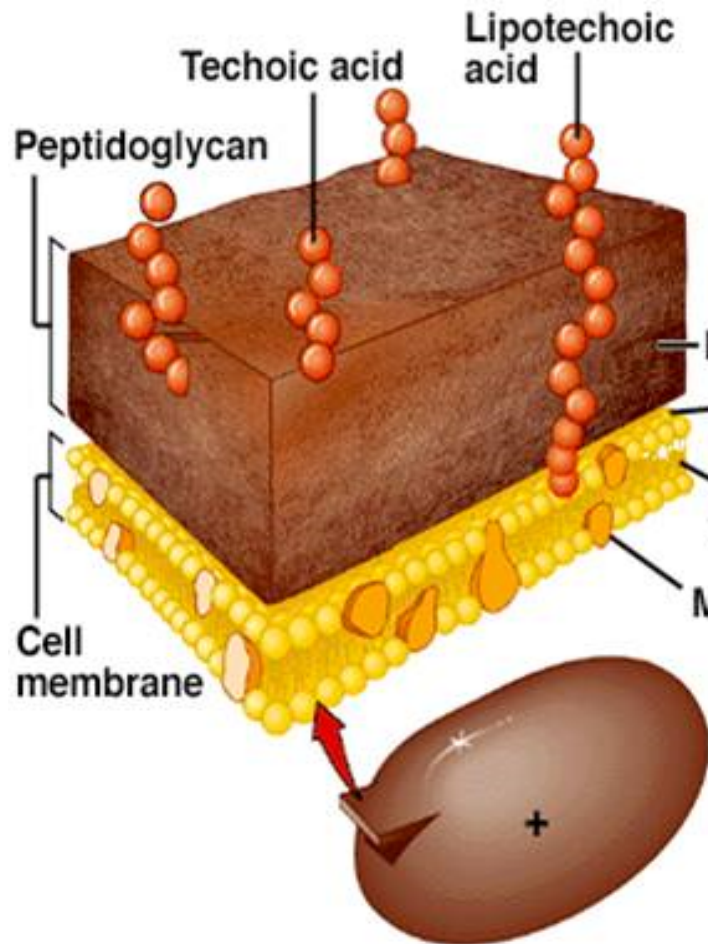
# Classification of bacteria

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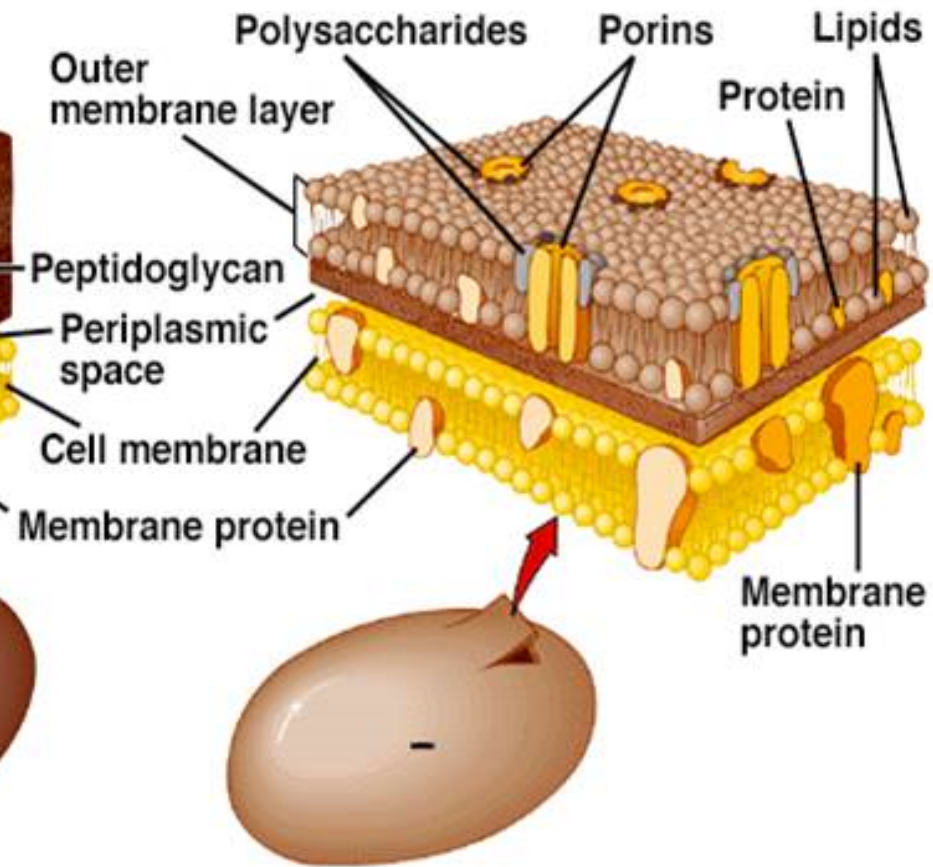
- By staining:
  - Gram positive & negative
  - Discovered by H. C. Gram in 1884
  - Gram(+): blue-purple / Gram(-): red
  - Based on cell wall characteristics

# Classification of bacteria

Gram Positive



Gram Negative



# Classification of bacteria

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- By energy source: phototrophs & chemotrophs (organotrophs/lithotrophs)
- By carbon source: autotrophs & heterotrophs
- By growth in the presence/absence of O<sub>2</sub>: aerobes & anaerobes
  - obligate anaerobes
  - aerotolerant anaerobes
  - obligate aerobes
  - facultative aerobes

# Enzyme reactivity

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- Works in lock-and-key fashion

