Basics of Microbiology

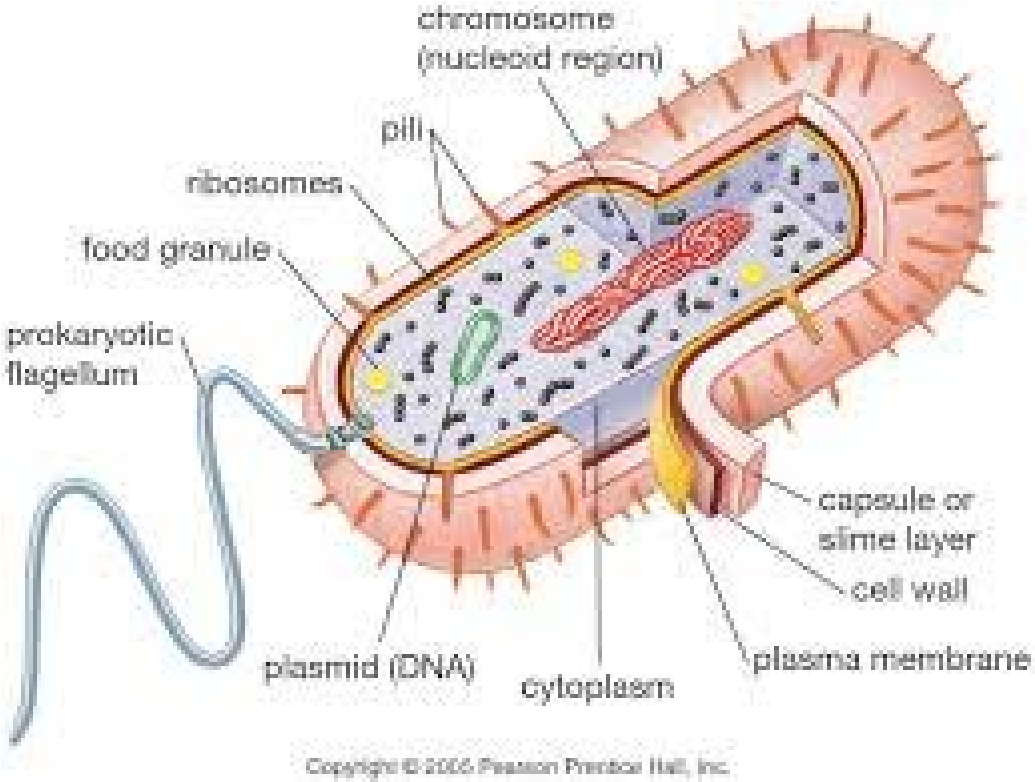
Today's lecture

- The Cell
- Genetic molecules
- Bacteria
- Enzyme reactivity

The cell

- 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



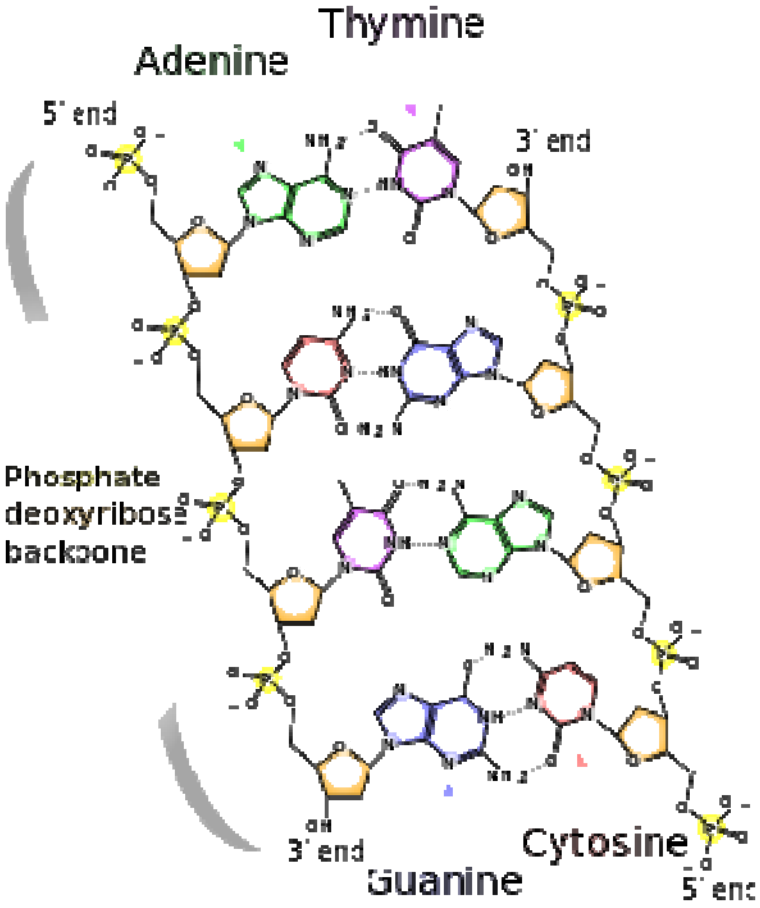
Prokaryotic cell

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

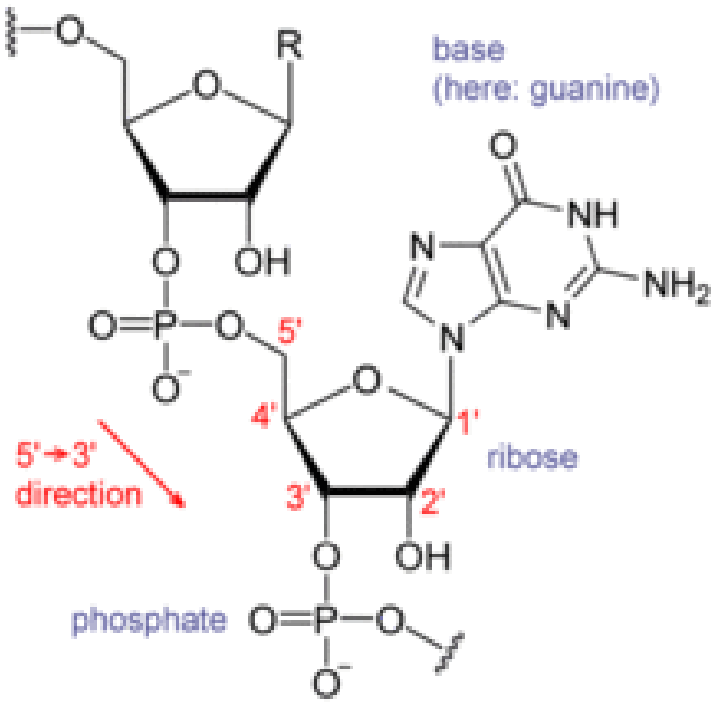
Genetic molecules

	DNA (deoxyribonucleic acid)	**RNA (ribonucleic acid)**
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



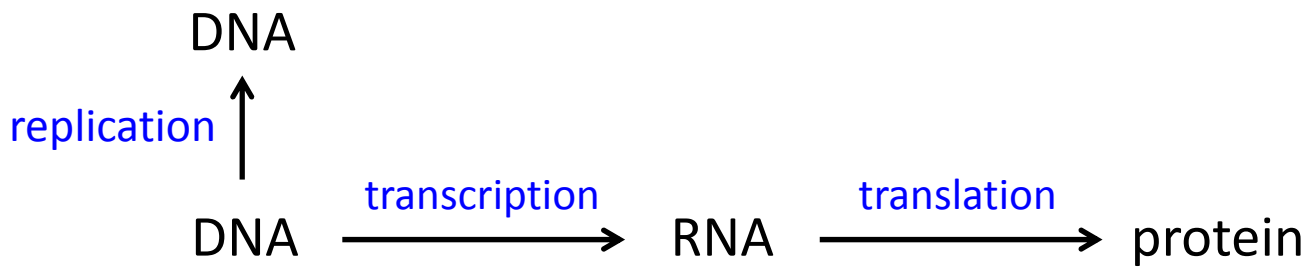
DNA



RNA

Genetic molecules

- 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

- Taxonomy: classification based on observable physical properties of organisms (phenotype)

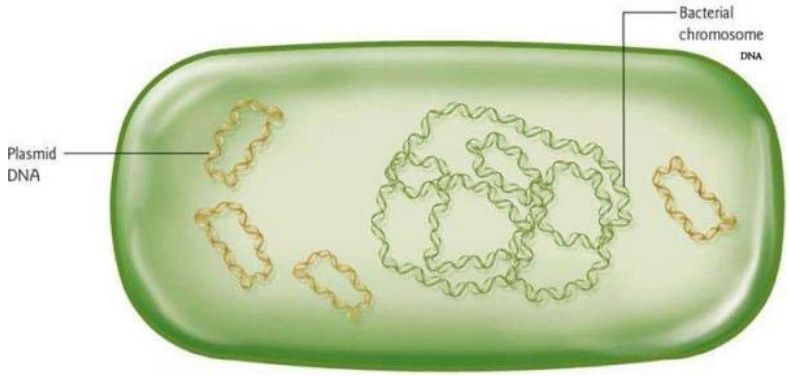
  ex) appearance, dye or strain characteristics, ability of chemical transformation

- Phylogeny: classification based on genetic characteristics (16S rRNA)

Bacteria

- Ubiquitous
- Can transform a great variety of inorganic and organic pollutants
- Plasmids – horizontal gene transfer
- 0.5 – 2 µm size

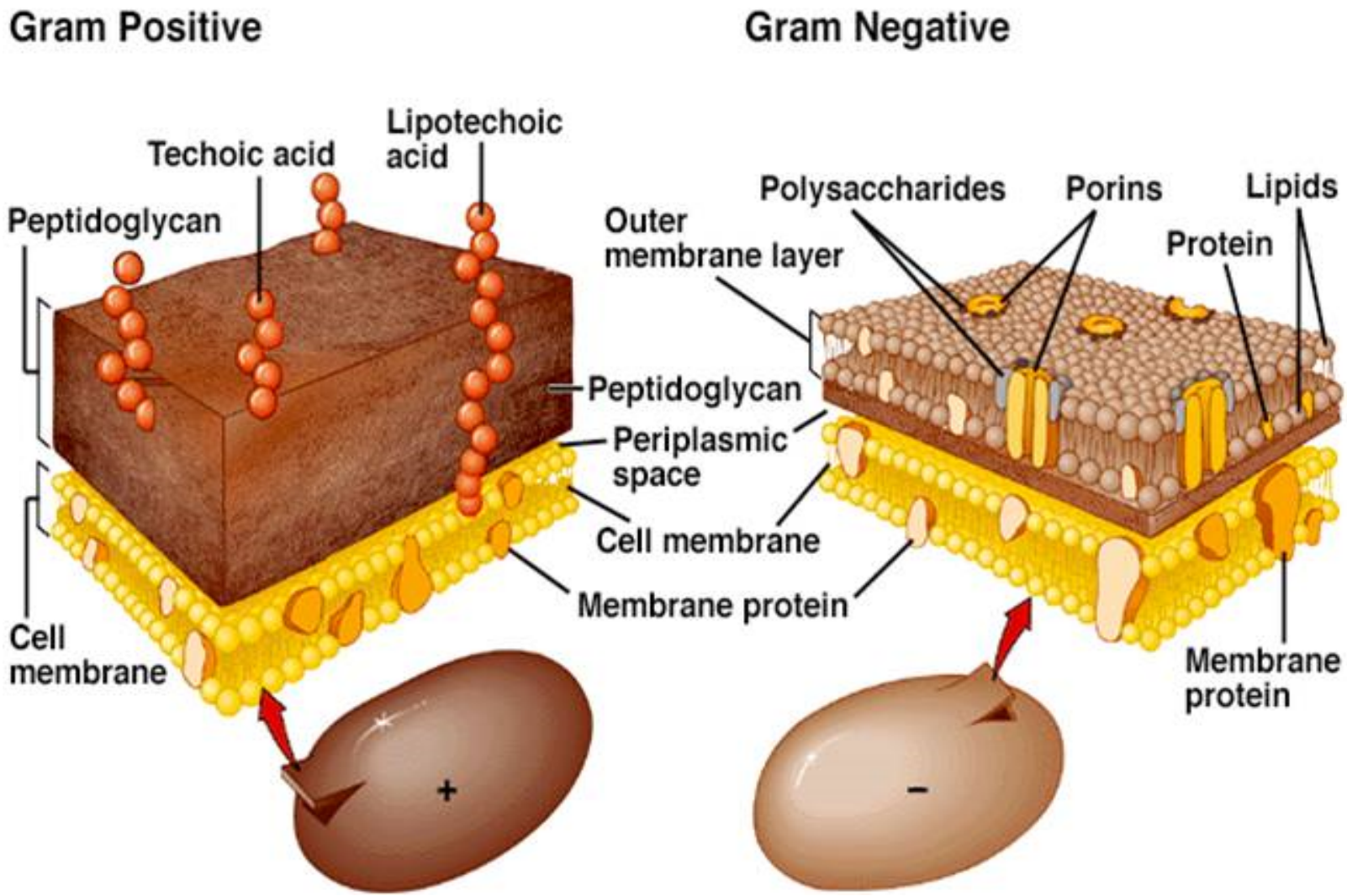
  → ~10^{12} cells/g



Classification of bacteria

- 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



Classification of bacteria

- By energy source: phototrophs & chemotrophs (organotrophs/lithotrophs)
- By carbon source: autotrophs & heterotrophs
- By growth in the presence/absence of O_2: aerobes & anaerobes
  - obligate anaerobes
  - aerotolerant anaerobes
  - obligate aerobes
  - facultative aerobes

Enzyme reactivity

- Works in lock-and-key fashion