

# Bioengineering

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Version: June 4, 2025

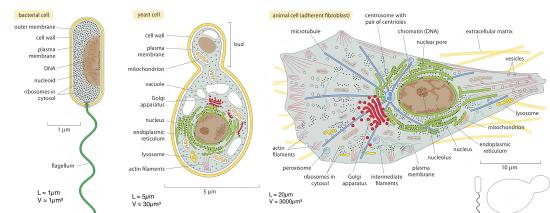
Tera	T	$10^{12}$	Kilo	k	$10^3$	Nano	n	$10^{-9}$
Giga	G	$10^9$	Milli	m	$10^{-3}$	Piko	p	$10^{-12}$
Mega	M	$10^6$	Mikro	$\mu$	$10^{-6}$	Femto	f	$10^{-15}$

## Orientation of the cell

Central Dogma of Molecular Biology



Cells:



**nucleus:** houses DNA for EK  
 **nucleolus:** produces ribosomes/rRNA  
**mitochondria:** cellular respiration (prod. ATP)  
**ribosome:** produces proteins from mRNA transcripts

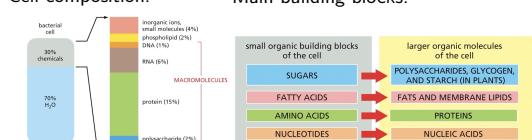
**RER, SER and Golgi:** involved in protein/lipid synthesis/processing

**cytoskeleton:** structure to cell, transport mol. in the cell or to enable the cell to move (cell migration)

**centrosome:** organizes microtubules during cell division allows the mother cell to split into 2 cells

## Building Blocks

Cell composition: Main building blocks:



- Lipids (fatty acids):** long-term energy storage, cell membrane structure, signaling molecules.
- Proteins (amino acids):** perform most of the cell's functions, including catalyzing reactions, signaling, and structural support. amino group NH<sub>2</sub>, carboxyl group COOH
- Nucleic acids (nucleotides):** store and transmit genetic information (DNA, RNA), carry energy
- Carbohydrates (Sugars):** short-term energy storages and for structural support.

## Enzymes (aka catalysts)

- Accelerate reaction by lowering the activation energy
- Are not consumed in the reaction
- Are specific to the reaction they catalyze
- Do not change the equilibrium point of the reaction.

## Bounds

$$K_D = \frac{k_{off}}{k_{on}}$$

Covalent  $\longleftrightarrow$   $100k_B T$

Ionic  $\longleftrightarrow$   $1 - 10k_B T$

Hydrogen  $\longleftrightarrow 1k_B T$

Van der Waals  $\longleftrightarrow 0.1k_B T$

Electrostatic  $\longleftrightarrow 0.1k_B T$

$K_D$ : Equilibrium constant

indicates the ratio of free & bound units

$k_{off}$ : Dissociation rate constant

inverse of time protein dissociates from the ligand

$k_{on}$ : Association rate constant, speed of the reaction

## Prozesse und Prozessketten

### Simulation

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### Urformen

### Pulvermetallurgie

### Umformen

### Trennen

### Fügen