**Diffusion**: the movement of solutes from areas of high concentration to areas of low concentration

Solutes: small particles suspended in water

**High concentration**  **Low concentration**

**DIFFUSION REQUIRES NO ENERGY INPUT!**
Osmosis

Solutes: small particles suspended in water

High solute concentration
Low solute concentration

Low water ‘concentration’
High water ‘concentration’

Osmosis: the movement of water from areas of low solute concentration to areas of high solute concentration

High solute concentration
Low solute concentration

Low water ‘concentration’
High water ‘concentration’

OSMOSIS REQUIRES NO ENERGY INPUT!
**Osmosis:** the movement of water from areas of low solute concentration to areas of high solute concentration

High solute concentration  
Low solute concentration

LOW WATER ‘CONCENTRATION’  
HIGH WATER ‘CONCENTRATION’

**PHOSPHOLIPIDS:**
the ‘building blocks’ of membranes

Fatty Acid Chains (2)  
Phosphate Molecule

**HYDROPHOBIC:** avoids water  
**HYDROPHILIC:** seeks water

**OSMOSIS REQUIRES NO ENERGY INPUT!**
Phospholipids gather together into layers...

...and then into a LIPID BILAYER – a membrane.
Diffusion and active transport also happen across lipid bilayer membranes.

**Diffusion**

- Requires no energy
- Moves solutes from high concentration to low concentration
- Simple (above) or facilitated (below)

**Active Transport**

- Requires energy
- Moves solutes against concentration gradient
High concentration
Low concentration

Active transport: moves solutes from low concentration to high concentration using energy from ATP

Requires energy

Active transport
Osmosis

- Movement of water from area of low solute concentration to area of high solute concentration

\[ \text{H}_2\text{O} \]

The cell membrane
(=plasma membrane)

Fig. 5.12, p. 80. KNOW THIS DIAGRAM!!!
What is a cell?

“The smallest unit of living matter”

“Building blocks for organisms”

All living organisms are made up of at least one cell, and usually many more than one.

Cells are surrounded by a membrane (a lipid bilayer).

What is a cell?

“The smallest unit of living matter”

“Building blocks for organisms”

In multicellular organisms, cells are organized into tissues, and tissues are organized into organs.
What do cells do?

-- Division of labor: cells have sub-cellular parts (organelles) that carry out specific functions:

A Generalized Animal Cell

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CELL: The smallest unit of living matter.
Nucleolus (small) and Nucleus (larger)
FUNCTION: Gene storage and ‘workspace’

Rough Endoplasmic Reticulum
FUNCTION: Translation/Protein synthesis (using ribosomes)
The smooth ER
FUNCTION: making lipids; storing Ca\textsuperscript{2+} ions

The Golgi apparatus
FUNCTION: processing and handling of proteins
**Vesicles and Lysosomes**
*FUNCTION: handling food and other molecules*

**Vacuoles**
*FUNCTION: handling water*
Vacuoles
FUNCTION: handling water; PLANT STRUCTURE

Mitochondria
FUNCTION: making ATP – providing energy
MITOCHONDRIA: “The Powerhouse of the Cell”
-- DOUBLE MEMBRANE
-- mitochondria also have their own DNA

Chloroplasts
FUNCTION: harnessing energy from the sun
CHLOROPLASTS: harness energy from the sun
-- Make sugars from CO₂
-- DOUBLE MEMBRANE
-- Chloroplasts also have their own DNA

Cytoskeleton:
Microtubules and microfilaments
Cell Wall: cellulose
FUNCTION: supports and protects plant cells

Peroxisomes
FUNCTION: maintenance; breakdown of peroxides
PROKARYOTES: Bacteria and Archaea;

Virus: DNA or RNA, a protein shell, and a few enzymes
### Eukaryotic Organelles and Their Functions

<table>
<thead>
<tr>
<th>General Function</th>
<th>Mesenchyme</th>
<th>Extracellular matrix (in mesenchyme)</th>
<th>Cilia</th>
<th>Nucleus</th>
<th>Ribosomes</th>
<th>Rough ER</th>
<th>Smooth ER</th>
<th>Golgi apparatus</th>
<th>Lysosomes</th>
<th>Peroxisomes</th>
<th>Vacuoles</th>
<th>Mitochondria</th>
<th>Chloroplasts (in plant cells and some protists)</th>
<th>Mitochondria</th>
<th>General Function: Support, Movement, and Communication Between Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Function: Mesenchyme</strong></td>
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<td>Conversion of chemical energy of food to chemical energy of ATP</td>
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<td>Maintenance of cell shape, anchorage for organisms; movement of organelles within cells; cell movement; mechanical transmission of signals from exterior of cell to interior; binding of cells in tissues; binding of cells in tissues</td>
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<tr>
<td><strong>General Function: Extracellular matrix (in mesenchyme)</strong></td>
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<tr>
<td><strong>Cilia</strong></td>
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<tr>
<td><strong>Nucleus</strong></td>
<td>DNA synthesis, RNA synthesis, assembly of ribosomal subunits (in nucleolus)</td>
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<td><strong>Ribosomes</strong></td>
<td>Polypeptide (protein) synthesis</td>
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<tr>
<td><strong>Rough ER</strong></td>
<td>Synthesis of membrane proteins, secretory proteins, and hydrolytic enzymes; formation of transport vesicles</td>
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<tr>
<td><strong>Smooth ER</strong></td>
<td>Lipid synthesis, carbohydrate metabolism in liver cells; detoxification in liver cells; calcium ion storage</td>
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<tr>
<td><strong>Golgi apparatus</strong></td>
<td>Modifications, temporary storage, and transport of membrane proteins and transport vesicles</td>
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<td><strong>Lysosomes</strong></td>
<td>Digestion of nutrients, bacteria, and damaged organelles; destruction of certain cells during embryonic development</td>
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<td><strong>Peroxisomes</strong></td>
<td>Oxidation of metabolites, processing of hydrogen peroxide</td>
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<tr>
<td><strong>Vacuoles</strong></td>
<td>Digestion, like lysosomes; storage of chemicals; cell enlargement; waste balance</td>
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