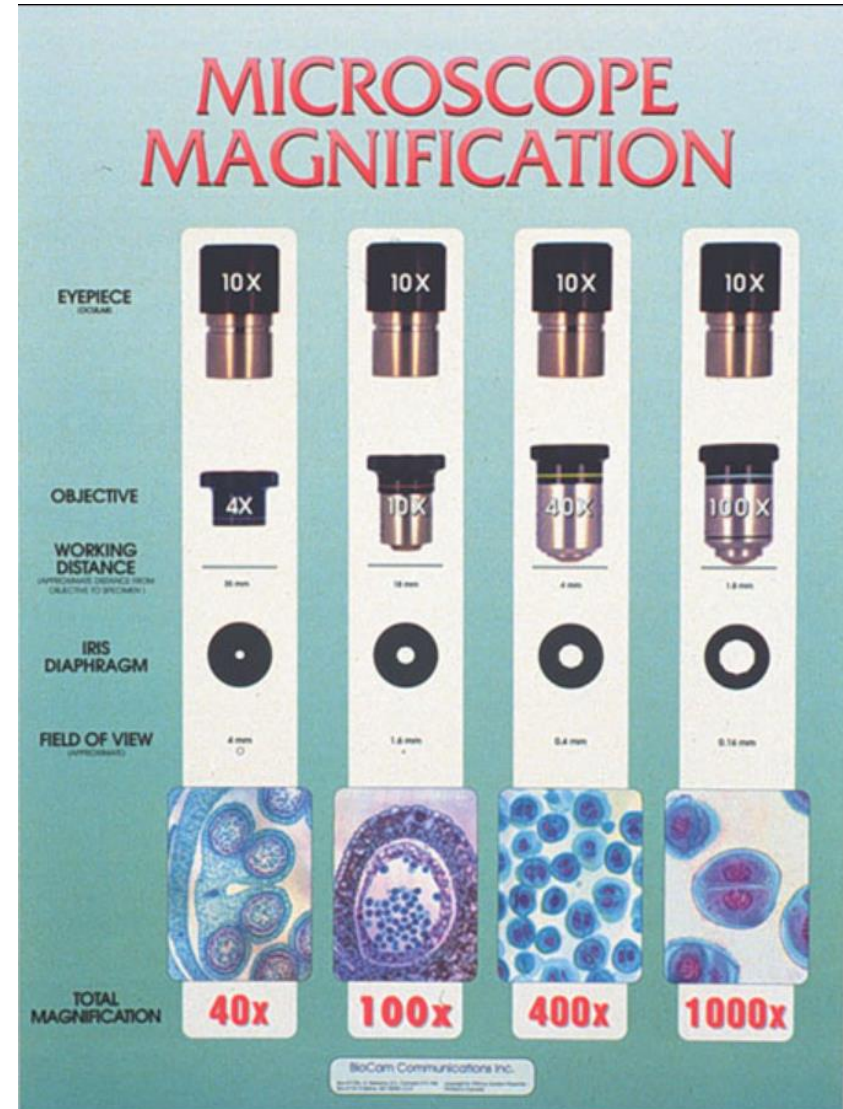
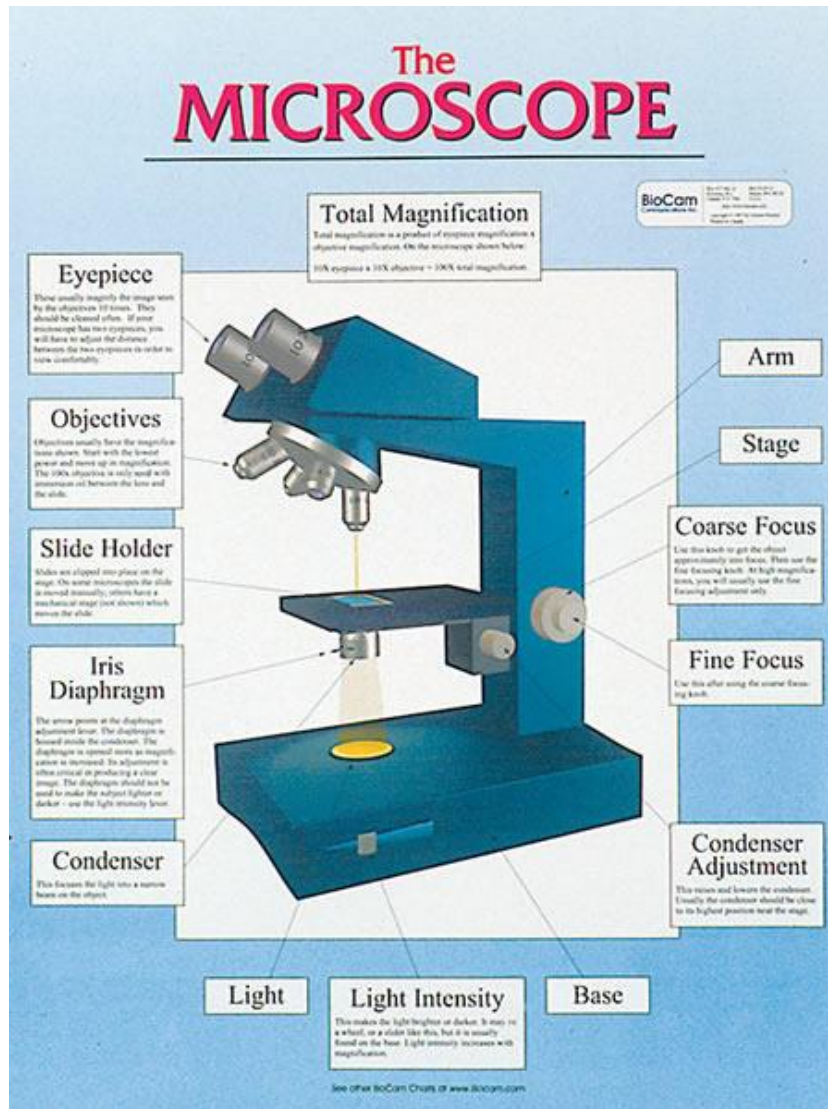
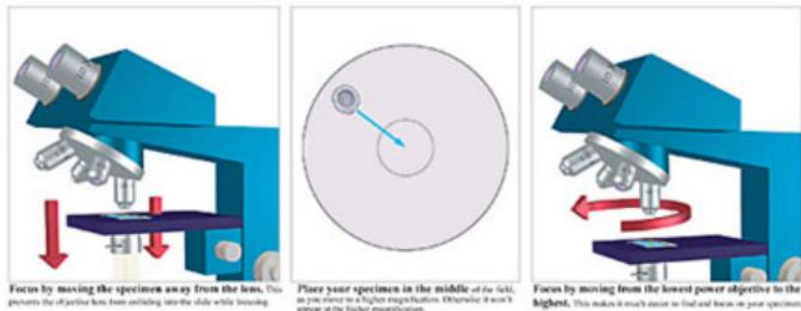
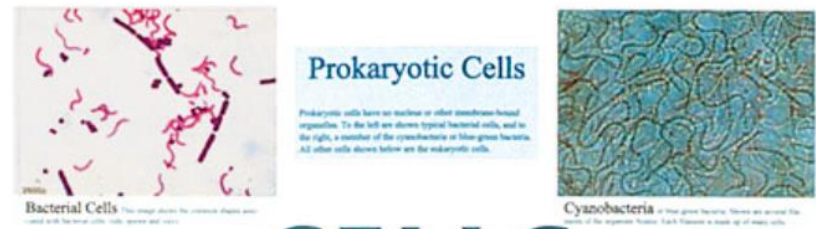
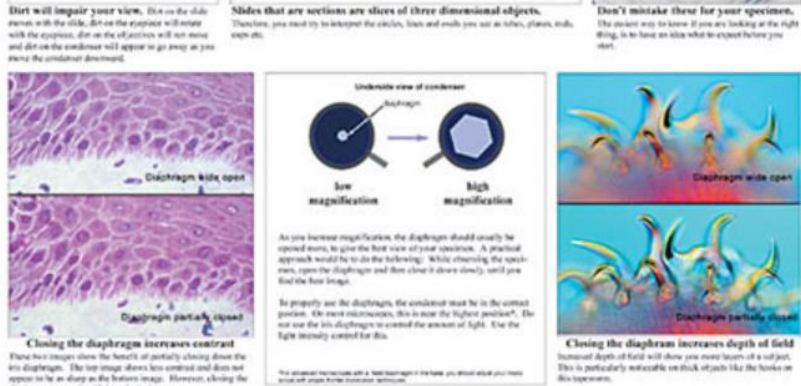


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MICROSCOPE FOCUSING TIPS

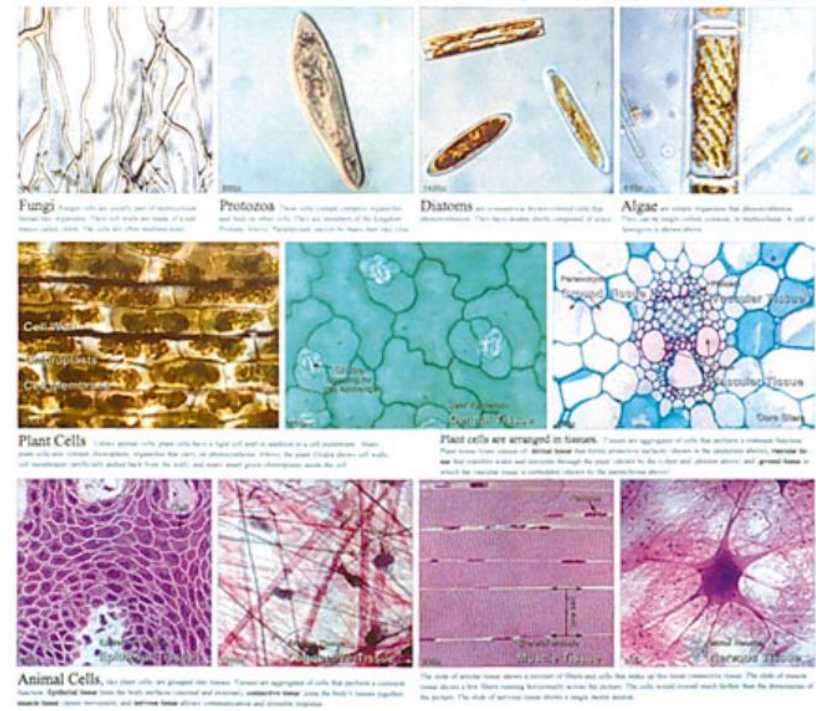


CELLS

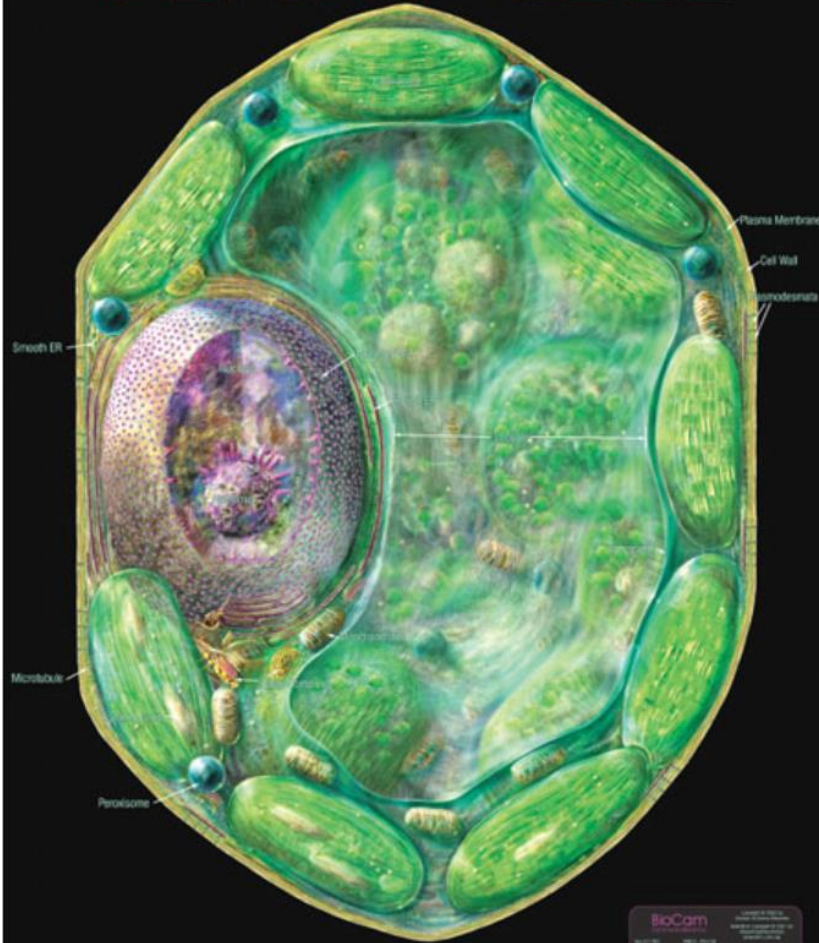


Eukaryotic Cells

These are cells with a nucleus and other membrane-bound organelles. All the cells shown below are eukaryotes.



PLANT CELL

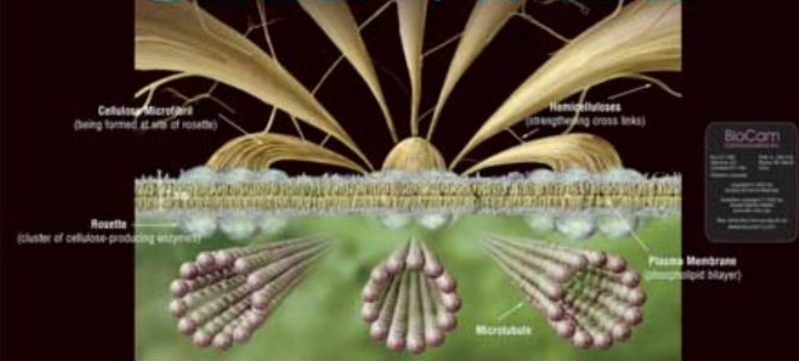


Plant cell drawn 20,000 times life size.

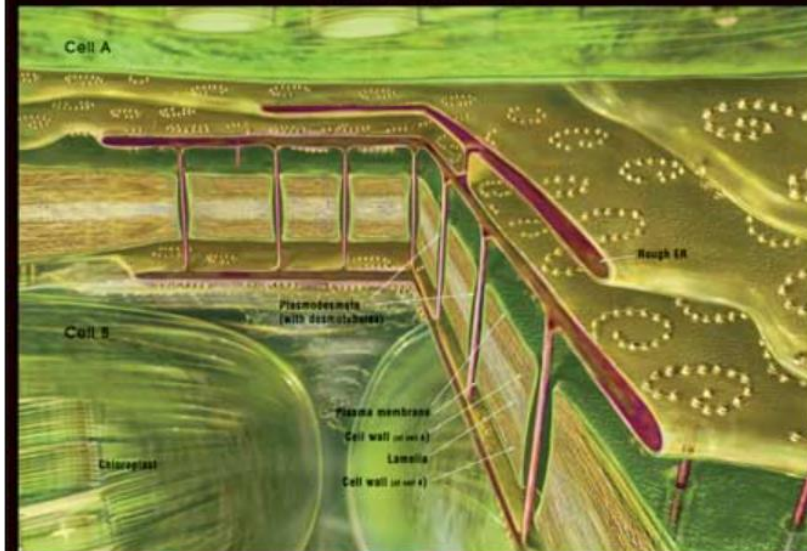


Plant Cell 101 48

CELL WALL



Plant Cell Wall - Synthesis of Cellulose



Two Adjacent Plant Cells

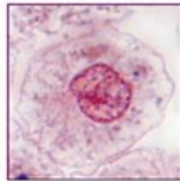
Cell Wall 101 58



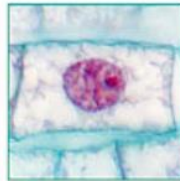
Interphase

Most cellular metabolic activity takes place during interphase. During this time the following events happen:

- Most cells increase in size.
- Cell organelles such as ribosomes, mitochondria, endoplasmic reticulum, and centrioles are duplicated.
- DNA is synthesized and chromosomes are duplicated. Each chromosome and its duplicate are joined at a region called the centromere. Together they are considered as one chromosome completing two parts called sister chromatids. They are not visible until the chromosomes tightly coil (condense) during mitosis.



Animal Cell
(Whiskfish Bladder)



Plant Cell
(New Root Tip)

The diagram of mitosis are of a cell with two pairs of chromosomes (4n).

Photographs show cells magnified 1000 X.

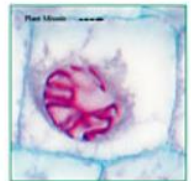
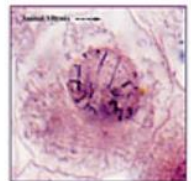
MITOSIS

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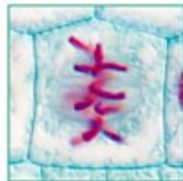
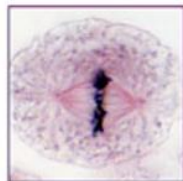
1 Prophase

Chromosomes condense and become visible. The nuclear membrane and nucleolus disappear. A spindle apparatus begins to form. In animal cells, centrioles move to either end of the spindle. The later part of this phase is also called prometaphase.



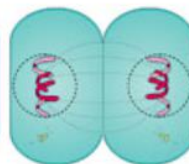
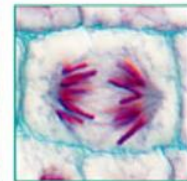
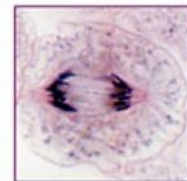
2 Metaphase

Chromosomes align themselves in a plane which is perpendicular to the center of the spindle. This plane is called the metaphase plate.



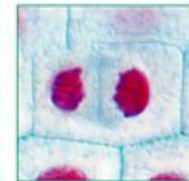
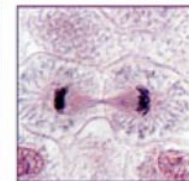
3 Anaphase

Sister chromatids split at the centromeres and travel towards opposite ends of the spindle. Each chromatid is now considered a full chromosome.



4 Telophase

Chromosomes arrive at the ends of the spindle and the spindle apparatus begins to disassemble. New nuclear membranes are formed around the chromosomes and the chromosomes uncoil. Cytokinesis or cell division begins as a cleavage furrow (in animal cells) and a cell plate (in plant cells).



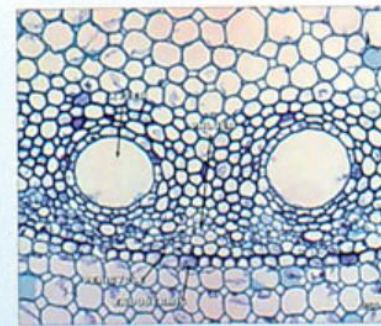
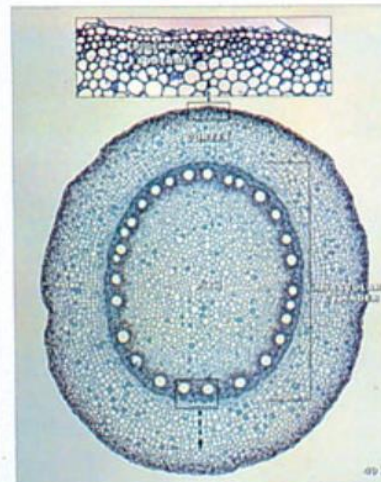
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HISTOLOGY OF THE ROOT

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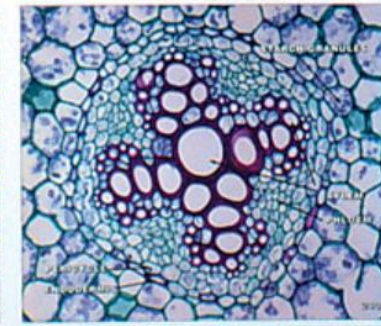
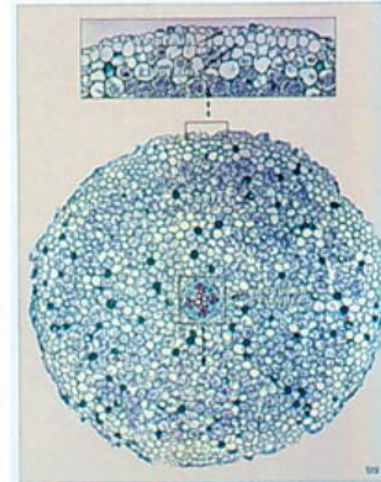
MONOCOTS



CORN

The top photograph shows a low magnification view of the corn root. The inset shows the detail of its epidermis. The bottom photograph shows a higher magnification of a part of the root's vascular cylinder.

DICOTS



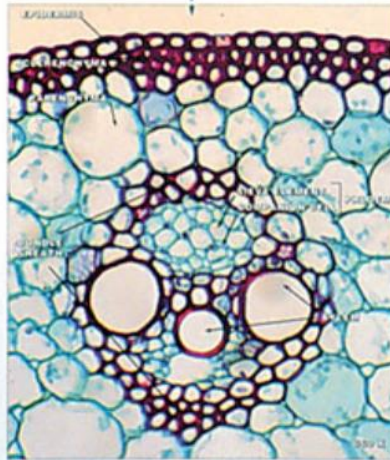
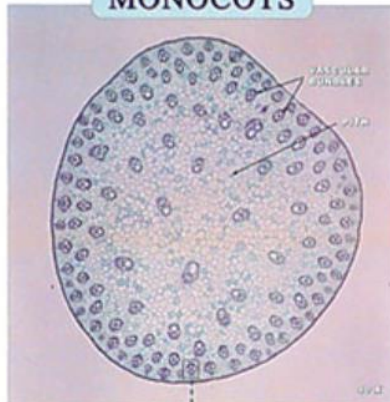
BUTTERCUP

The top photograph shows a low magnification view of the buttercup root. The inset shows the detail of its epidermis. The bottom photograph shows a higher magnification of a part of the root's vascular cylinder.

HISTOLOGY OF THE STEM

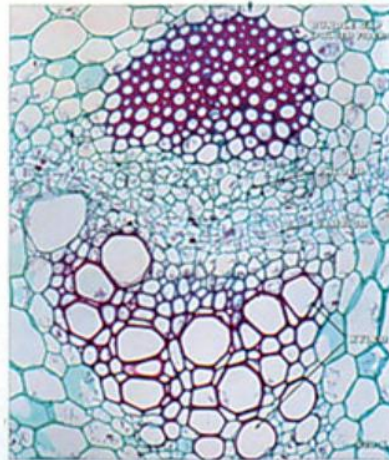
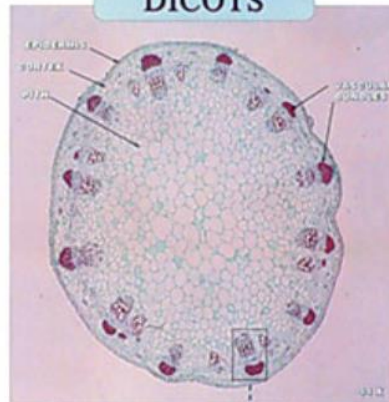
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MONOCOTS



Corn The top photograph shows a low magnification view of the cross section of a corn stem. The bottom photograph shows a single vascular bundle from this stem.

DICOTS

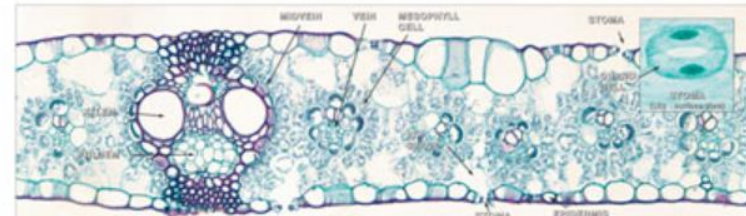


Sunflower The top photograph shows a low magnification view of the cross section of a sunflower stem. The bottom photograph shows a single vascular bundle from this stem.

HISTOLOGY OF THE LEAF

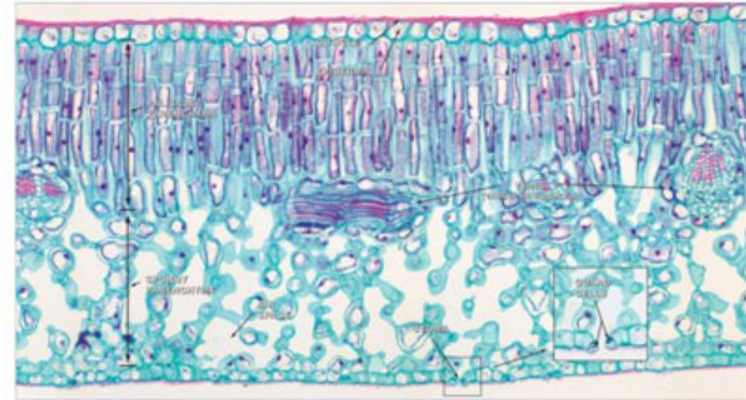
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MONOCOTS

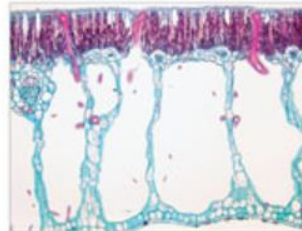


Corn Leaf 440x

DICOTS



Lilac Leaf 430x

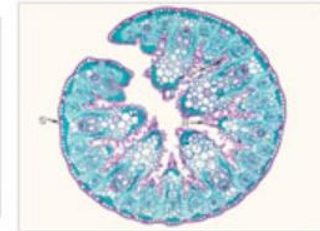


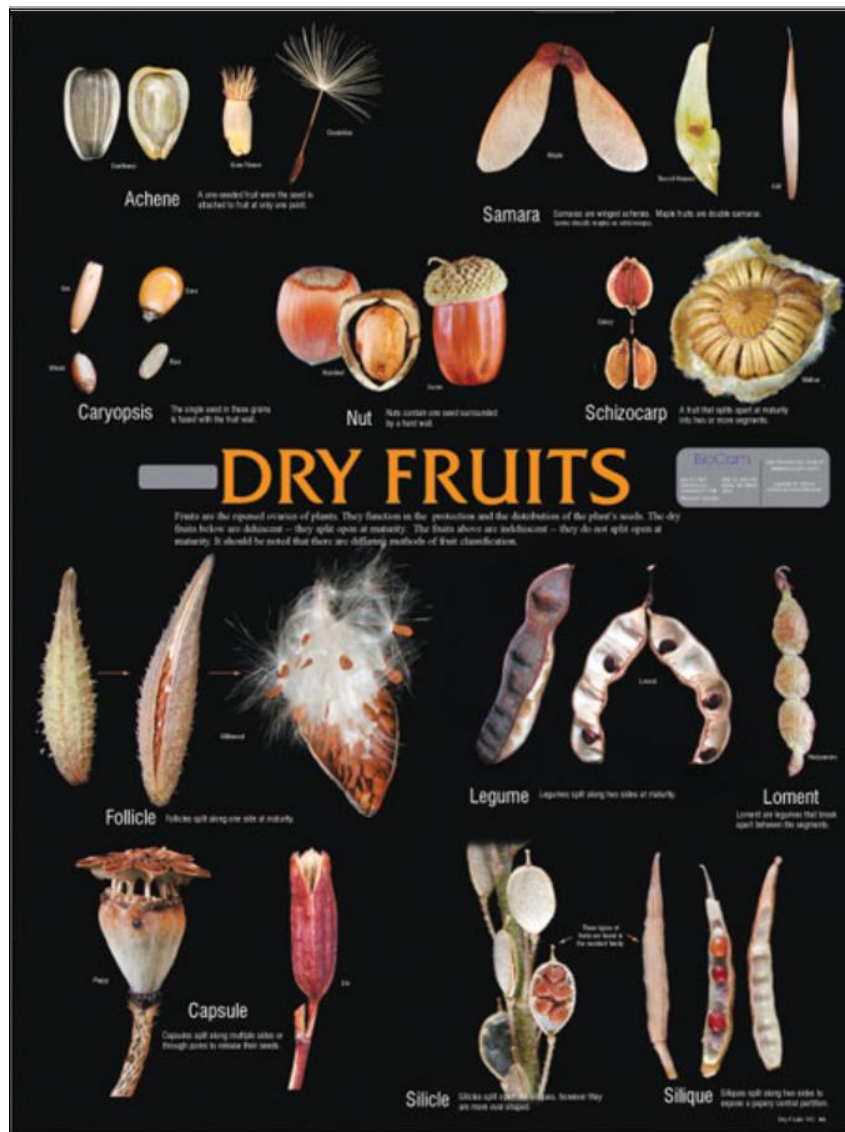
Hydrophilic leaves are adapted to very wet environments. This water lily leaf on the left has stomata only on the top surface, large air spaces for flotation and reduced vascular tissue.

Water Lily Leaf, 120x

Xerophilic leaves are adapted to very dry environments. This grass on the right has a curled leaf shape, many hairs (to cover the surface), stomata buried in deep pits (to trap a thick cuticle to seal and evaporate).

Grass Leaf, 130x





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OSMOSIS

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Low Solute Concentration
(High water to solute on other side of membrane)

High Solute Concentration
(Low water to solute on other side of membrane)

Osmosis is the diffusion of water across a selectively permeable membrane from an area of low solute (high water) concentration to an area of high solute (low water) concentration.

Although water molecules travel in both directions, more water molecules move into the area of high solute concentration than move out, therefore, there is a net movement of water to the area of high solute concentration. Fewer water molecules leave the high solute concentration area because there are fewer water molecules there—they have been diluted down by the solute molecules. Also, bonds have been formed between the water molecules and the solute molecules, making the water molecules unavailable to leave.

When comparing environments, one that has a higher solute concentration is called hypertonic, while a lower solute concentration is called hypotonic. If the solute concentrations are the same, they are called isotonic.

A cell placed in a hypotonic environment swells. Water molecules move in and out of the cell, but more move into the cell.

A cell placed in an isotonic environment maintains its shape. Water molecules move in and out of the cell equally.

A cell placed in a hypertonic environment shrinks. Water molecules move in and out of the cell, but more move out of the cell.

Red blood cells in hypotonic solution (distilled water) swell and may burst (lyse) in a hypotonic environment.

Red blood cells in isotonic solution (0.9% NaCl) maintain their shape in an isotonic environment.

Red blood cells shrivel (crenate) in a hypertonic environment.

Plant Cells

When a plant cell is in a hypotonic environment, it swells with as much as its rigid cell wall will allow. This turgor pressure puts the cell in a turgid, or "firm" state. This is the healthy state for plant cells, and allows for the plant to support. When placed in a hypotonic environment, water will leave the cell. The cell membrane will then pull back from the cell wall, and the plant will lose its rigidity. These effects can be seen in cells from the water plant Elodea.

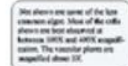
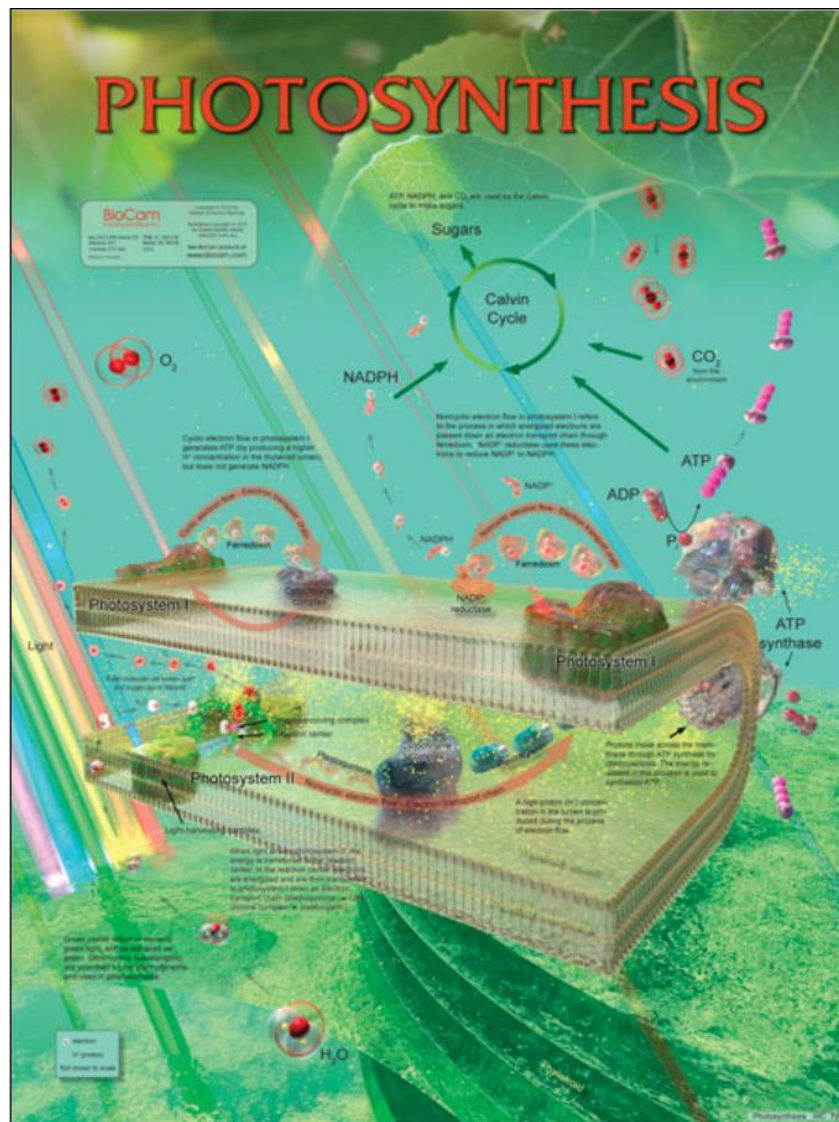
Elodea cells in hypotonic environment (distilled water) are turgid.

Elodea cells in hypertonic environment (10% NaCl) plasmolyze. A turgid cell contents shrivel and pull away from the cell wall in a hypertonic environment. This is called plasmolysis.

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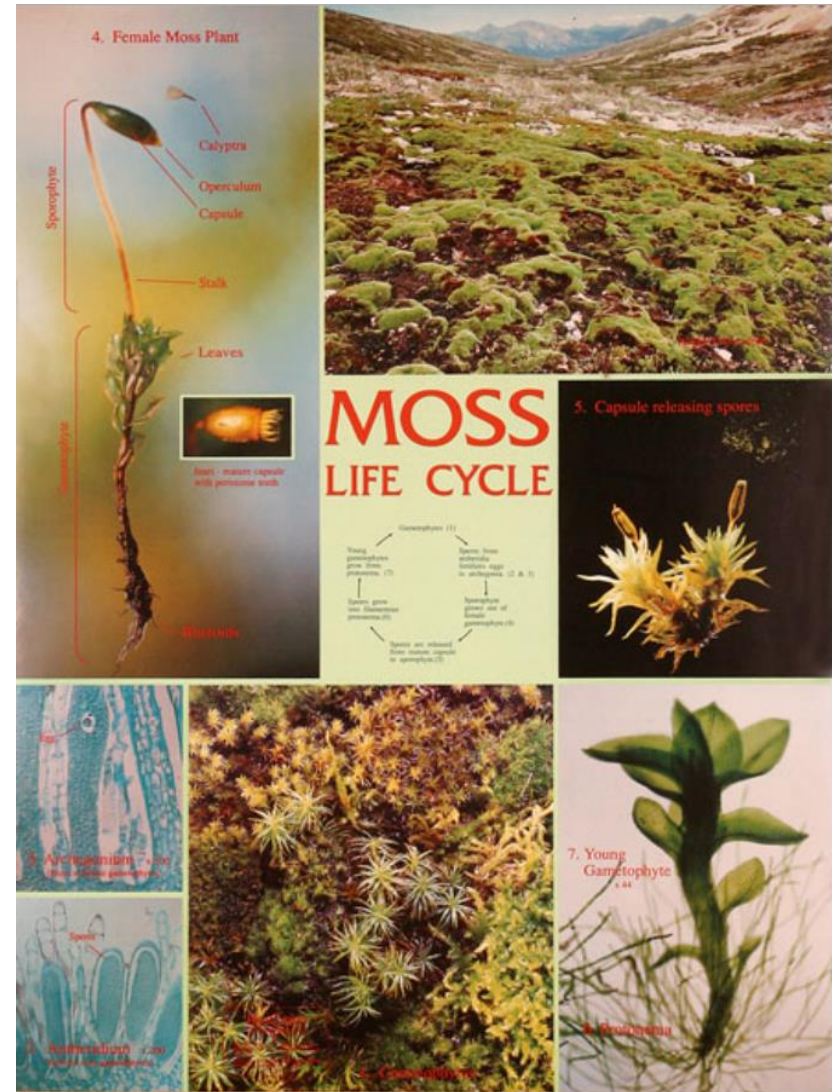
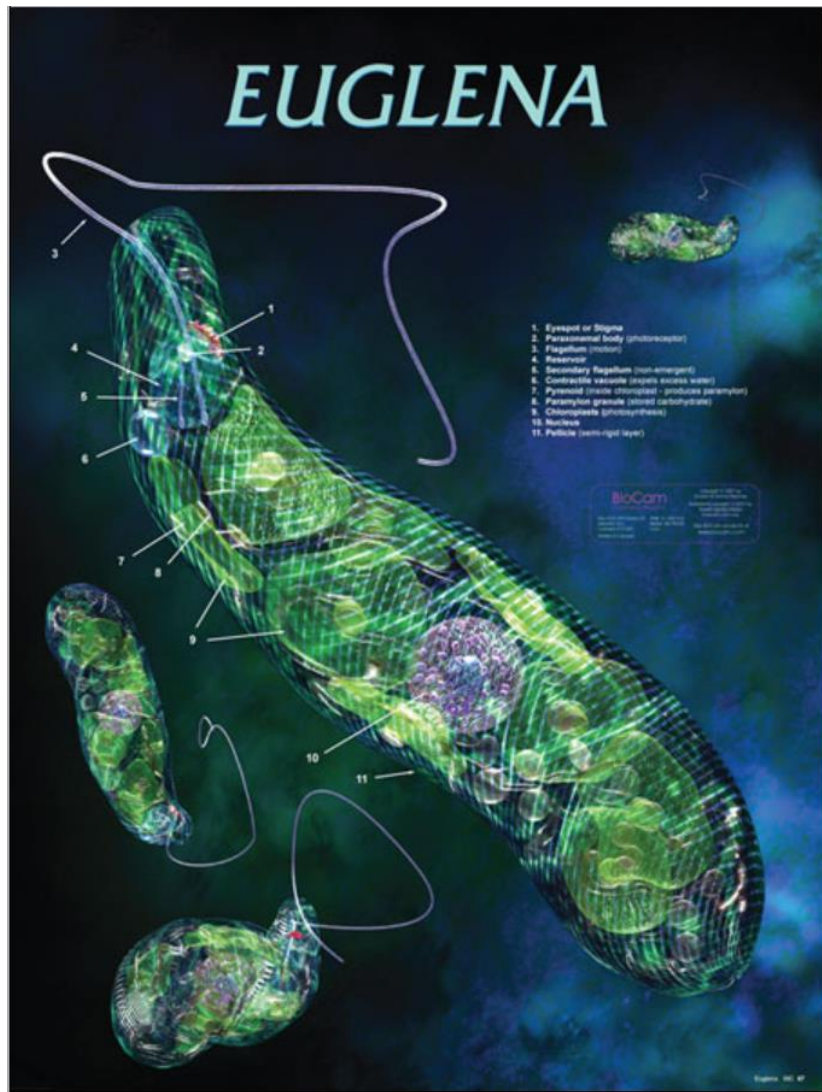
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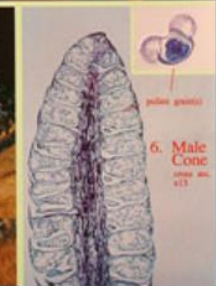
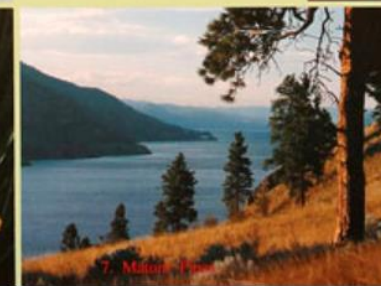
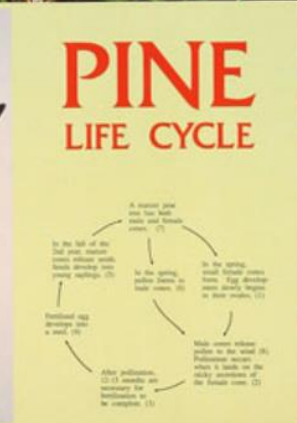
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The Flower

