The Cell Organelles! A Brief Summary

- The **CELL MEMBRANE** controls transport of materials in and out of cell. It also functions in recognition, communication, and **homeostasis**. It is **SELECTIVELY PERMEABLE**.
- **Plant Cells** also have a **Cell Wall** surrounding their cell membrane.

- The **NUCLEUS** is a large organelle surrounded by a double membrane. It is the **control center** or "brain" of cell. **Contains the DNA** and is site of manufacture of RNA. The DNA may be bound up tightly in **chromosomes**, or in the form of **chromatin**. The nucleus contains one or more **DARK-STAINING** structures called **NUCLEOLI**, which are sites of **RIBOSOMAL RIBONUCLEIC ACID (rRNA) SYNTHESIS**.

- **ENDOPLASMIC RETICULUM**: the ER is a system of **MEMBRANOUS TUBULAR CANALS** that begins just outside the nucleus and branches throughout the cytoplasm. The endoplasmic reticulum membranes provide an **increase in surface area** where chemical reactions can occur.
  - if **ribosomes** are attached to the ER, it is called **ROUGH Endoplasmic Reticulum**. The function of rough ER is **PROTEIN SYNTHESIS**.
  - if no ribosomes are attached to the ER, it is called **SMOOTH Endoplasmic Reticulum**. The function of smooth ER is **synthesis of lipids, Phospholipids and cholesterol**. The main components of membranes throughout the cell, are synthesized in the smooth ER. A second important function of smooth ER is to **detoxify drugs and chemicals** in the cell.

- **RIBOSOMES**: Ribosomes are small organelles. They are made of rRNA and protein. They are NOT covered by membrane. They have two main subunits, which are made in the nucleolus and then sent out to the cytoplasm. The function of ribosomes is that they are the **SITE OF PROTEIN SYNTHESIS**.
  - **GOLGI APPARATUS** (= Golgi Bodies): are **stacks of flattened, hollow cavities** enclosed by membranes. The Golgi apparatus functions in **modification, assembly, packaging, storage and secretion** of substances, like proteins.
  - vesicles from the ER will often merge with the Golgi bodies. The contents of the vesicles will be modified by enzymes within the Golgi bodies. Then the "finished" proteins etc. will be "pinched off" the Golgi bodies into new vesicles, which can now be transported to their destination. The Golgi bodies usually modify and package proteins that are to be used **outside** the cell.

- **VESICLES & VACUOLES**: A **VESICLE** is a small **vacuole**. Vacuoles and vesicles are formed by: 1) pinching off from the Golgi apparatus 2) endocytosis of the cell membrane 3) extension of the ER membrane (for example, the large central vacuole of a plant cell). Vesicles are used for **transport and storage of materials**.

- **Plant cells** usually have one large **Central Vacuole** for storing water. It might also store food, wastes, and also helps to support the plant through "turgor pressure."
• **LYSOSOMES** are special vesicles which are formed by the Golgi apparatus. They contain powerful **HYDROLYTIC ENZYMES** (over 40 kinds). Lysosomes function in 1) **cellular digestion** of food 2) **autodigestion** or breaking down damaged cell components like old mitochondria 3) occasionally breaking down of a whole cell (by releasing lysosome contents into the cell cytoplasm).

• **MITOCHONDRION**: large, double-membrane bound organelles that are the **SITE OF CELLULAR RESPIRATION**. In mitochondria, organic molecules (especially those formed when glucose is split) are broken down in the presence of oxygen to **produce energy** in the form of ATP. The waste products of this reaction are water and carbon dioxide. Are sometimes referred to as the "**Powerhouses of the Cell.**" Mitochondria are found in all eukaryotic cells, including plant cells.

• **CHLOROPLASTS**: large, double-membrane bound organelles that are found only in **PLANT CELLS**. They **produce food for plant cells**. Specifically, they capture the energy of the sun with a special green pigment called **chlorophyll**, and then use that energy to combine **CO₂** and **H₂O** to form **GLUCOSE**.

• Animal cells have two cylindrical bodies, called **CENTRIOLES**, located near the **nucleus**. The centrioles appear as sets of triple tubes. Centrioles **play a role in cell division**. They organize the spindle apparatus during mitosis. Centrioles are short cylinders with a **9+0 pattern of microtubular triplets**. Centrioles also give rise to **basi bodies**. Basal bodies, in turn **direct the formation of CILIA and FLAGELLA**.

• **CILIA** are short, hairlike projections that function in **cell movement** (e.g. *Paramecium*) or to move materials past cells (e.g. cells of human respiratory tract and oviducts). They consist of **membrane-bound cylinder**, with a **9+2 arrangement of microtubules**. Cilia are much shorter than flagella, and beat stiffly back and forth, like oars.

• **FLAGELLA** are **longer than cilia**, but with same basic anatomy as cilia (membrane-bound cylinder, with 9+2 arrangement of microtubules). They beat in a **whip-like fashion**. They **function in cell movement** (e.g. sperm cells, *Euglena*).

• The **CYTOSKELETON** is not an organelle, but rather a **network of microtubules and microfilaments** within the cell that **help it maintain shape, anchor organelles, or help the organelles move** as necessary. The primary constituents of the cytoskeleton are **microtubules** (which are like tiny hollow tubes) and **microfilaments**.

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Make sure you can list the differences between plant and animal cells!