Topic 1.2: Ultrastructure of Cells

**Essential Idea: Eukaryotes have a much more complex cell structure than prokaryotes.**

**1.2.U1 Prokaryotes have a simple cell structure without compartmentalization.**

Outline the major differences between prokaryotic and eukaryotic cells.

**(Outline**: Give a brief account or summary)

List the functions of the following structures of a prokaryotic cell: cell membrane, nucleoid, plasmid, cytoplasm, ribosome, cell wall, pili, capsule, and flagella.

**(List**: Give a sequence of brief answers with no explanation.)

Define extracellular.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Contrast the size of eukaryotic and prokaryotic ribosomes.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

**1.2.U2 Eukaryotes have a compartmentalized cell structure.**

State the meaning and advantages of eukaryotic cells being “compartmentalized.”

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**1.2.U3 Prokaryotes divide by binary fission.**

Define asexual reproduction.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Outline the four steps of binary fission.​

**(Outline**: Give a brief account or summary)

**1.2.U4 Electron microscopes have a much higher resolution than light microscopes.**

Define resolution.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Compare the maximum resolutions of a light microscope with those of an electron microscope.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

List three example structures that are visible with electron microscopes but not with a light microscope.​

**(List**: Give a sequence of brief answers with no explanation.)

**1.2.A1 Structure and function of organelles within exocrine gland cells of the pancreas.**

State the function of an exocrine gland cell.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Describe the function of the following structures in an exocrine gland cell: plasma membrane, nucleus, mitochondria, Golgi apparatus, lysosomes, vesicles and endoplasmic reticulum.

**(Describe**: Give a detailed account)

**1.2.A2 Structure and function of organelles within palisade mesophyll cells of the leaf.**

State the function of a palisade mesophyll cell.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Describe the function of the following structures in a palisade mesophyll cell: cell wall, plasma membrane, chloroplasts, vacuole, nucleus, and mitochondria.​

**(Describe**: Give a detailed account)

**1.2.S1 Drawings of the ultrastructure of prokaryotic cells based on electron micrographs.**

Explain why the ultrastructure of prokaryotic cells must be based on electron micrographs.

(**Explain**: Give a detailed account including reasons or causes)

Draw the ultrastructure of E.coli, including the cell wall, pili, flagella, plasma membrane, cytoplasm, 70s ribosomes, and nucleoid with naked DNA.​

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

**(Label** : Add labels to a diagram)

**1.2.S2 Drawings of the ultrastructure of eukaryotic cells based on electron micrographs.**

Recognize features and identify structures in micrographs of eukaryotic cells (inclusive of the plasma membrane, cytoplasm, free 80s ribosomes, nucleus, rough endoplasmic reticulum, Golgi apparatus, lysosome, mitochondria, chloroplast, vacuoles, vesicles, centrioles, microtubules, cilia, flagella and cell wall).

**(Identify**: Find an answer from a given number of possibilities)

Given a micrograph, draw and label the ultrastructure of a eukaryotic cell.​​

**(Draw** :Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted(if appropriate) and joined in a smooth curve. )

**1.2.S3 Interpretations of electron micrographs to identify organelles and deduce the function of specialized cells.**

Explain why cells with different functions will have different structures.

(**Explain**: Give a detailed account including reasons or causes)

Identify ultrastructures visible in a micrograph of a eukaryotic cell.

**(Identify**: Find an answer from a given number of possibilities)

Given a micrograph of a cell, deduce the function of the cell based on the structures present.​​

**(Deduce:** Reach a conclusion from the information given.)

**1.2.NOS Developments in scientific research follows improvements in apparatus- the invention of the electron microscopes led to greater understanding of cell structure.**

With reference to a specific example, explain how an improvement in apparatus allowed for greater understanding of cell structure.

(**Explain**: Give a detailed account including reasons or causes)

**Key facts**

1. Prokaryotes have a simple cell structure without compartments.

2. Prokaryotic cells divide by binary fission.

3. Prokaryotic cells include ribosomes, a cell wall, a cell membrane, a nucleoid region, and, in most cases, plasmids.

4. Some prokaryotic cells include an exterior layer of a complex sugar compound called a capsule.

5. Ribosomes carry out protein production, and they do not include an exterior membrane.

6. Bacteria are examples of prokaryotic cells and are between one and ten micrometers in size.

7. Flagella occur in some bacteria and they allow organism mobility.

8. The nucleoid region is composed of a circular thread of pure DNA.

9. The cell wall is made of a material called peptidoglycan.

10. Eukaryotes have a compartmentalized cell structure.

11. Eukaryotic cells are up to 100 micrometers in size.

12. Membrane bound organelles are characteristic of eukaryotic cells.

13. Common organelles include: endoplasmic reticulum, ribosomes, lysosomes, Golgi apparatus, mitochondria, nucleus, chloroplasts, centrosomes, and vacuoles.

14. Animals cells contain centrioles but plant cells do not. Plant cells contain chloroplasts, animal cells do not. Plant cells have cell walls, animal cells do not. Plant cells have larger vacuoles than animal cells.

15. The extracellular matrix of the animal cell is produced by the secretion of glycoproteins. This matrix functions in support, adhesion and movement.

16. The exterior of the plant cell involves the cell wall and it maintains cell shape, prevents excessive water uptake, and holds the whole plant up against the force of gravity.

17. Electron microscopes have a much higher resolution than light microscopes.

**Key Terms**

Prokaryote

Eukaryote

Naked plasmid

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nucleoid

nucleus

DNA

golgi apparatus

centriole

binary fission

plasma membrane

ribosome

peptidoglycan

mitochondria

rough ER

smooth ER

nucleolus

milli-

cell wall

cellulose

flagella

Archaea

plasma Membrane

cell wall [plant]

virus

micro-

ribosomes

meter

organelle

capsule

cytoplasm

ribosomes

vacuole

pili

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eubacteria

protoctista

centi

E. coli

cytoskeleton

lysosomes

​

bacterium