

Section 1-Solution key:

1. Organisms such as bacteria, yeasts, flies, mice and rabbits are used as model systems for different biological experiments.

iii. Classify each of the above organisms as prokaryotic or eukaryotic.

Cells that lack a membrane bound nucleus and cell organelles are prokaryotic (i.e. bacteria) whereas cells with a distinct nucleus and cell organelles are eukaryotic (i.e. yeasts, flies, mice and rabbits).

iv. Classify each of the above organisms as unicellular or multi-cellular.

Bacterial and yeast cells are unicellular whereas flies, mice and rabbits are multi-cellular.

2. You are given three different cell types, each stained with a dye that specifically binds to deoxyribonucleic acid (DNA). You observe these cells under the microscope. Classify them as *prokaryotic, eukaryotic, gametes* or *skin cells* based on the following observation. If there is more than one good choice, **include all**.

i. Cells contain **circular** DNA. *Prokaryotic mostly, but eukaryotic cells, gametes and skin cells may have circular DNA in their mitochondria.*

ii. Cells contain DNA segments in a specific organelle. *Eukaryotic, skin cells, gametes*

iii. Cells contain **two copies** of DNA segments in a specific organelle. *Eukaryotic, skin cells*

iv. Cells contain **single copy** of DNA segments in a specific organelle. *Eukaryotic, gametes*

3. Human beings are complex multi-cellular organisms made of different cell types each responsible for specialized function. Compare three cell types: retinal cells, skin cells and unfertilized ova.

iv. Do all these cell types have the same set of genes and same number of chromosomes?

All the cells in an organism are derived from a fertilized ovum and therefore have the SAME set of genes.

Unfertilized ovum, being haploid, has half the number of chromosomes as retinal and skin cells, which are diploid.

v. Are the genes expressed in the unfertilized egg same as the genes in the retinal cells?

No, each cell expresses a unique combination of genes.

vi. Are the proteins in the retinal cells the same as the proteins in the skin cells?

Although all cells in an organism have the same set of genes, the gene expression (a process by which DNA directs the synthesis of proteins) is specific for each cell type and it determines cell structure and functions.

Therefore, although some proteins may be common to both retinal and skin cells (i.e. enzymes involved in synthesizing ATP), both retinal and skin cells will have their own UNIQUE set of proteins, which regulate their specific structure and functions.

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