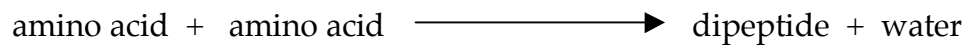


## STUDY GUIDE -- CELL STRUCTURE AND FUNCTION

### Answers to Problems:

1. Where in the cell would you expect this dehydration synthesis reaction to take place?



*Ribosomes (either free in the cytoplasm or bound to the rough endoplasmic reticulum) are the site of protein synthesis.*

2. Name ONE organelle in the cell where you would expect ALL of the following reactions to take place: hydrolysis of triglycerides, hydrolysis of proteins, hydrolysis of carbohydrates?

*Lysosomes*

3. Bacterial cells are 0.25 to 10  $\mu\text{m}$  in size. What allows prokaryotic cells to be smaller than the lower limit imposed on eukaryotic cells?

*The lower limit on cell size is imposed by the amount of space required to hold all the essential cellular components. Since prokaryotic cells lack a true nucleus and any membrane-bound organelles, the space requirements are significantly less than those of eukaryotic cells.*

4. Many unfertilized eggs are larger than the usual 100  $\mu\text{m}$  upper limit on cell size. What allows unfertilized eggs to exceed the upper limit?

*Unfertilized eggs are metabolically suppressed. Consequently their relatively small surface area to volume ratio is adequate to meet their limited needs. However, after fertilization, the metabolism of the egg increases tremendously. The fertilized egg begins to divide rapidly and repeatedly to divide its mass into many smaller (<100  $\mu\text{m}$ ) cells, thereby increasing the surface area to volume ratio.*

5. Compare the cellular composition of a mouse and an elephant. (How would their cells compare in size and number? Explain why.)

*The size of most cells is constrained between 10 and 100  $\mu\text{m}$  by the lower and upper limits. Therefore, in order for an elephant to be so many times larger than a mouse it must contain many more cells. The difference in their size is primarily due to the number of cells rather than the size of the cells.*

6. Which of the seven characteristics of life (described in Unit 1) are exhibited by a virus? Which of the seven characteristics of life are exhibited by a virus once it infects a cell? Based on the characteristics of life, are viruses living?

*Viruses are highly **organized** structurally and, to a limited degree, are able to **sense and respond to stimuli**. However, they are only capable of **reproduction, growth and development, metabolism and adaptation** after they have infected a cell and taken over the cell's machinery. Viruses are incapable of carrying out these activities independently. Therefore, they are not considered living organisms.*

7. For a class project, Tom made two electron micrographs of mouse cells, two of bean leaf cells and two of *E. coli* bacteria. He forgot to label the pictures and on the way to class he got them mixed up. The micrographs are close-ups; only the structures listed below are visible. Which pictures can you positively identify? Is it possible to sort out the others? How? Identify as many as you can. (From Campbell et al, 2nd Edition)

Picture A: Chloroplast, ribosomes, nucleus

Picture B: Cell wall, plasma membrane

Picture C: Mitochondrion, cell wall, plasma membrane

Picture D: Microtubules, Golgi apparatus

Picture E: Plasma membrane, ribosomes

Picture F: Nucleus, rough ER

*Remember that Tom took only two pictures of each type of cell. Pictures A (with a chloroplast) and C (with a cell wall and mitochondrion) must be pictures of a plant cell. Pictures D and F are also of eukaryotic structures and therefore must be the pictures of the mouse (animal) cells. By process of elimination, photos B and E must be pictures of bacteria; the structures present in these pictures are also consistent with this conclusion.*