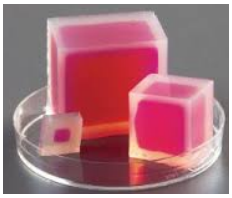
TOPIC 2.3 - Cell Size

The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.

1. Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.
    a. Surface area-to-volume ratios affect the ability of a biological system to obtain necessary resources, eliminate waste products, acquire or dissipate thermal energy, and otherwise exchange chemicals and energy with the environment.
        i. _____ requirements also impose theoretical upper limits on the size that is practical for a _____ _____.
    b. The surface area of the plasma membrane must be large enough to adequately exchange materials.
        i. Would it be better if the ratio of surface area were greater to volume in a cell? Explain.

    c. These limitations can restrict cell size and shape. Smaller cells typically have a higher surface area-to-volume ratio and more efficient exchange of materials with the environment.

        i. In this model, which cube has the greater ratio of surface area to volume?
            1. The smallest cube
            2. The medium cube
            3. The largest cube
        ii. In this model, which cube has the greater ratio of volume to surface area?
            1. The smallest cube
            2. The medium cube
            3. The largest cube
    d. As cells increase in volume, the relative surface area decreases and the demand for internal resources increases.



        i. In this model, cubes were originally fully pink and they sat in water for a certain amount of time. Which cube is most efficient at dispelling the dye? Explain.

e. More complex cellular structures (e.g., membrane folds) are necessary to adequately exchange materials with the environment.
    i. The mitochondria is responsible for producing ATP and the location of production is in it's cristae. How might folds in it's cristae produce more ATP rather than them having no folds?

    ii. The rough ER contains many folds as well as many ribosomes that produce proteins. If there are more folds then there are more ribosomes and if there are more ribosomes what happens?

f. As organisms increase in size, their surface area-to-volume ratio decreases, affecting properties like rate of heat exchange with the environment.
    i. If an elephant and a chicken were in a desert, which would be best suited base off size and why?

2. Explain how specialized structures and strategies are used for the efficient exchange of molecules to the environment.
    a. Organisms have evolved highly efficient strategies to obtain nutrients and eliminate wastes. Cells and organisms use specialized exchange surfaces to obtain and release molecules from or into the surrounding environment.
        i. The _____ _____ functions as a selective barrier that allows passage of enough oxygen, nutrients, and wastes to service the cell.
        ii. The _____ is the shipping and receiving center.
        iii. How is the golgi is one of the main ways of how materials enter and leave the cell? How does a vesicle relate to this process?