Apoptosis Background

As a cell goes through the cell cycle, it has to pass checkpoints to move onto the next stage. If the cell fails one of those checkpoints, the cell is flagged to be destroyed so that it doesn't affect the cell cycle or any other functions in the body. Apoptosis is the most common form of cell death in living organisms. It is mediated by a specific kind of enzyme called a caspase. Caspases kill specific proteins found in the nucleus and the cytoplasm to trigger cell death (Alberts B, Johnson A, Lewis J, et al., 2002). If apoptosis checkpoints are not working, a cancerous tumor can form (J. Grisham, 2014).

As the cell begins to shrink during apoptosis, chromatin in the nucleus, and the nucleus itself, condense to the point where you can see them on a microscope. Once condensed, the chromatin are chopped up into pieces to ensure that the mutated DNA sequence does not replicate and affect any other cells. The nuclear membrane then begins to "bleb", or bulge, to detach from the remains of the cell. When it comes to programmed cell death, chloroplasts are looked at in relation to mitochondria. Mitochondria and chloroplasts are where most, if not all energy, created in a plant comes from. Guard cells regulate CO2 influx and water loss. These guard cells contain many mitochondria and many chloroplasts, making them a perfect place for apoptosis to initiate. Mitochondria and chloroplasts have been found to regulate the activation of caspases. Caspase activation ensures that all cellular components are degraded in a controlled manner and do not really affect surrounding tissues ("Caspase"). Pyrenoids are part of the chloroplasts and are known to promote photosynthetic CO2 fixation in a plant. This means that it directs the CO2 wherever it needs to go in an organism. It is important that apoptosis start where the mitochondria and chloroplasts are so that all cellular components are degraded in a controlled manner.

Algae is a very diverse group of simple organisms ranging from unicellular to multicellular. Though they lack stems, leaves, and other major organisms a normal plant might have, they contain chlorophyll and are thus autotrophic species. In this assignment we will be looking at four different types of algae: *Pandorina morum, Volvox aureus, Chlorella,* and *Rhodochorton.* All four kinds of algae can dwell in freshwater, however *Rhodochorton* is typically a marine species. *Pandorina morum* is a freshwater algae composed of 8 to 32 cells held together to form a colony, each cell having one chloroplast with one or multiple pyrenoids ("Pandorina"). *Volvox aureus* is a freshwater algae that also forms colonies, but these colonies are much larger than that of the *Pandorina* colonies at around 50,000 cells. *Volvox aureus* algae have chloroplasts that contain chlorophyll for photosynthesis ("Volvox"). *Chlorella* are a group of single celled freshwater organisms that contain chloroplasts with chlorophyll-a and -b. There are about thirteen species of algae within this group of algae ("Chlorella"). *Rhodochorton,* or red algae, are

multicellular organisms that also contain chloroplasts with chlorophyll to make their own food (“Red algae”).

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