**Unit 8: Plants & Photosynthesis Unit Guide HSPVA AP Biology**

**8.1: Organisms capture and store free energy for use in biological processes.**

d. The light-dependent reactions of photosynthesis in eukaryotes involve a series of coordinated reaction pathways that capture free energy present in light to yield ATP and NADPH, which power the production of organic molecules.

*Evidence of student learning is a demonstrated understanding of each of the following:*

1. During photosynthesis, chlorophylls absorb free energy from light, boosting electrons to a higher energy level in Photosystems I and II.

2. Photosystems I and II are embedded in the internal membranes of chloroplasts (thylakoids) and are connected by the transfer of higher free energy electrons through an electron transport chain (ETC). [See also **4.A.2**]

3. When electrons are transferred between molecules in a sequence of reactions as they pass through the ETC, an electrochemical gradient of hydrogen ions (protons) across the thykaloid membrane is established.

4. The formation of the proton gradient is a separate process, but it is linked to the synthesis of ATP from ADP and inorganic phosphate via ATP synthase.

5. The energy captured in the light reactions as ATP and NADPH powers the production of carbohydrates from carbon dioxide in the Calvin cycle, which occurs in the stroma of the chloroplast.

e. Photosynthesis first evolved in prokaryotic organisms; scientific evidence supports that prokaryotic (bacterial) photosynthesis was responsible for the production of an oxygenated atmosphere; prokaryotic photosynthetic pathways were the foundation of eukaryotic photosynthesis.

**LO 2.4** The student is able to use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store and use free energy. [See **SP 1.4, 3.1**]

**LO 2.5** The student is able to construct explanations of the mechanisms and structural features of cells that allow organisms to capture, store or use free energy. [See **SP 6.2**]

**8.2: Plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis.**

a. Plants, invertebrates and vertebrates have multiple, nonspecific immune responses.

*\Students should be able to demonstrate understanding of the above concept by using an illustrative example such as:*

* **Plant defenses against pathogens include molecular recognition systems with systemic responses; infection triggers chemical responses that destroy infected and adjacent cells, thus localizing the effects.**

**LO 2.30** The student can create representations or models to describe nonspecific immune defenses in plants and animals.[See **SP 1.1, 1.2**]

**8.3: Timing and coordination of physiological events are regulated by multiple mechanisms.**

a. In plants, physiological events involve interactions between environmental stimuli and internal molecular signals. [See also **2.C.3**]

*Evidence of student learning is a demonstrated understanding of each of the following:*

1. Phototropism, or the response to the presence of light

2. Photoperiodism, or the response to change in length of the night, that results in flowering in long-day and short-day plants

**8.4: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.**

b. Responses to information and communication of information are vital to natural selection. [See also **2.C.3**]

*Evidence of student learning is a demonstrated understanding of each of the following:*

1. In phototropism in plants, changes in the light source lead to differential growth, resulting in maximum exposure of leaves to light for photosynthesis.

2. In photoperiodism in plants, changes in the length of night regulate flowering and preparation for winter.

**8.5: Organisms exhibit complex properties due to interactions between their constituent parts.**

a. Interactions and coordination between organs provide essential biological activities.

*To foster student understanding of this concept, instructors can choose an illustrative example such as:*

* Root, stem and leaf

b. Interactions and coordination between systems provide essential biological activities.

*To foster student understanding of this concept, instructors can choose an illustrative example such as:*

* Plant vascular and leaf

**LO 4.8** The student is able to evaluate scientific questions concerning organisms that exhibit complex properties due to the interaction of their constituent parts. [See **SP 3.3**]

**LO 4.9** The student is able to predict the effects of a change in a component(s) of a biological system on the functionality of an organism(s). [See **SP 6.4**]

**LO 4.10** The student is able to refine representations and models to illustrate biocomplexity due to interactions of the constituent parts.[See **SP 1.3**]

**8.6: Timing and coordination of behavior are regulated by various mechanisms and are important in natural selection.**

4. Cooperative behavior within or between populations contributes to the survival of the populations.

*Students should be able to demonstrate understanding of the above concept by using an illustrative example such as:*

* **Biology of pollination**