

**LECTURE 16 – Photosynthesis**  
**QUESTIONS TO TRY FOR PRACTICE**

- 1) The process of photosynthesis probably originated
  - A) in plants.
  - B) in prokaryotes.
  - C) in fungi.
  - D) three separate times.
  
- 2) Which of the following statements concerning chloroplasts is FALSE?
  - A) They are unrelated to plastids.
  - B) They have outer and inner membranes.
  - C) They have their own DNA.
  - D) They have an internal membrane system known as the thylakoids.
  
- 3) Early investigators thought the oxygen produced by photosynthetic plants came from carbon dioxide. In fact, it comes from
  - A) water.
  - B) glucose.
  - C)  $\text{H}_2\text{S}$ .
  - D) electrons from NADPH.
  
- 4) Which of the following statements best describes the relationship between photosynthesis and respiration?
  - A) Respiration runs the biochemical pathways of photosynthesis in reverse.
  - B) Photosynthesis stores energy in complex organic molecules; respiration releases energy from complex organic molecules.
  - C) Photosynthesis occurs only in plants; respiration occurs only in animals.
  - D) ATP molecules are produced in photosynthesis but not in aerobic respiration.
  - E) Photosynthesis is catabolic; respiration is anabolic.
  
- 5) Which of the following is FALSE regarding photosynthesis?
  - A) It first appeared in ancient prokaryotes.
  - B) The earliest form of photosynthetic reactions oxidized (used)  $\text{H}_2\text{O}$  and yielded  $\text{O}_2$ .
  - C) Development of oxygenic photosynthesis led to atmospheric changes that allowed evolution of cells/organisms able to use aerobic respiration.
  - D) Some forms of photosynthesis involve oxidizing compounds such as ferrous iron or  $\text{H}_2\text{S}$ .

6) Chlorophylls absorb light in which colours of the visible range?

- A) green and blue
- B) blue and red
- C) green and red
- D) orange and blue

7) The proteins of the electron transport chain active in the light-dependent reactions

- A) are membrane proteins present in the thylakoid.
- B) are free proteins present in the thylakoid lumen.
- C) are part of the reaction center of photosystem I.
- D) have hydrophilic exterior surfaces.

8) Besides proteins, thylakoid membranes must contain a large number of \_\_\_\_\_ molecules in the reaction centers in order to harvest light energy.

- A) phospholipid
- B) oligosaccharide
- C) pigment
- D) electron carrier

9) What is a difference between chlorophyll *a* and chlorophyll *b*?

- A) Chlorophyll *a* is a pigment, and chlorophyll *b* is the enzyme that transfers excited electrons from chlorophyll *a* to electron carriers of the thylakoid membrane.
- B) Chlorophyll *a* absorbs yellow light, and chlorophyll *b* absorbs green.
- C) Chlorophyll *a* contains  $Mg^{++}$  in a ring structure, whereas chlorophyll *b* contains iron.
- D) Chlorophyll *a* and *b* absorb light energy at slightly different wavelengths.

10) Why are there several structurally different pigments in the reaction centers of photosystems?

- A) Excited electrons must pass through several pigments before they can be transferred to electron acceptors of the electron transport chain.
- B) This setup enables the plant to absorb energy from sunlight from a variety of wavelengths.
- C) They enable the plant to absorb more photons from light energy, all of which are at the same wavelength.
- D) They enable the reaction center to excite electrons to a higher energy level.

11) If pigments from a particular species of plant are extracted and subjected to paper chromatography, which of the following is the most believable result?

- A) Paper chromatography for the plant would isolate a single band of pigment that is characteristic of the particular plant.
- B) Paper chromatography would separate the pigments from a particular plant into several bands.
- C) The single band of pigment that is isolated is always some shade of green.
- D) Paper chromatography isolates only the pigments that reflect green light.

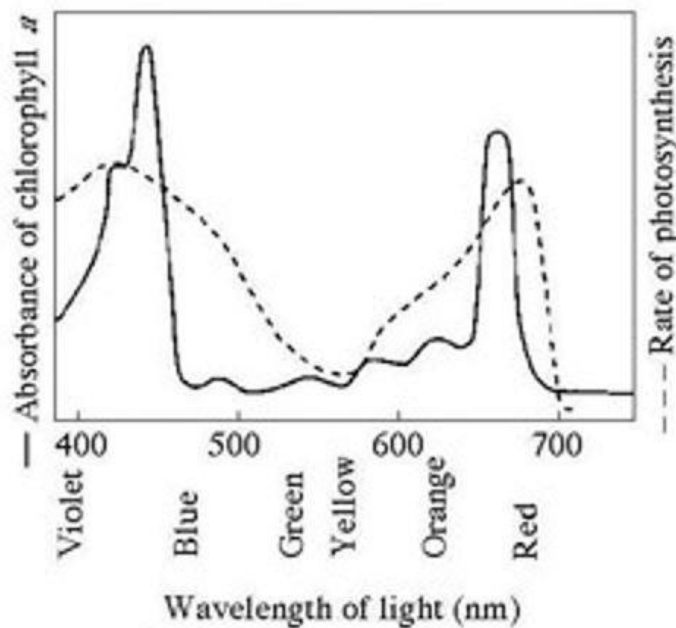
12) The absorption spectrum of a plant shows what wavelengths of light the plant absorbs. The absorption spectrum depends on

- A) the wavelengths of light that hit the plant.
- B) wavelengths of light that are transmitted by the plant.
- C) wavelengths of light to which the plant's pigments respond.
- D) the thickness of the plant's leaves.

13) In autumn, the leaves of deciduous trees change colours. This is because the chlorophyll is degraded, and

- A) the carotenoids and other pigments are still present in the leaves.
- B) degraded chlorophyll becomes a pigment with different colours.
- C) water supply to the leaves has been reduced.
- D) the cells of the leaves begin to die.

14) The figure provided shows the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis. Why are they different?



- A) Green and yellow wavelengths inhibit the absorption of red and blue wavelengths.
- B) Bright sunlight destroys photosynthetic pigments.
- C) Oxygen given off during photosynthesis interferes with the absorption of light.
- D) Other pigments absorb light in addition to chlorophyll *a*.
- E) Aerobic bacteria take up oxygen, which changes the measurement of the rate of photosynthesis.

15) What is the difference between  $\text{NAD}^+$  and  $\text{NADP}^+$ ?

- A)  $\text{NAD}^+$  functions as an electron transporter, whereas  $\text{NADP}^+$  does not.
- B)  $\text{NAD}^+$  functions as a free energy source for cells, whereas  $\text{NADP}^+$  does not.
- C) Both function as electron carriers, but  $\text{NADP}^+$  has a phosphate group and  $\text{NAD}^+$  does not.
- D) Both transport electrons to the electron transport chain (ETC) found on the inner mitochondrial membrane, but  $\text{NADP}^+$  transfers its electrons to the ETC at a higher energy level.

16) As electrons are passed through the system of electron carriers associated with photosystem II, they lose energy. What happens to this energy?

- A) It excites electrons of the reaction center of photosystem I.
- B) It is lost as heat.
- C) It is used to establish and maintain a proton gradient.
- D) It is used to phosphorylate  $\text{NAD}^+$  to  $\text{NADPH}$ , the molecule that accepts electrons from photosystem I.

17) The final electron acceptor(s) associated with photosystem I is

- A) oxygen.
- B) hydrogen ions.
- C)  $\text{NADP}^+$ .
- D) pheophytin.

18) During a discussion of photosynthesis, you are given the following series of facts:

1. Photosystem P700 alone is involved.
2. Water-splitting is not occurring.
3. A proton gradient is created in the Thylakoid lumen.

To which of the following processes do these statements collectively refer?

- A) linear electron transport
- B) cyclic electron transport
- C) the Calvin cycle
- D) the Krebs cycle (Citric Acid Cycle)

19) In photosynthesis, what is the role of water ( $\text{H}_2\text{O}$ )?

- A) It accepts electrons liberated from the reaction centre of photosystem I.
- B) It donates electrons to replace lost electrons in the reaction centre of photosystem II.
- C) It provides the necessary  $\text{H}^+$  ions needed to reduce glyceraldehyde-3-phosphate (G3P).
- D) It provides  $\text{O}_2$ , the terminal electron acceptor for the electron transport chain.
- E) It allows cyclic photophosphorylation to occur when ATP levels are low in the stroma.

20) Assume a thylakoid is somehow punctured so that the interior of the thylakoid is no longer separated from the stroma. This damage will most directly affect the

- A) splitting of water.
- B) absorption of light energy by chlorophyll.
- C) flow of electrons from photosystem II to photosystem I.
- D) synthesis of ATP.
- E) reduction of  $\text{NADP}^+$ .

21) The light-independent reactions of plants function to make organic molecules using carbon dioxide as a carbon source. What is the electron source that helps reduce carbon dioxide to sugars and other organic molecules?

- A) NADH
- B) NADPH
- C) ATP
- D) electrons from oxygen

22) How are the light-dependent and light-independent reactions of photosynthesis related?

- A) They cannot occur in the absence of light.
- B) The products of light-dependent reactions are used in light-independent reactions.
- C) The products of light-independent reactions must be present for light-dependent reactions to take place.
- D) They are not related.

23) In the carbon fixation step of the Calvin cycle, ribulose-1,5-bisphosphate (a five-carbon compound) is carboxylated to produce

- A) citric acid.
- B) 2 three-carbon compounds.
- C) acetyl CoA (two carbons) and oxaloacetate (four carbons).
- D) glucose.

24) Stomata, openings in the leaf, are important to photosynthesis for

- A) entry of carbon dioxide that is used in the Calvin cycle.
- B) entry of oxygen that is used in the Calvin cycle.
- C) removal of water and carbon dioxide, the end-products of photo-oxidation.
- D) removal of nitrogen-containing waste products.