FRQ Friday – 2/26

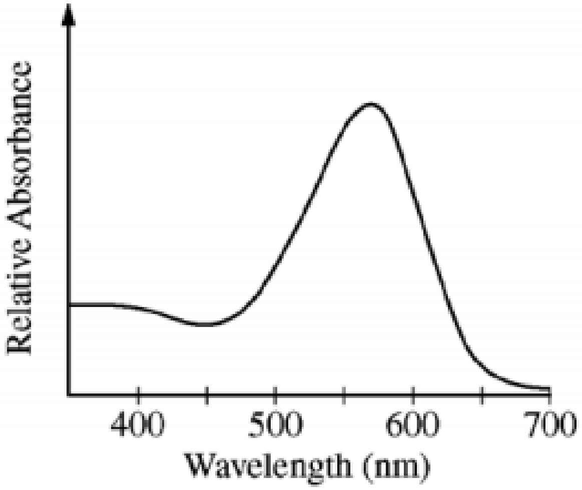
AP Biology Insta-Review @apbiopenguins

2013 #2

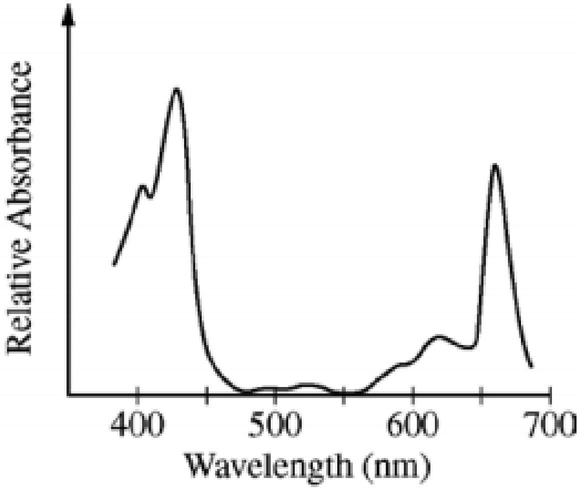
2017 #5

FRQ 2013 #2

AP Biology Insta-Review @apbiopenguins



Graph I



Graph II

Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

An absorption spectrum indicates the relative amount of light absorbed across a range of wavelengths. The graphs above represent the absorption spectra of individual pigments isolated from two different organisms. One of the pigments is chlorophyll *a*, commonly found in green plants. The other pigment is bacteriorhodopsin, commonly found in purple photosynthetic bacteria. The table above shows the approximate ranges of wavelengths of different colors in the visible light spectrum.

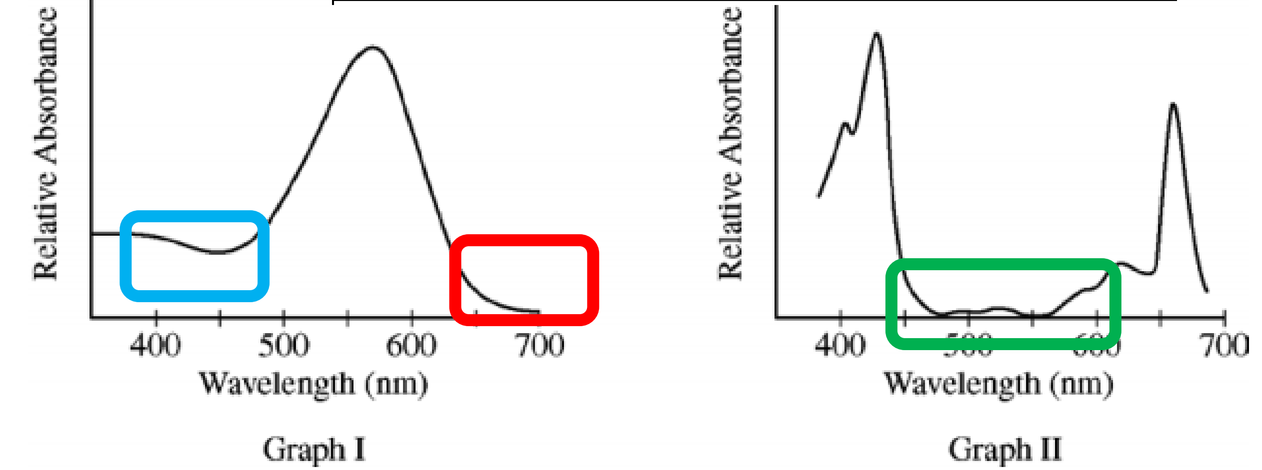
FRQ 2013 #2

Chlorophyll – green plants
Bacteriorhodopsin – purple bacteria

AP Biology Insta-Review @apbiopenguins

(a) **Identify** the pigment (chlorophyll *a* or bacteriorhodopsin) used to generate the absorption spectrum in each of the graphs above. **Explain** and **justify** your answer.

Identify BOTH pigments:
Graph 1 = bacteriorhodopsin AND graph 2 = chlorophyll *a*



Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

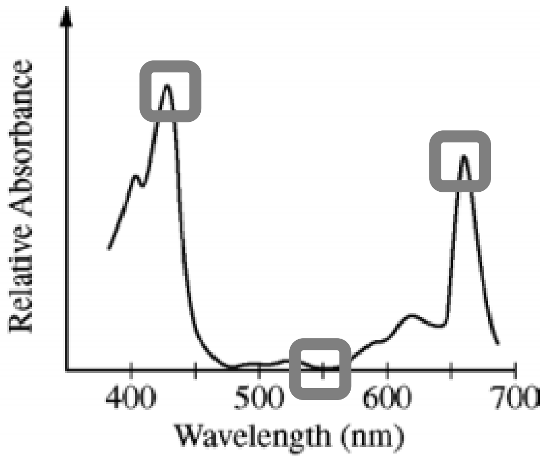
Explain that an organism containing bacteriorhodopsin appears purple because the pigment absorbs light in the green range of the light spectrum and/or reflects violet or red and blue light. The reflected red and blue light appears purple.

Explain that an organism containing chlorophyll *a* appears green because the pigment absorbs light in the red and blue ranges of the light spectrum and/or reflects green light.

FRQ 2013 #2

AP Biology Insta-Review @apbiopenguins

(b) In an experiment, identical organisms containing the pigment from Graph II as the predominant light-capturing pigment are separated into three groups. The organisms in each group are illuminated with light of a single wavelength (650 nm for the first group, 550 nm for the second group, and 430 nm for the third group). The three light sources are of equal intensity, and all organisms are illuminated for equal lengths of time. **Predict** the relative rate of photosynthesis in each of the three groups. **Justify** your predictions.



Graph II

Wavelength (Group)	Prediction (**1 point each box**)	Justification (**1 point each box**)
650 nm (1st Group)	Intermediate rate	An intermediate level of absorption occurs at 650 nm (compared to 430 nm and 550 nm); *therefore*, an intermediate amount of energy is available to drive photosynthesis.
550 nm (2nd Group)	Lowest rate	The lowest level of absorption occurs at 550 nm; *therefore*, the least amount of energy is available to drive photosynthesis.
430 nm (3rd Group)	Highest rate	The highest level of absorption occurs at 430 nm; *therefore*, the greatest amount of energy is available to drive photosynthesis.

FRQ 2013 #2

AP Biology Insta-Review @apbiopenguins

(c) Bacteriorhodopsin has been found in aquatic organisms whose ancestors existed before the ancestors of plants evolved in the same environment. **Propose** a possible evolutionary history of plants that could have resulted in a predominant photosynthetic system that uses only some of the colors of the visible light spectrum.

Proposal that includes an environmental selective pressure: • Green light was being absorbed by aquatic organisms using bacteriorhodopsin. • Unabsorbed wavelengths of light were available resources that organisms could exploit. • Absorbing visible light at all wavelengths may provide too much energy to the organism. • Absorbing light from ultraviolet wavelengths (shorter wavelengths = higher energy) could cause damage to the organism. • Absorbing light with longer wavelengths may not provide sufficient energy for the organism.
Appropriate reasoning to support the proposal: • Natural selection favored organisms that rely on pigments that absorb available wavelengths of light. • Endosymbiosis: chloroplasts evolved from cyanobacteria with pigments that used only certain wavelengths. • Genetic drift eliminated pigments that absorbed certain wavelengths of light. • Mutation(s) altered the pigment(s) used by organism.

FRQ 2017 #5

AP Biology Insta-Review @apbiopenguins

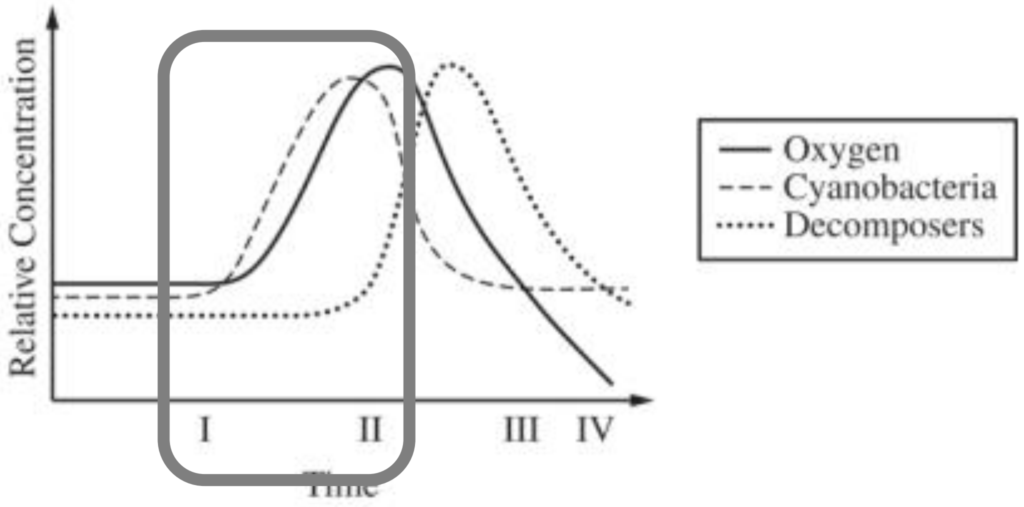


Figure 1. Characteristics of a pond community over time

Time Period	Metabolic pathway **(1 point per box)**	Organism **(1 point per box)**
I – II	Photosynthesis	Cyanobacteria (*M. aeruginosis*)

Microcystis aeruginosis is a freshwater photosynthetic cyanobacterium. When temperatures increase and nutrients are readily available in its pond habitat, *M. aeruginosis* undergoes rapid cell division and forms an extremely large, visible mass of cells called an algal bloom. *M. aeruginosis* has a short life span and is decomposed by aerobic bacteria and fungi. **Identify** the metabolic pathway and the organism that is primarily responsible for the change in oxygen level in the pond between times I and II AND between times III and IV.

FRQ 2017 #5

AP Biology Insta-Review @apbiopenguins

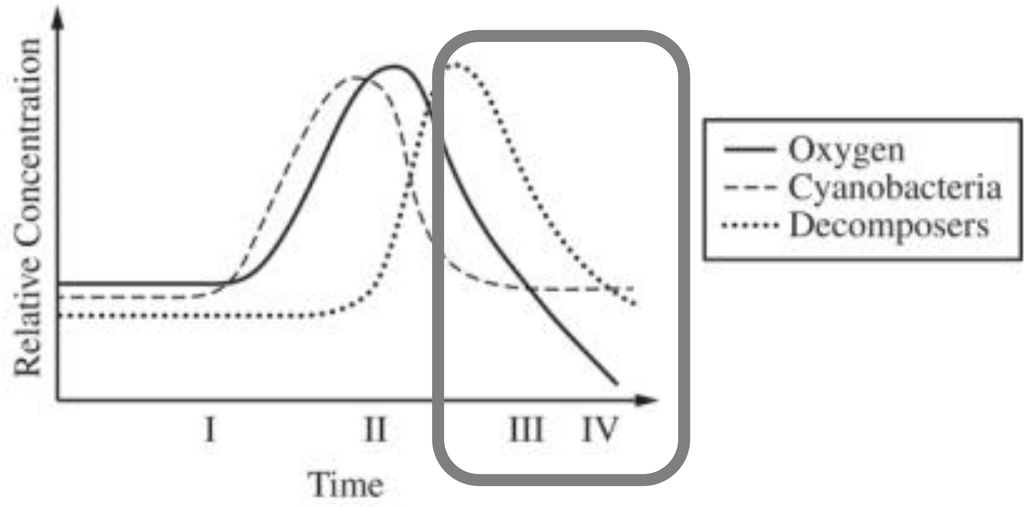


Figure 1. Characteristics of a pond community over time

Time Period	Metabolic pathway **(1 point per box)**	Organism **(1 point per box)**
III – IV	Cellular respiration	Decomposers/fungi/bacteria

Microcystis aeruginosis is a freshwater photosynthetic cyanobacterium. When temperatures increase and nutrients are readily available in its pond habitat, *M. aeruginosis* undergoes rapid cell division and forms an extremely large, visible mass of cells called an algal bloom. *M. aeruginosis* has a short life span and is decomposed by aerobic bacteria and fungi. **Identify** the metabolic pathway and the organism that is primarily responsible for the change in oxygen level in the pond between times I and II AND between times III and IV.

Next FRQ Friday (3/5)

AP Biology Insta-Review @apbiopenguins

2018 #2
2018 #8