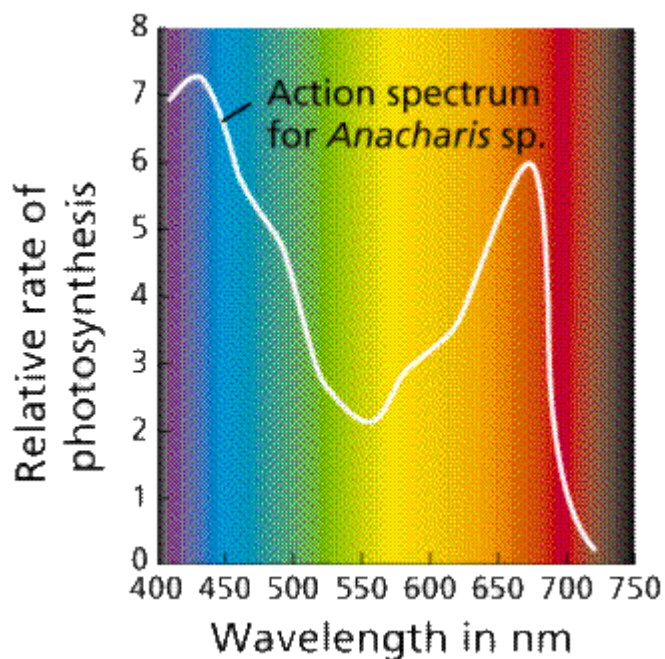


**BLUE LIGHT, RED LIGHT, WHITE LIGHT
GROWTH COMPARISON OF *BRASSICA RAPA***

Author(s) Redacted

INTRODUCTION

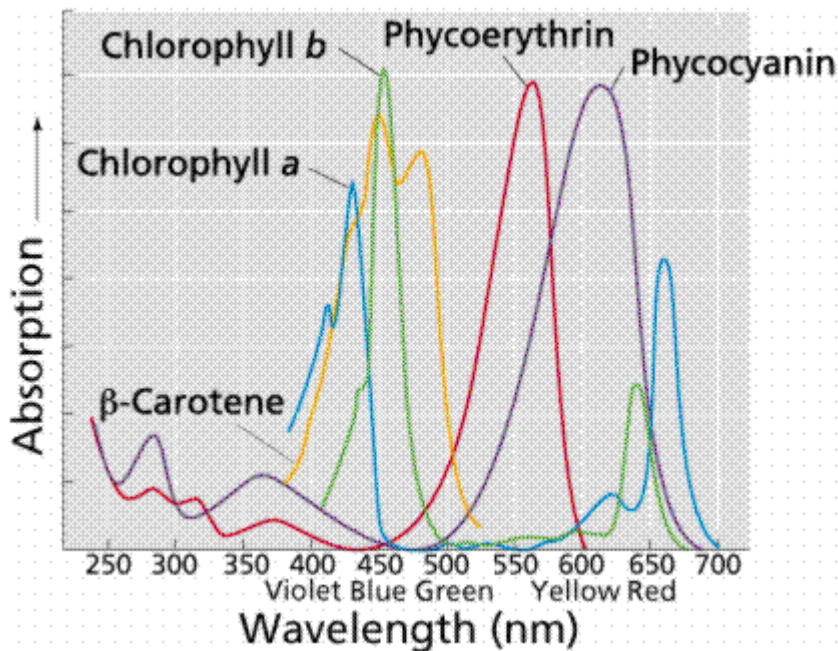
In growing *Brassica Rapa* Group One decided to use light as the independent variable. Our hypothesis was that BLUE light would allow for a greater growth as compared to RED light. The wavelength of blue light is 475 nanometers while the wavelength of red is 650 nanometers. BLUE light carries a higher energy signature then RED light does and that higher energy with a shorter wavelength should provide the plants with a better environment for growth.



Blue light has a wavelength that is shorter in the visible spectrum as compared to red light and has a higher energy.

(eosweb.larc.nasa.gov)

Chlorophyll is a complex molecule. Several modifications of chlorophyll occur among plants and other photosynthetic organisms. All photosynthetic organisms (plants, some protists, prochlorobacteria, and cyanobacteria) have chlorophyll a.



Accessory pigments absorb energy that chlorophyll a does not absorb. These pigments may be more effective at energy absorption but do not necessarily dictate the plant growth potential.

Accessory pigments include chlorophyll b (also c, d, and e in algae and protists), xanthophylls, and carotenoids (such as beta-carotene). Chlorophyll a absorbs its energy from the Violet-Blue and Reddish orange-Red wavelengths, and little from the intermediate (Green-Yellow-Orange) wavelengths. Carotenoids and chlorophyll b absorb some of the energy in the green wavelength. Why not so much in the orange and yellow wavelengths? Both chlorophylls also absorb in the orange-red end of the spectrum (with longer wavelengths and lower energy).

<http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookPS.html>

The origins of photosynthetic organisms in the sea may account for this. Shorter wavelengths (with more energy) do not penetrate much below 5 meters deep in seawater. The ability to absorb energy from the longer (hence more penetrating) wavelengths might have been an advantage to early photosynthetic algae that were not able to exist

outside of the upper photonic zone of the sea, but current species of plants have evolved past that limitation.

METHODS AND MATERIALS

White light (a combination of natural and 40-w fluorescent) was used as the control light. The blue and red light consisted of a 40-watt incandescent light with the glass bulb colored red or blue. All of the plants were exposed to the light(s) 24 hours a day with the daylight component being the exception. All plants had the same fertilizer and water source (a wicking cloth soaking in ionized water) and all plants had the same container size. The container was made of Styrofoam and 16 compartments were devoted to the control plants, 8 devoted to blue and 8 devoted to red. All of the plants had the same amount of nutrients and each section had two seeds placed in the soil. The dome of the apparatus was constructed of heavy duty cardboard and tinfoil so as to keep all light out except for the desired color. Blue and red plants were kept 8 inches from the light source while the control plants were twelve inches away from their light source. The temperatures of the surrounding environments were:

BLUE - 50.5 degrees Celsius

RED - 52.6 degrees Celsius

CONTROL - 21.8 degrees Celsius

This was explained by having the blue and red plants completely enclosed while the control plants remained open to the ambient air/environment. All of the plants were measured once a week. Stem length, number of cotyledons, number of flower buds, number of true leaves and number of flowers were recorded on a chart. Also indicated was no growth or dead zones.

Figure 1

Number of Leaves

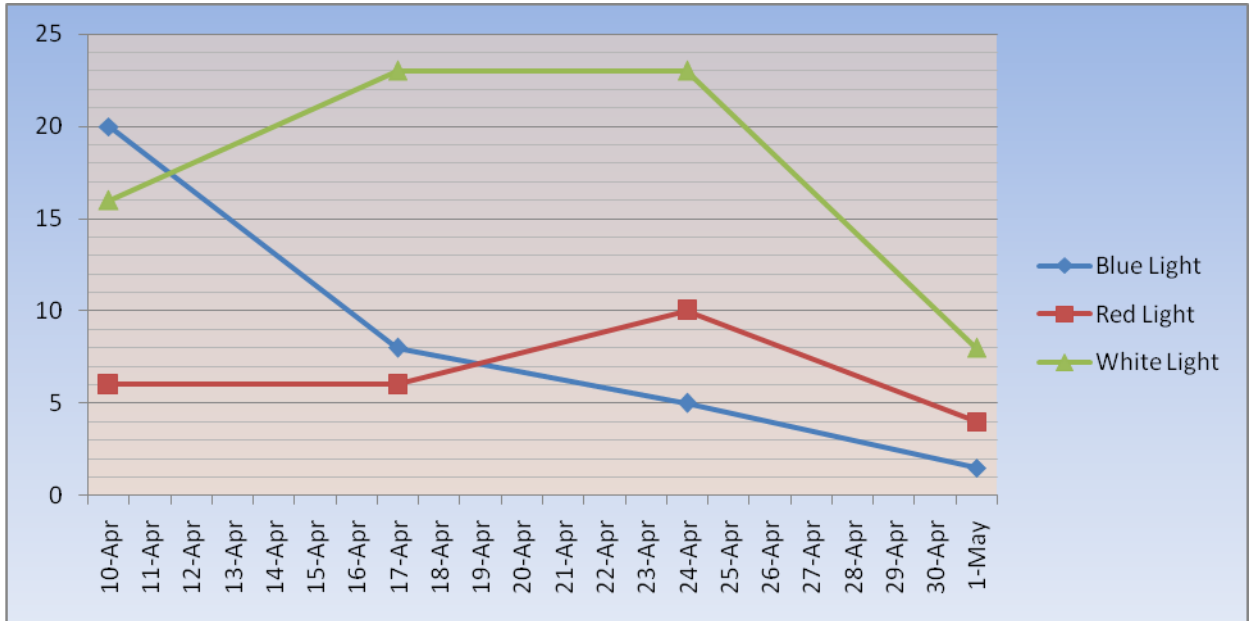


Figure 2

Height of stalk in centimeters

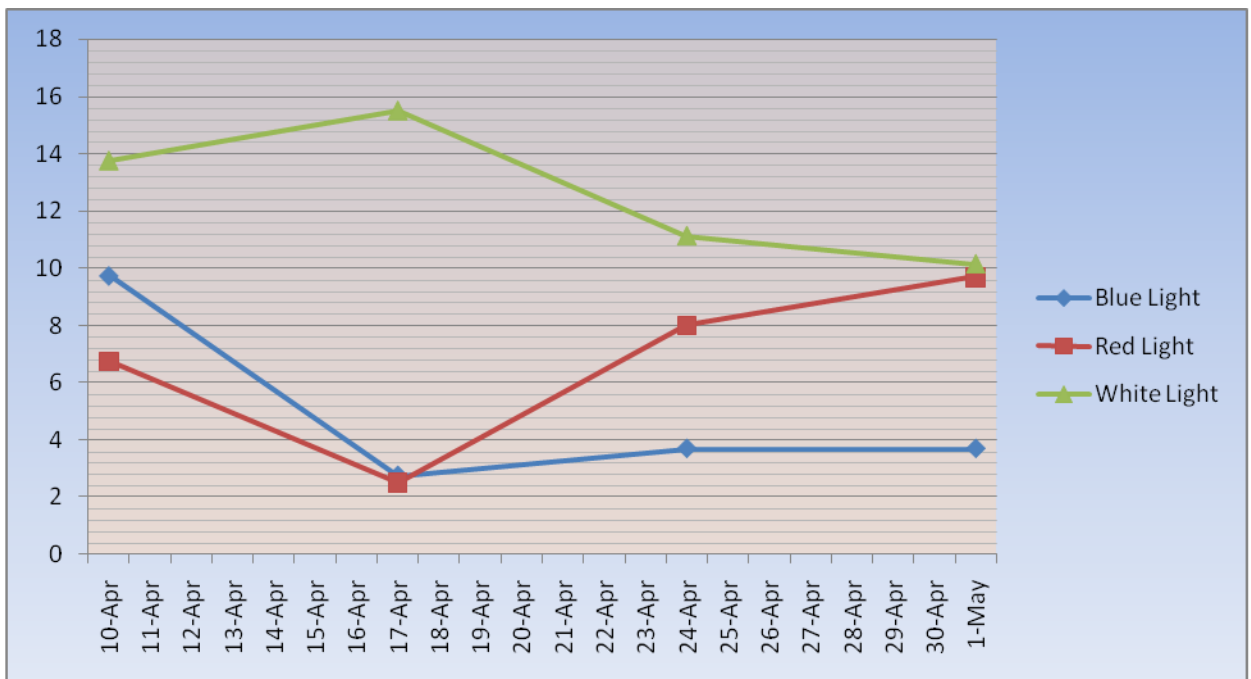


Figure 3

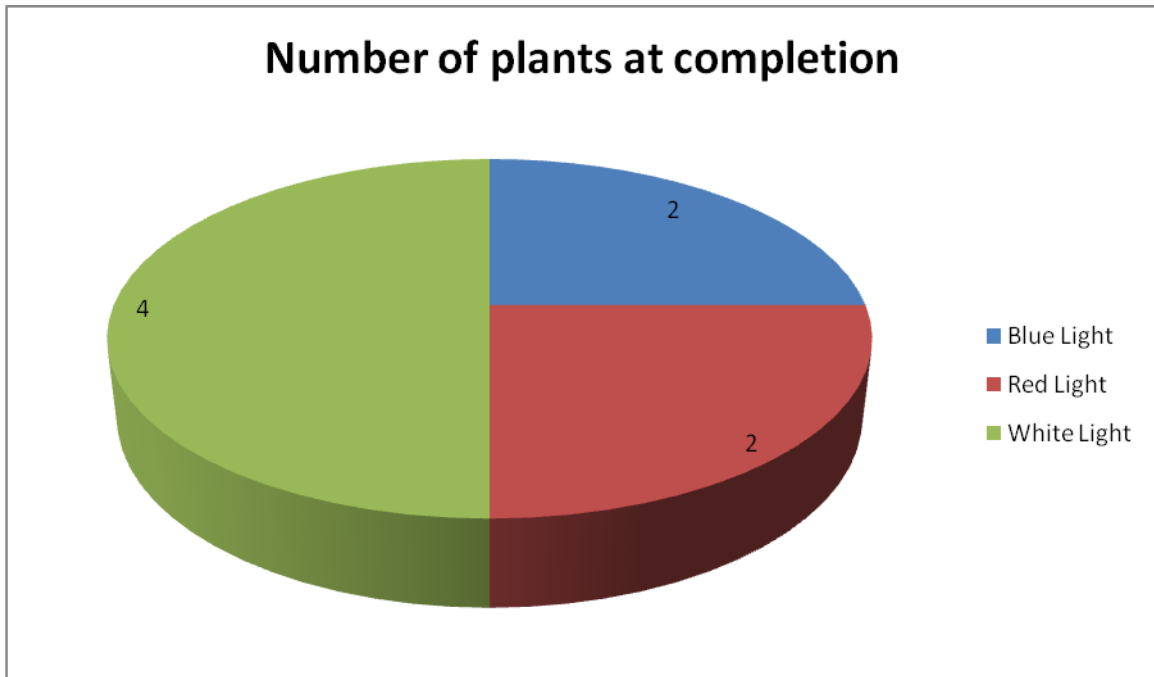
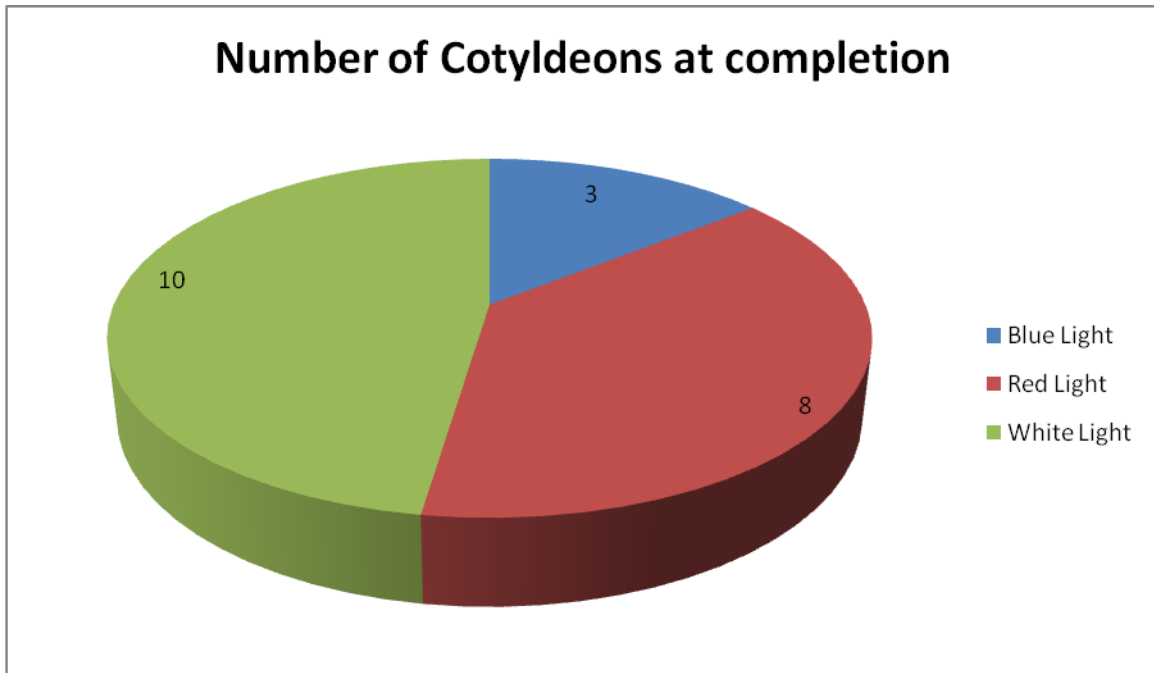


Figure 4



DISCUSSION

Figure 1 and 2 clearly show that the red light segment of the plants and the blue light section did not hold up well to the lack of true white light. The white light plants in the experiment averaged 23 leaves with a stalk height average of 13 inches. Between the blue and red light plants the average length of the stalks were 6 inches, with leaves numbering in the vicinity of 8. The main reason for this is that white light is a mixture of all the colors in the visible spectra.

In the thylakoid membranes of plants the light absorbing molecules called pigments absorb and or reflect wavelengths of light. Chlorophyll a and chlorophyll b are 2 of these pigments. While chlorophyll a absorbs mostly blue-violet and red light, chlorophyll b is busy absorbing blue and yellow-green light, and transforming the energy to chlorophyll a for use in light reactions. Subsequently there are also carotenoids busy at work absorbing blue-green light. One of carotenoids important functions is that of absorbing excessive light energy that could be harmful to the other chlorophylls.

Chlorophyll a and chlorophyll b had much do with the experiment. While the red light plants had chlorophyll a working over time, they lacked the needed nutrients from chlorophyll b, and the carotenids. Vice-versa for the blue-light plants, these plants were receiving plenty of nutrients form chlorophyll b, however the carotenids and chlorophyll a were virtually non-existent. The only plants that did well in the experiment were the white-light plants which were receiving all of the photons from the visible spectrum and were reaped the benefit of the full range of needed chemical reactions between chlorophyll a, chlorophyll b, and the carotenoids.

Chory, J (2007, September 27). Howard Hughes Medical Institution. Retrieved May 4, 2008, from HHMI Investigators Web site: http://www.hhmi.org/research/investigators/chory_bio.html (Chory, 2008)

CONCLUSION

The *Brassica Rapa* plants were expected to have a greater growth rate under BLUE light which has a higher energy level receiving most of its needed nutrients from chlorophyll b. RED light plants were expected to have a weaker growth rate receiving most of its nutrients from chlorophyll a. White light having a better balance of chlorophyll a, chlorophyll b, and the carotenoids and having all the photons of the visible light spectrum gave a better growth environment.