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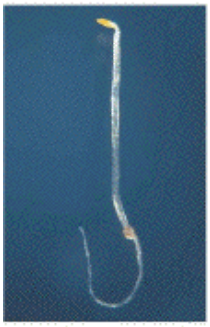
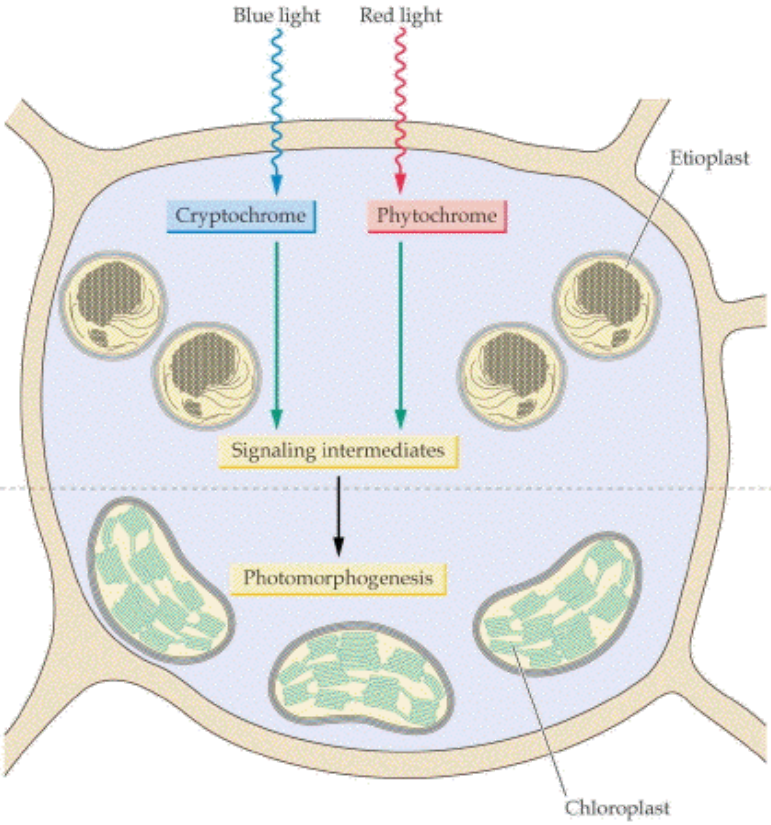
Experiment Proposal

**HEBA**

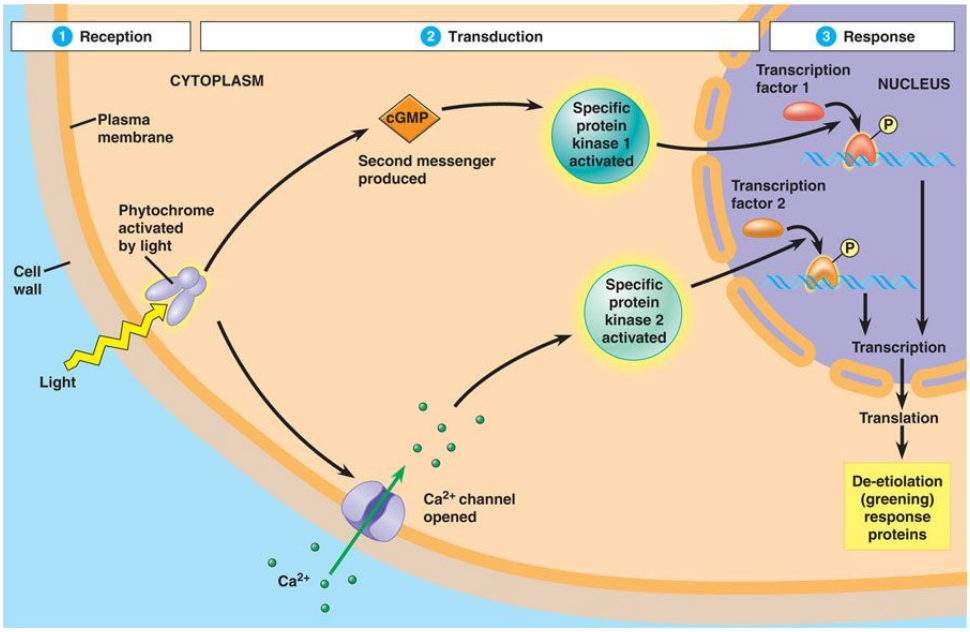
1. Research Report
    a. Arabidopsis thaliana is a flowering plant that is often used for educational purposes because of its petite physical size and rapid life span (Minx).






    i. (Shinkle)

    ii. There are several rather unique physiological characteristics in Arabidopsis thaliana. One includes photomorphogenesis, which is light-regulated plant development (Shinkle). In plants like Arabidopsis thaliana, photomorphogenesis includes the process of de-etiolation, commonly known as “greening”. When a plant is grown in darkness (partial or whole), it exerts most (if not all) of its energy into growing against the force of gravity to find a light source. De-etiolation is the procedure a plant undergoes when it gets the sufficient light after being in the dark for an amount of time. This process aids the plant to produce chloroplasts which, in time, makes the plant green as a whole (Presley).




(Signal Transduction)

iii. The ecology of Arabidopsis thaliana is rather broad. This plant grows in a variety of conditions since it can tolerate either sand-like soil or clay-like soil. Additionally, Arabidopsis thaliana can grow in either no shade or partial shade, and in dry or moist soil (Minx).

iv. The mutations, phyB-5 and phyA-201, greatly impact the wild type and its photomorphogenesis. First, the gene mutation, phyB-5, is involved in the light-induced seed germination and in the shade avoidance response. This mutation encourages seedling etiolation whether or not phytochrome A is present (Polymorphism: PhyB-5). The second gene mutation, phyA-201, functions as a dimer in Arabidopsis thaliana. It mainly mediates the FR high irradiance response (HIR) and the red-light induction of phototropic enhancement (Polymorphism: PhyA-201). Depending on the type of light the mutated plants are placed in, the hypocotyls will vary in length and the color of the plant will be different with each mutant. The plant, Arabidopsis thaliana, needs photomorphogenesis to grow. However, mutants phyB-5 and phyA-201 have deficiencies in their phytochrome photoreceptor gene and therefore, in numerous ways, result differently than the wild type.

b. The gap in our study we plan on researching involves the intensity of the light. We intend to place our plants in different intensities of light as well as different types of light to observe just how much light is necessary for the plant to grow to its full potential.

i. Just because a plant is in the “right” type of light does not automatically conclude that the plant will grow to its full potential. One also needs to consider the amount of light that the plant receives.

**FILIP**

c. Our specific plant research may be incredibly useful one day. Whenever new towns and cities spring up, they bring buildings and infrastructure with them. Since previously available vertical space is now being used, numerous plants are etiolating due to insufficient sunlight. Our research may be found useful by modern scientists who are researching if plants can be grown to their full potential by an alternate light source.

d. The information gained from this study can help the sustainability of countless organisms. If we conclude that there *are* other possible alternatives instead of natural light that provide the equivalent advantages that sunlight does, we may apply that to other vegetation that are food sources for countless organisms.

e. Minx, Patrick. "Genome: Arabidopsis Thaliana." *Washington University in St. Louis*, McDonnell Genome Institute, 2014, genome.wustl.edu/genomes/detail/arabidopsis-thaliana/. Accessed 5 Oct. 2017.

*Polymorphism: PhyA-201*. Arabidopsis Biological Resource Center / Phoenix Bioinformatics. *Tair*, www.arabidopsis.org/servlets/TairObject?id=115300&type=polyallele. Accessed 19 Oct. 2017.

*Polymorphism: PhyB-5*. Arabidopsis Biological Research Center / Phoenix Bioinformatics. *Tair*, www.arabidopsis.org/servlets/TairObject?id=115308&type=polyallele. Accessed 19 Oct. 2017.

Presley, Jay, and Laura LeMay. "De-etiolation." *Biology Teaching Greenhouse*, Berry College, 2017, sites.berry.edu/cborer/news-2/plant-physiology-student-videos/de-etiolation/. Accessed 19 Oct. 2017.

Shinkle, James. "Basic Photomorphogenesis." *Photobiology*, 4 Apr. 2016, photobiology.info/Shinkle.html. Accessed 5 Oct. 2017.

Signal Transduction Pathway for De-etiolation. *University of Miami*, www.bio.miami.edu/dana/226/226F08_21.html. Accessed 19 Oct. 2017.

2. Research Question

a. Our aim in this study is to see how different phytochromes in our mutated Arabidopsis thaliana plants react to contrasting types of light. The kinds of light we intend to use is white and far-red light.

b. We will grow our mutated plants (phyB-5, phyA-201) in white and far-red light and observe their hypocotyl lengths and how green they are (on a scale) to see whether plants are capable of living to their greatest potential in different types of light.

**ITZEL**

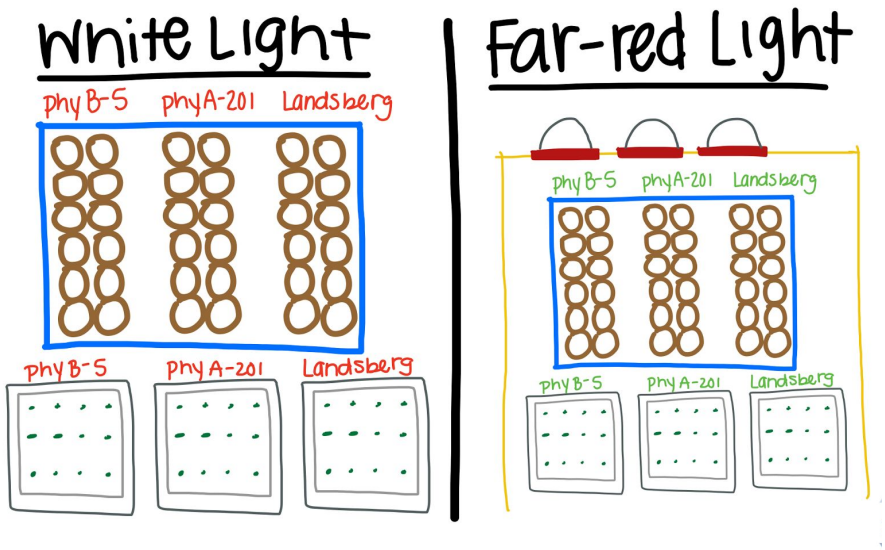
3. Research Methods

a. Our null hypothesis is that plants can only grow to their fullest capacity in white light. Our alternative hypothesis is that plants can, in fact, achieve those similar results in multiple types of light, not only white light.
b. We will plant our Arabidopsis thaliana seeds in different types of light (white and far-red) and collect the results by measuring the hypocotyls and observing the color of the plant (on a scale).

**HEBA**

c. Experimental Design

i.




**ITZEL**

ii. Materials - Arabidopsis thaliana mutant seeds (phyB-5, phyA-201), wild-type seeds, soil pods, planting trays with clear & ventilated lids, white light, far-red light, Ziploc bags, paper towels, cardboard box, scissors, duct tape, water, fertilizer, plastic labels, ruler.

iii. The independent variable in our experiment is the type of light that the plants are exposed to. The dependent variables are the hypocotyl lengths and the shade of green (color) of the plants. There are countless controlled factors in our experiment including temperature, water moisture, soil amount, air quality, number of seeds, and time provided to grow.

**SAFA**

iv. Procedure

1. Setup: Line up 36 soil pods in groups of 12 in a planting tray. Repeat with another tray for a total of 72 soil pods. Fill tray with water so all pods can absorb; wait until water is all absorbed. Put 4-5 fertilizer droplets in each pod. Wait at

least 2 days. Distribute a quarter amount of phyB-5 seeds in 12 pods of each tray. Repeat with phyA-201 seed mutants and the wild type seeds. Half the seeds should remain. Label all pods. Place lids on trays. Elsewhere, wet three layers of paper towel and place in 6 quart-sized Ziploc bags. Distribute an equal amount of the remaining phyB-5 seeds between two bags. Repeat with phyA-201 and the wild-type seed. In a cardboard box, cut out shapes on the bottom the same as the actual far-red light bulbs. Turn the box upside down and duct tape the far-red lights into the holes so that the inside of the box does not receive any outside light.

2. Experimentation: Place one tray and a bag of each type of seed in white light. Place the other tray and the remaining bags in the far-red light box. Water regularly and observe plants. After one week, with a ruler, measure all the hypocotyls from the seeds in the bags (for more exact results than the soil pods) and compare the color of the plants to the green color scale.

v. To evaluate whether or not our hypothesis is supported by our data, we will measure all our plants' hypocotyls and observe their color (on a scale) to then compare the numbers of mutant plants to the numbers of wild type plants.