HOLDEN FORESTS & GARDENS

TEACHER RESOURCES

Uncovering the Black Botanical Legacy

by Tanisha Williams (Bucknell University)

These educational materials were designed to accompany the video seminar "Uncovering the Black Botanical Legacy" by Dr. Tanisha Williams, presented on April 14th, 2021 as part of a virtual Holden Forests & Gardens Scientist Lecture Series, Growing Black Roots: the Black Botanical Legacy.

Learn more about the lecture series here.

Access the talk here.

Comprehend and Connect – Ask yourself, why does representation matter?

Listen to the talk to find out: What does Dr. Williams mean by the phrase "Black Botanical Legacy", and why does she find this to be an important topic of study?

1) Visit the Encyclopedia Britannica page on notable botanists, looking at the pictures for reference make an account of the gender and race of each person shown https://www.britannica.com/biographies/sciences/botany, then answer the following:
    a. Do the people pictured appear to be historic people, modern people, or both?
    b. Does anyone on this list represent your own gender and race? What do/did they study?
    c. How many Black Female Botanists are represented in this reference material?
    d. Which gender and race has the most representation in this reference?
2) Visit another website that provides information about botanists, Project Biodiversify https://projectbiodiversify.org/examples/
    a. Do the people pictured appear to be historic people, modern people, or both?
    b. Does anyone on this list represent your own gender and race? What do/did they study?
    c. Are there similarities or differences between who is shown on this Project Biodiversify website versus who is shown on the Encyclopedia Britannica website? Why do you think the people listed are similar or different across the two websites?
3) Watch a short video about why representation matters, discuss the video with your learning group and then reflect on what it means for you to see people who look like you portrayed in different careers. https://www.pbs.org/newshour/arts/why-on-screen-representation-matters-according-to-these-teens

To Do – Learn about the impact of the Black Botanical Legacy on your own high school biology class.

Listen to the talk to find out: Who are some of the historic Black botanists that Dr. Williams notes as an inspiration for her work? What positive outcomes has Dr. Williams herself experienced through delving into the history of Black botany?

1) Read a short biography of one Black botanist, Dr. Marie Clark Taylor https://projectbiodiversify.org/2020/11/24/marie-clark-taylor/
    a. What did Dr. Clark Taylor study for her research?
    b. The article mentions that Dr. Clark Taylor was a pioneer in high school teaching. What did she introduce into the classroom? What did she do to help high school teachers?
2) Get a sense of how revolutionary Dr. Clark Taylor's new teaching ideas were, by reading an excerpt of an article by DB Rosenthal describing the early history of high school biology classes prior to the innovations introduced by Dr. Clark Taylor beginning in the 1930's. Then, answer the following:
    a. Dr. Clark Taylor pioneered a hands-on approach to teaching biology, advocating for the use of laboratory equipment and plant materials in the classroom. How might her hands-on approach benefit student learning? The excerpt mentions that the new approach to high school biology courses sought to move away from highly academic courses, instead embracing "a more practical orientation that would address the needs of future citizens", how might Dr. Clark Taylor's hands-on approach accomplish that goal? Considering immigrant students who are likely to be learning English as a second language, how might hands-on teaching be beneficial for these students?

A Brief Review of the Early History of High School Biology

The first general biology course in American high schools began in 1881 in Milwaukee. By 1900, seven other cities were teaching general biology and New York had developed a state curriculum.

The new biology courses were immensely popular. By 1923, almost 84 percent of high schools offered courses in general biology.

The success of general biology has been attributed to…a reaction against the highly academic, specialized courses in botany, zoology and human physiology. These predecessors of general biology were only slightly revised versions of college courses. They stressed technical vocabulary, taxonomy and morphological detail. If they were at all appropriate, it was only for college-bound students. Although early general biology courses suffered from some of the same problems, they became a vehicle for those who advocated a more practical orientation that would address the needs of future citizens.

In the first quarter of the 20th century, the number of students attending high school increased dramatically, not only because of a general population increase, but also because of a greater percentage of young people attending high school. The result was an increase in the numbers and percentage of noncollege-bound students, many of whom were children of immigrants or migrants from rural to urban areas.

Excerpt from: Rosenthal, DB (1990) What's past Is Prologue: Lessons from the History of Biology Education. The American Biology Teacher (1990) 52 (3): 151–155. https://doi.org/10.2307/4449067

3) Carry on Dr. Clark Taylor's teaching legacy by using a time lapse video to teach a scientific concept about plants to your fellow classmates. On YouTube, search for videos using the key words "time lapse plant", pick any video that you like which shows a plant in a time lapse video. Consider the following in developing your teaching presentation:
    a. Determine, what can your fellow students learn from the video? Write a list of interesting facts or observations that you see in the video.
        1. Pick one fact or observation that you made about the video. For example, in this video about a growing cucumber plant https://www.youtube.com/watch?v=NgK-Z5Gs67E one might observe that the plant is moving a lot on its own, even though there is no wind or a person moving it.
    b. Learn more about the science behind what you observed in the video.
        1. Conduct a google search to find out more about the science that you observed and will be teaching, for the cucumber example, you could search for the answer to "why do plants move on their own?"
        2. Search the internet for more images, activities, or any other resources you can use to teach or demonstrate the scientific explanation. For example, I found this page about why plants move on their own and some demonstrations you can do to test if a plant is moving on it's own: https://www.sciencefriday.com/educational-resources/track-a-plants-movement/#:~:text=Many%20plants%20perform%20these%20movements,when%20plants%20move%20towards%20sunlight.&text=Phototropisms%20allow%20plants%20to%20maximize,orienting%20them%20towards%20the%20sun
    c. Make your teaching presentation. Use PowerPoint or a similar program to make a 5-minute presentation teaching the concept that you developed from your video, include a screening of the time lapse video at the beginning of your presentation along with describing the observations you made on your video, and information you learned from the internet about the scientific basis of the one observation you chose to teach.
    d. Administer your teaching presentation to a group of fellow students.
4) Assess the success of your lesson by asking your fellow students the following: What did they learn, what do they want to know more about, and what questions do they have? Finally, ask your fellow students how the addition of the time-lapse video impacted their learning, was the video fun? Was it helpful to understand the concept?

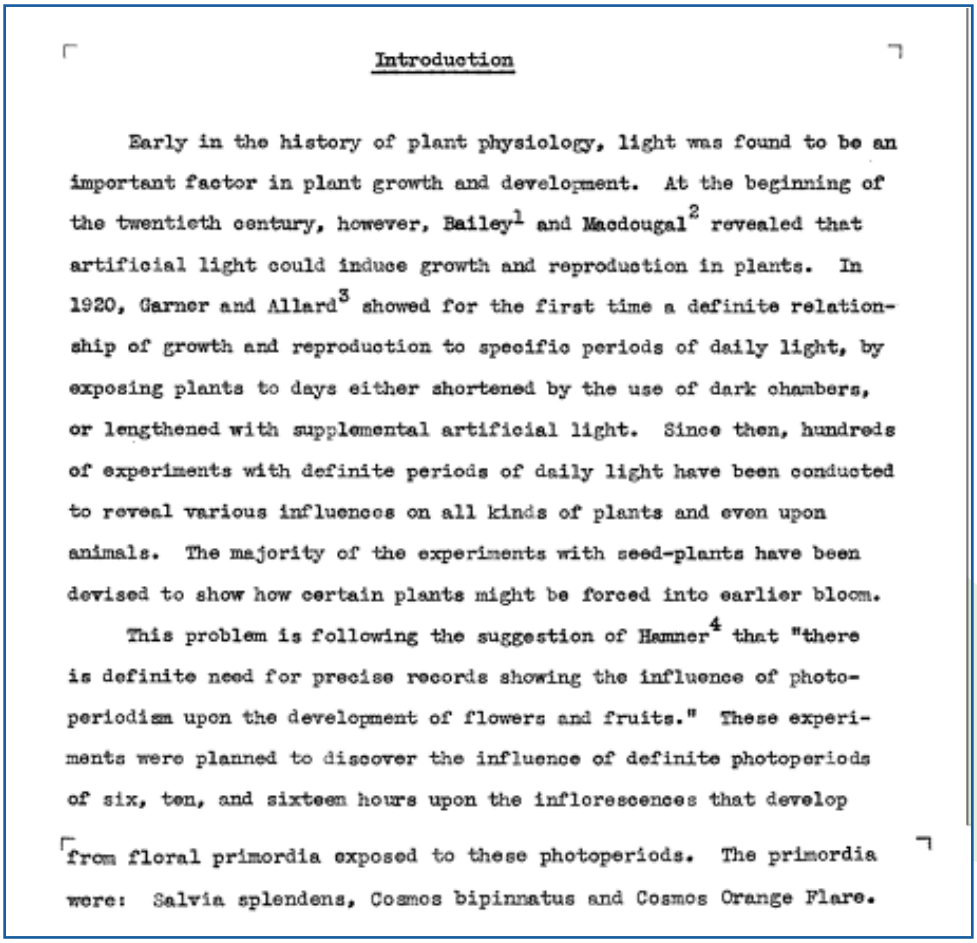
Follow up work – Learn about and build upon the scientific legacy of Dr. Marie Clark Taylor.

Listen to the talk to find out: What research is Dr. Williams conducting? Who are the historic Black figures who inspired her line of research?

1) Get an in-depth view into the research of one of the Black botanists Dr. Williams introduced, Dr. Marie Clark Taylor. First, read an excerpt from the introduction to Dr. Clark Taylor's PhD dissertation, then complete the following:
    a. Make a list of unfamiliar words, then use a search engine to find the definition.
    b. As a group, or on your own, summarize the main goals of the study, what problem did the study address?
    c. As a group, discuss what floral primordia are and why are they interesting and important to humankind? How does study this relate to things in your everyday life? Why is it important to know how this aspect of plants is impacted by daylength? Who might use this information?
    d. Make a list of keywords for the introduction. View the following video to understand more about what keywords are and how to make them https://www.youtube.com/watch?v=Ui-iFnS-9hs&list=FLcSawhbDFr-ajRoM2y2jHJg

Note for teachers: this is an abbreviated lesson on keywords, for more fulsome lesson plans and resources, please visit http://www.readwritethink.org/resources/resource-print.html?id=1122 or https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1014&context=nc_oers

Excerpt from: Clark, MB (1935) The influence of definite photoperiods on the growth and development of initiated floral primordia. Electronic Thesis and Dissertation Collection for Fordham University. AAI10992533. https://research.library.fordham.edu/dissertations/AAI10992533



Introduction

Early in the history of plant physiology, light was found to be an important factor in plant growth and development. At the beginning of the twentieth century, however, Bailey[1] and Macdougal[2] revealed that artificial light could induce growth and reproduction in plants. In 1920, Garner and Allard[3] showed for the first time a definite relationship of growth and reproduction to specific periods of daily light, by exposing plants to days either shortened by the use of dark chambers, or lengthened with supplemental artificial light. Since then, hundreds of experiments with definite periods of daily light have been conducted to reveal various influences on all kinds of plants and even upon animals. The majority of the experiments with seed-plants have been devised to show how certain plants might be forced into earlier bloom.

This problem is following the suggestion of Hamner[4] that "there is definite need for precise records showing the influence of photoperiodism upon the development of flowers and fruits." These experiments were planned to discover the influence of definite photoperiods of six, ten, and sixteen hours upon the inflorescences that develop from floral primordia exposed to these photoperiods. The primordia were: Salvia splendens, Cosmos bipinnatus and Cosmos Orange Flare.

2) Read about the methods Dr. Clark Taylor used for her study, then complete the following:
    a. Are there more unfamiliar words in the text? Use a search engine to define new words.
    b. What plant species were examined?
    c. What were the growing conditions? Consider the soil, the temperature and the light levels.
    d. What were the treatments that were tested?
    e. How was the length of daylight for different treatments controlled, what did Dr. Clark Taylor do to make the daylength shorter or longer?

Procedure

Uniform plants of the same planting were selected from flats and transplanted, one per 6-in pot, in sandy garden loam sufficiently rich for the length of the experiment. These young plants were exposed to ordinary out-of-doors conditions until the floral primordia began to appear. Then, the plants were divided into groups to be exposed to the following photoperiods:

	Hours	Daylight	A. M. – P. M.
I	8	only	7 – 3
II	10	only	7 – 5
III	16	Supplemented (6 hrs.)	7 – 11

At the end of their daily light periods the plants receiving only daylight were placed in a nearby well-ventilated cellar room where wooden frames covered with a double thickness of medium grade, closely woven muteen were placed over them, completely obliterating all sources of light.

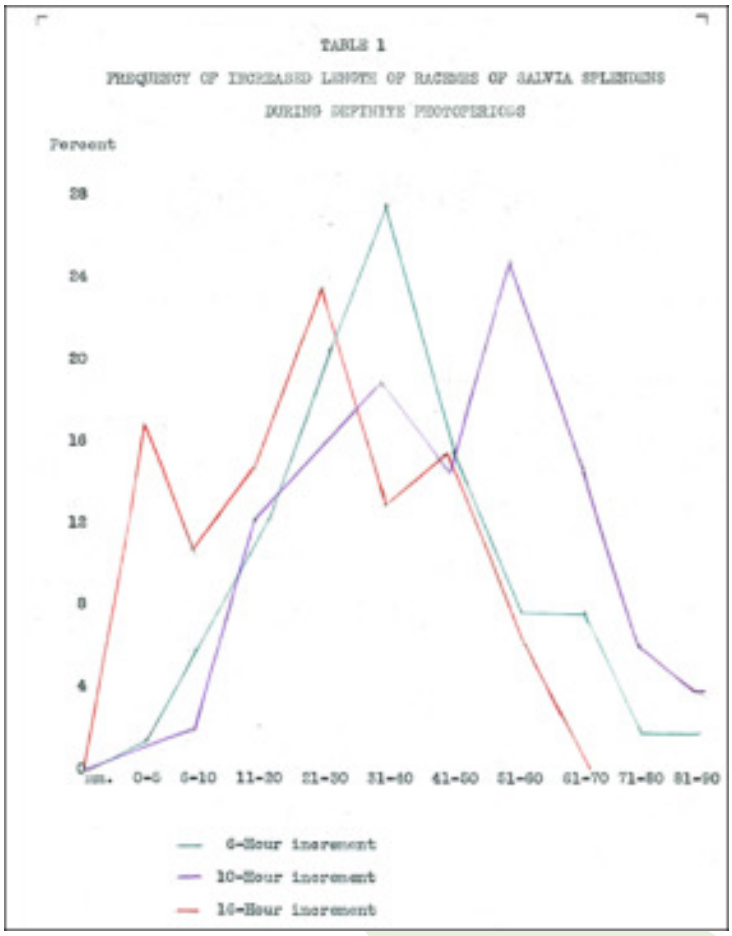
The plants receiving supplemental light were placed on a table in the same room at the end of the 10-hour period of daylight. The remaining six hours of light were supplied by a 500 watt Mazda lamp set in a mirrored reflector, nine inches in diameter, and placed 30 inches above the soil in the pots.

Since the sixteen hour photoperiods killed the primordia of many Salvia racemes in an early stage, some Salvia were permitted to elongate further than the primordium stage to note the influence of the period on the subsequent floral development.

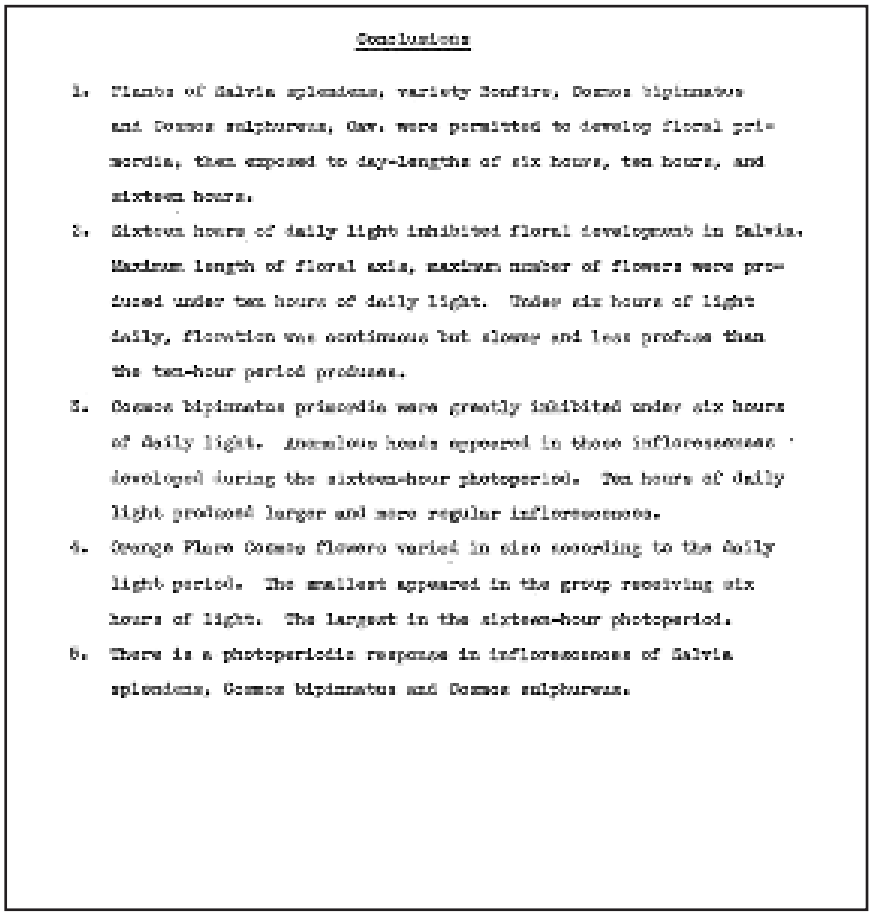
3) Find out the results of her study, and what she concluded about the effect of light on plants. Note that in 1935 when the dissertation was written, computers were not available, and the graphs had to be created by typing the axes on a typewriter, then drawing in the data by hand. Can you see the pen marks that Dr. Clark Taylor made in constructing her graph? Now, consider the data shown on the graph, then work as a group with your classmates to answer the following:
    a. Note any unfamiliar words and use an internet search engine to define them.
    b. What is the title of the graph? Work with your classmates to re-write the title in your own words, using the definitions you found to simplify the title.
    c. What variable is shown on the X-axis? What are the units of measurement?
    d. What variable is shown on the Y-axis? What are the units of measurement?
    e. What are the three treatments, and what color is used to represent each treatment?
    f. Which treatment results in the greatest percent increase in length for Salvia splendens?
    g. Which treatment results in the smallest percent increase in length for Salvia splendens?

Toxic Soils & Special Plants: Serpentine Endemism in California

by Tatyana Soto (Purdue University)



4) Read about the conclusions of Dr. Clark Taylor's study, then answer the following:
   a. Are there any new unfamiliar words? Use an internet search to define the new words.
   b. As a class, pick one of the five conclusions, and re-write them in your own words, replacing unfamiliar words with more common words, as you did for the title of the graph.
   c. Thinking back to the keywords you made for the introduction, would those same keywords be helpful to describe this conclusion? Or, would you need additional keywords to capture what is shown in the conclusions? If you see a need for more keywords, work as a group to revise your list of keywords to include these concluding statements.



Conclusions

1. Plants of Salvia splendens, variety Bonfire, Cosmos bipinnatus and Cosmos sulphureus, Cav. were permitted to develop floral primordia, then exposed to day-lengths of six hours, ten hours, and sixteen hours.
2. Sixteen hours of daily light inhibited floral development in Salvia. Maximum length of floral axis, maximum number of flowers were produced under ten hours of daily light. Under six hours of light daily, flowering was continuous but slowly and less profuse than the ten-hour period produces.
3. Cosmos bipinnatus primordia were greatly inhibited under six hours of daily light. Anomalous heads appeared in those inflorescences developed during the sixteen-hour photoperiod. Ten hours of daily light produced larger and more regular inflorescences.
4. Orange Flare Cosmos flowers varied in size according to the daily light period. The smallest appeared in the group receiving six hours of light. The largest in the sixteen-hour photoperiod.
5. There is a photoperiodic response in inflorescences of Salvia splendens, Cosmos bipinnatus and Cosmos sulphureus.

5) Learn about the ongoing legacy of Dr. Clark Taylor by using keywords in Google scholar to conduct a search for recent studies that expand on her work.
    a. Watch this short video with tips on how to search using keywords https://www.youtube.com/watch?v=1tUqc4gnxc8&t=0s
    b. Take your list of keywords and head over to https://scholar.google.com/ and start searching for recent scientific studies on the topic that Dr. Clark Taylor investigated. Then complete the following:
        i. As noted in the video, you'll want to conduct your search multiple times using slightly different keywords, synonyms - capitalize - punctuate - different order. Make a list of the keywords that you tried and note changes, for example, do some keywords result in more hits than others?
    c. Once you have tried a few combinations of keywords, chose one that provides results which look interesting to you, this will be your final search. Teachers note: As an example, when I used the terms "daylength", "salvia" and "racemes" I got the following article as my top hit https://www.actahort.org/books/723/723_50.htm
        i. Provide a number showing how many articles you found in your final search.
        ii. Provide the citation for the one article you picked that expands on Dr. Clark Taylor's work, use a standard citation format, then answer the following:
            1. Does the new article have more unfamiliar words? Rate the difficultly of the new article on a scale of 1-10 with 1 being "this article is extremely easy for me to read" and 10 being "I would need a lot of help to read this article."
            2. Consider just the title of the article. Define any unfamiliar words, then re-write the title in your own words. Based on the title, what was the problem that the study was seeking to address?
6) Design your own experiment to follow up on Dr. Clark Taylor's research. Now that you have learned about the work that she conducted, what would you do next or differently? Make a plan to repeat the experimental protocol using different plants or different light treatments, or even different types of growing lights. Compare your results to the ones reported in Dr. Clark Taylor's dissertation.

Note for teachers: There is an art and a lot of training that goes into reading scientific articles. Those written in the 1930's like Dr. Clark Taylor's study are much more accessible to students, compared to modern scientific papers. This short tutorial is a great guide on how to read scientific papers https://www.huffpost.com/entry/how-to-read-and-understand-a-scientific-paper_b_5501628