Name _____ Date _____ Period _____

ZornScience
zornscience.org

Same Seeds, Different Colors

Biology

Work with your group. Record every measurement with its unit. Answer questions in complete sentences.

Draft lab. This lab has not been tested in a classroom yet. Your teacher may change some steps, times or amounts.

The Puzzle

Radish sprouts from the same packet can come up deep purple on a sunny windowsill but pale and yellow-white in a dark cupboard. The purple color is a pigment called **anthocyanin**. Every cell in every seedling has the same genes for making it. So why are some seedlings purple and others pale?

Question

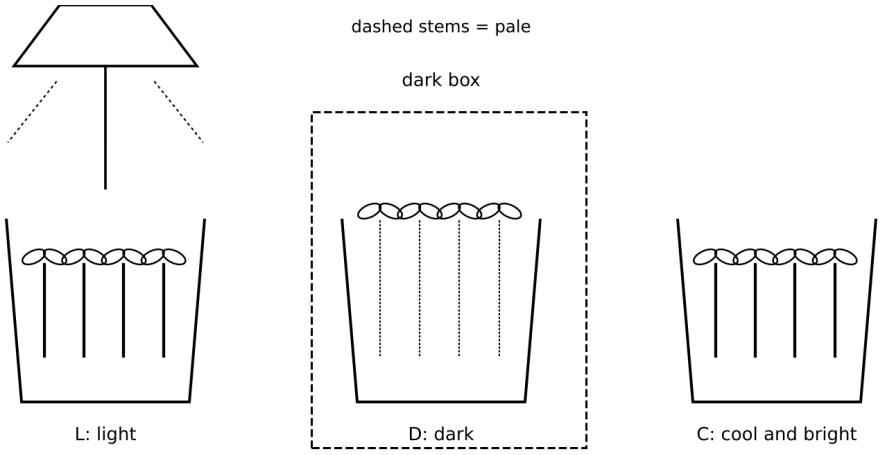
How do light and temperature affect how much anthocyanin pigment radish seedlings make?

Safety

- Wear goggles when using vinegar.
- Do not eat the seeds or sprouts. Wash your hands after the lab.

Materials (per group)

- Red radish sprouting seeds (about 1 teaspoon per cup)
- 3 clear cups with wet paper towels, labeled L (light), D (dark), C (cool and bright)
- Scissors, plastic spoon, 6 small clear vials or cups, white vinegar, dropper
- White paper for comparing colors



Three cups from the same seed packet, grown in three conditions.

Before the Lab

1. Write one question you could test about why seedlings with the same genes might look different.

CC BY-NC-SA 4.0 | zornscience.org

Procedure

Day 1

1. Sprinkle a teaspoon of seeds on the wet towel in each cup. Cover loosely with plastic wrap.
2. Put cup L under a lamp at room temperature, cup D in a dark box at room temperature, and cup C in a cool, bright place your teacher chooses (such as next to a cold window). Keep the towels wet.

Day 5

1. Observe the stem (hypocotyl) color in each cup and record it.
2. From each cup, cut 10 stems just below the leaves. Put them in a vial with 5 mL of vinegar and crush them with the spoon. Wait 10 minutes.
3. Make standards from extract L: Full (undiluted), 1/2 (1 mL extract + 1 mL vinegar), 1/4, and 1/8.
4. Hold each extract against white paper and find the closest standard. If an extract is darker than Full, mix it 1:1 with vinegar, match it again, and double the score.
5. Optional: move half of the cup D seedlings into the light. Check their color 2 days later.

Data

Table 1. Anthocyanin results

Cup	Condition	Stem color (words)	Pigment score (Full = 1)
L	Light, room temp		1
D	Dark, room temp		
C	Cool and bright		
D moved to light (optional)	Dark, then 2 days of light		

Analysis

2. Rank the three conditions from most pigment to least. What two factors affected pigment?

3. The dark seedlings were pale. Did they lose the genes for making anthocyanin? Use evidence to explain.

4. Anthocyanin is made by enzymes, which are proteins. Use the words **gene**, **transcription**, and **protein** to explain how light could lead to more pigment.

CC BY-NC-SA 4.0 | zornscience.org

5. A seedling that can never make anthocyanin, even in bright light, is found in your cup. Is this more likely a difference in gene expression or a mutation? Explain.

6. Claim, evidence, reasoning: Do organisms with the same genes always have the same traits?

Claim

Evidence

Reasoning

CC BY-NC-SA 4.0 | zornscience.org