TEACHER PREPARATION GUIDE.

ZornScience
zornscience.org

Same Seeds, Different Colors

Biology | TEACHER GUIDE

Planning notes for teachers: materials, setup, expected results, and what to watch for.

Not yet classroom-tested. This is a new lab design that has not been tested in a classroom yet. Expected results, times and costs are estimates, not measured values. Run the full lab yourself before you use it with students or grade it, and adjust amounts to match your materials.

Item	Details
Unit and lessons	Unit 9: DNA and Gene Expression. Lessons: Transcription, Translation, Mutations
Class time	One 20-minute setup, then one 50-minute data period 5 days later (optional check 2 days after that)
Groups	3 to 4 students
Cost	About $1 to $2 per group
Standards	HS-LS3-1, HS-LS1-1. SEP: Asking Questions and Defining Problems; Analyzing and Interpreting Data. CCC: Cause and Effect.

Big Idea

Same DNA, different expression. Light-induced anthocyanin in seedling stems is a classic, reliable plant response. The optional "dark to light" step gives direct evidence that the gene was there all along, which separates gene regulation from mutation.

Materials for 8 Groups

Item	Amount	Notes
Red radish sprouting seed (or red cabbage seed)	1 packet (about 50 g)	Sprouting seed from a grocery or garden store. Test a red-stem variety.
Clear cups and paper towels	24 each	
Plastic wrap, lamp, cardboard box		For the L and D conditions.
White vinegar	About 300 mL	Extracts the pigment.
Small vials or 1 oz cups	48	

Advance Preparation

1. Choose a cool, bright spot for cup C, such as a windowsill on a cold day (about 10 to 15 °C). If none is available, run only L and D.
2. Pilot one cup in light. Stems should show clear pink by day 4 or 5.
3. Plan the optional step: on day 5, set aside half of each group's D seedlings in light.

Expected Results

Light-grown stems are pink to purple, dark-grown stems are pale and longer, and cool bright stems are often the darkest. Dark seedlings moved into light usually start turning pink within 1 to 2 days. Scores in the key are sample values.

CC BY-NC-SA 4.0 | zornscience.org

What Can Go Wrong

- A green-stemmed variety will not work. Check that the seed is a red-stem type.
- Moldy cups: rinse seeds and keep towels damp, not flooded.
- Weak extracts: crush the stems well, or use 15 stems instead of 10.

Misconceptions to Listen For

- "Different traits mean different DNA."
- "Genes are always on."
- "The environment changed the seedlings' DNA." It changed which genes were expressed.

Differentiation and Extensions

- Support: a color strip for scoring. Sentence frame: "The seedlings in ___ made more pigment because ___ turned on ___."
- Bridge to Unit 10: Fast Plants with the non-purple stem trait stay green even in bright light. That is a gene difference, not an environment difference.
- Extension: use a free phone colorimeter app to measure the extracts.

Safety and Disposal

- Goggles for vinegar.
- Seedlings and extracts in compost or down the drain.

Standards

This lab builds toward these NGSS performance expectations:

- **HS-LS3-1:** Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- **HS-LS1-1:** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Disciplinary core ideas: LS1.A Structure and Function; LS3.A Inheritance of Traits; LS3.B Variation of Traits

Science and engineering practices: Asking Questions and Defining Problems; Analyzing and Interpreting Data

Crosscutting concepts: Cause and Effect

CC BY-NC-SA 4.0 | zornscience.org