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Publication No. 10231

# Heredity and Environment

## Albino Tobacco Seed Activity

### Introduction

What is the balance between heredity and environment in determining what an organism will look like?

### Biological Concepts

- Genotype
- Phenotype
- Dominant
- Recessive

### Materials

- |   |  |
|---|--|
| Disposable plastic Petri dishes, 100 × 15 mm, 2 | Pipet  |
| Filter paper, 9 cm, 2                           | Tobacco seeds (from parents heterozygous for albinism), 50 |
| Lightproof storage area or covers               | Water  |

### Procedure

1. Label the bottom of one Petri dish "light" and the bottom of another Petri dish "dark." Label both with your name and date.
2. Place a piece of filter paper into the bottom half of each Petri dish. Trim the paper as necessary so that the paper lies flat in the bottom of each dish.
3. Soak the filter paper with tap water using a pipet. Remove or drain any excess water that is not absorbed into the paper.
4. Sprinkle 25 tobacco seeds evenly over the moistened paper in each Petri dish. Be sure the seeds are nicely spread out in the two dishes.
5. Replace the cover on each Petri dish. Place the dish labeled "light" in a well-lighted area (greenhouse, window area, under lights, etc.) as directed by your teacher. Place the dish labeled "dark" in a completely darkened area where it will receive absolutely no light. (This could be in a drawer or closet, or under a light-tight box or cover.)
6. Allow the seeds to germinate for one week. Let the dishes sit undisturbed except to add water if the filter paper should become dry. If the dish in the dark needs added water, add it quickly and in a reduced light environment.
7. Observe the Petri dishes at the end of one week. Some seedlings will be pale in color (albino) with little or no green pigment. Other seedlings will have green areas forming. When nearly all the seedlings have germinated, count each seedling as either green or albino. Record your results in a data table like the following.

	Seeds in Light		Seeds in Dark	
	Green	Albino	Green	Albino
<b>Number</b>				
<b>Ratio of Green:Albino</b>				

8. After counting the number of green and albino seedlings in both the “light” and “dark” Petri dishes, reverse the location of the dishes for 2–3 days. Place the “light” dish in the dark environment and the “dark” dish in the light environment.
9. After several days observe the seedlings in the Petri dishes again and record the number of each kind of seedling (green vs. albino) in the data table.
10. Answer the following questions:
  - a. If the parents of the tobacco seeds used in this experiment were heterozygous for albino (green being dominant), what ratio of green to albino would you expect in this generation of tobacco plants? Did the expected ratio result? In the light? In the dark?
  - b. How do you explain what happened when you reversed the environmental conditions?
  - c. Predict which factor seems to be most important for tobacco seedlings—its heredity or its environment. Use your data to defend your answer.

## Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Dispose of all materials following Flinn Suggested Disposal Method #26a. This activity is considered nonhazardous.

## Discussion

Green is a dominant trait to albino in tobacco leaves. The parents of the tobacco seeds used in this experiment were both heterozygous for green/albino. An expected ratio of 3:1 (green:albino) is, therefore, predicted. A ratio of approximately 3:1 will result when the seedlings are grown in the light environment. In the dark, however, the genotype cannot express itself due to the lack of light necessary for chlorophyll production. The seedlings will all look albino when grown in the dark. When placed in the light (after being in the dark), the phenotype will quickly change to green in those seedlings possessing the gene for green. This should restore the predicted 3:1 ratio.

Reversing the environment of the seedlings first grown in the light (and then placed in the dark) will likely not reverse the albino:green ratio very quickly. Given enough time in the dark, however, the seedlings will all become achlorophic and all will look albino.

## Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

### ***Unifying Concepts and Processes: Grades K–12***

- Evidence, models, and explanation
- Constancy, change, and measurement

### ***Content Standards: Grades 5–8***

- Content Standard A: Science as Inquiry
- Content Standard C: Life Science, structure and function in living systems, reproduction and heredity
- Content Standard F: Science in Personal and Social Perspectives; populations, resources, and environments

### ***Content Standards: Grades 9–12***

- Content Standard A: Science as Inquiry
- Content Standard C: Life Science, the cell, molecular basis of heredity
- Content Standard F: Science in Personal and Social Perspectives

## Materials for *Heredity and Environment* are available from Flinn Scientific, Inc.

Catalog No.	Description
FB1165	Albino Tobacco Seeds
AP3102	Filter Paper, Qualitative
AP8170	Dish, Culture (Petri), disposable

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.