

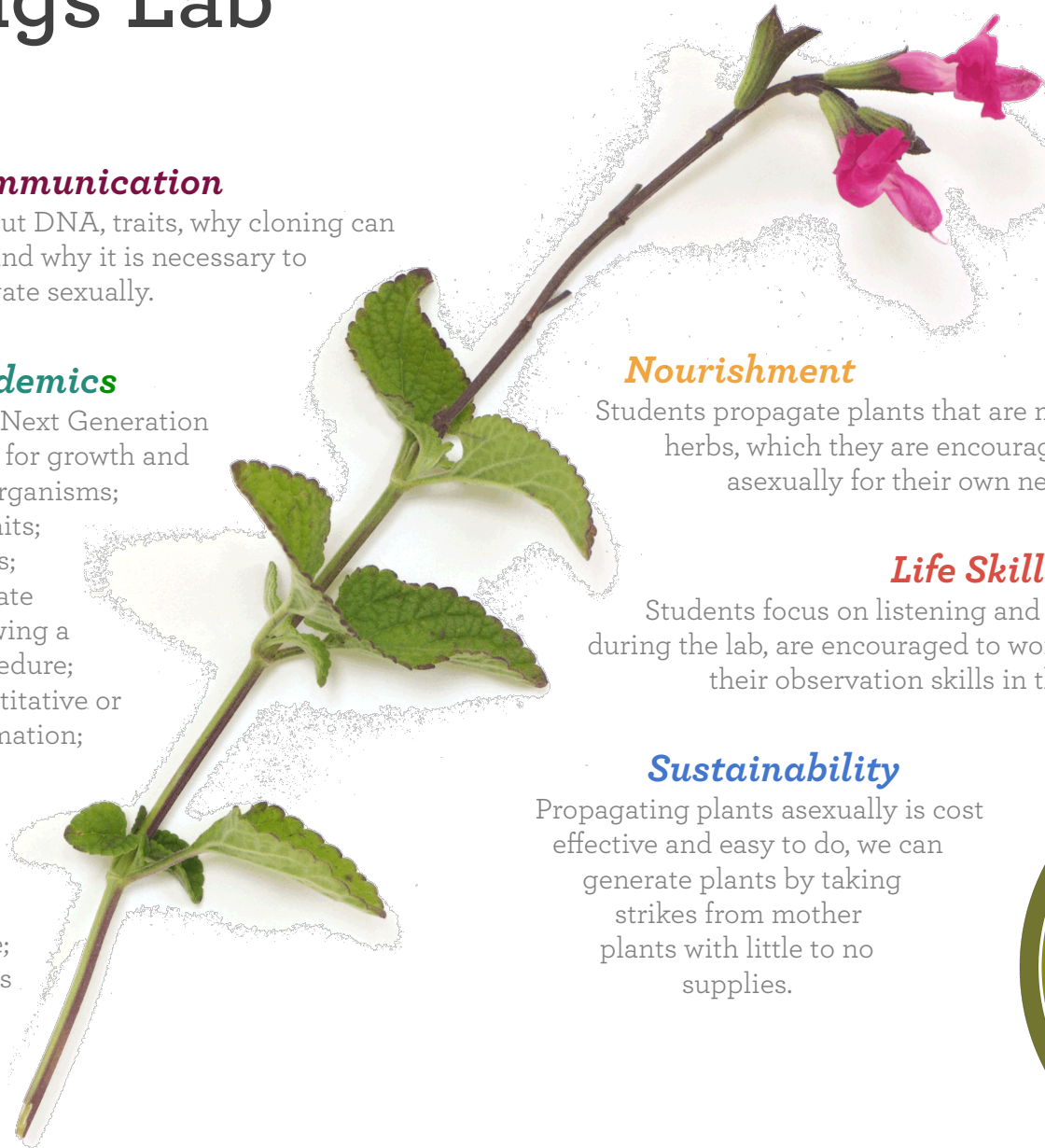
# Cuttings Lab

## Communication

Students learn about DNA, traits, why cloning can be problematic and why it is necessary to propagate sexually.

## Academics

This lesson fulfills Next Generation Science Standards for growth and development of organisms; inheritance of traits; variation of traits; Common Core State Standards for following a multistep procedure; translating quantitative or technical information; integrating information; collaborative discussion; speaking and listening; language; and acquiring words and phrases.



## Nourishment

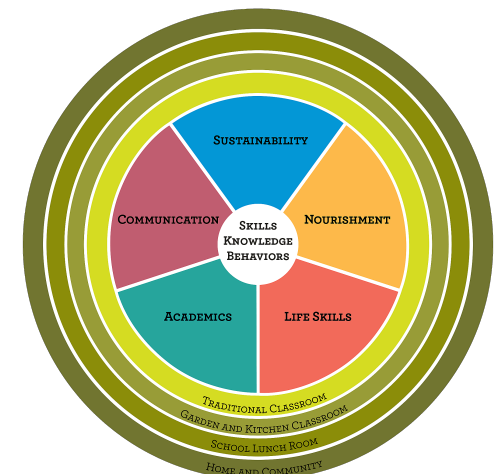
Students propagate plants that are medicinal perennial herbs, which they are encouraged to propagate asexually for their own needs at home.

## Life Skills

Students focus on listening and following directions during the lab, are encouraged to work together and use their observation skills in the garden.

## Sustainability

Propagating plants asexually is cost effective and easy to do, we can generate plants by taking strikes from mother plants with little to no supplies.



## Cuttings Lab Abstract

### Summary

In this 7th grade science lesson, students identify desirable traits in plants and take **cuttings** from parent plants to facilitate **asexual propagation** and produce offspring with identical **DNA**.

### Objectives

After this lesson, students will be able to:

- Explain why plants are reproduced **asexually**
- Understand that **asexual** offspring are genetically identical to the mother plant
- Use **cuttings** to propagate **perennial** plants

### Assessments

During this lesson, students will:

- Identify three reasons for reproducing plants **asexually** in the garden
- Identify the **cutting** as genetically identical to the mother plant
- Successfully propagate a plant **asexually**

**Communication** is strengthened by learning about **DNA**, traits, why cloning can be problematic and why it is necessary to propagate sexually. **Sustainability** is highlighted by learning that propagating plants **asexually** is cost effective and easy to do, we can generate plants by taking strikes from mother plants with little to no supplies. **Nourishment** is acquired by propagating plants that are medicinal **perennial** herbs, which students are encouraged to propagate **asexually** for their own needs at home. **Life Skills** are sharpened as students focus on listening and following directions during the lab, are encouraged to work together and use their observation skills in the garden.

**Academics** fulfill Next Generation Science Standards for growth and development of organisms; inheritance of traits; variation of traits; Common Core State Standards for following a multistep procedure; translating quantitative or technical information; integrating information; collaborative discussion; speaking and listening; language; and acquiring words

and phrases. See **Connections to Academic Standards** below for details.

*Edible Schoolyard* curriculum emphasizes developing community and personal stewardship, along with skills that will help students navigate different situations throughout their lives; and grafting plants and **propagating cuttings**.

This lesson follows the BEETLES Project's *Learning Cycle* (Invitation-> Exploration -> Concept Invention -> Application -> Reflection) and uses their *Discussion Routines* (Think-Pair-Share, Whip-Around). All are highlighted in *Green*\* with an asterisk for easy identification. See the documents BEETLES\_Discussion\_Routines.pdf and BEETLES\_Learning\_Cycle.pdf included in **Resources** below for more information. Games and activities from other sources are also identified in *Green*, without an asterisk.

### Connections to *Academic Standards*

Next Generation Science Standards, Middle School

Disciplinary Core Ideas:

- LS1.B: Growth and Development of Organisms
  - Organisms reproduce, either sexually or **asexually**, and transfer their genetic information to their offspring. (*secondary to MS-LS3-2*)
- LS3.A: Inheritance of Traits
  - Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
  - Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)
- LS3.B: Variation of Traits
  - In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
  - In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

## Common Core State Standards, English Language Arts and Literacy, Grade 7

- RST.7.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.7.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 7 topics, texts, and issues*, building on others' ideas and expressing their own clearly.
  - SL.7.1.b Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
  - SL.7.1.c Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
  - SL.7.1.d Acknowledge new information expressed by others and, when warranted, modify their own views.
- SL.7.2 Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
- SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.7.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 7 Language standards 1 and 3 on page 53 for specific expectations.)
- L.7.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
  - L.7.1.a Explain the function of phrases and clauses in general and their function in specific sentences.
  - L.7.1.b Choose among simple, compound, complex, and compound-complex sentences to signal differing relationships among ideas.
  - L.7.1.c Place phrases and clauses within a sentence, recognizing and correcting misplaced and dangling modifiers.\*
- L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
  - L.7.3.a Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.
- L.7.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

### Connections to *Edible Schoolyard* Standards

Edible Schoolyard 3.0

In the Edible Schoolyard Program

- 1.0 Students work with each other and teachers to develop community and personal stewardship, along with skills that will help them navigate different situations throughout their lives.
- 1.1.1 – 1.3.12: This lesson fulfills all Edible Schoolyard Program standards, numbers 1.1 through 1.3.12. See *The Edible Schoolyard Berkeley Standards* for details.

In the Garden Classroom, 7<sup>th</sup> grade

- Techniques 3.2.6 Sow seeds and transplant seedlings with increased independence; graft plants and **propagate cuttings** with guidance; identify necessary ingredients for soil mixes; understand why the greenhouse provides an optimal environment for plant propagation.

## Cuttings Lab Lesson

### Materials

- G7-2 Visual Aid
- Wooden flat of growing medium (we use perlite)
- **Perennial** plants with branches available for **cutting**
- Examples of a rooted **cutting** and a mature, potted up **cutting**

### Before You Begin

- Create the Visual Aid
- Collect and prepare all the materials
- Set up seating area near greenhouse

### Timeline Overview

Total Duration: 90 minutes

1. *Invitation\** (5 minutes)
2. *Concept Invention\** (5 minutes)
3. *Application\** (40 minutes)
4. *Concept Invention* (10 minutes)
5. *Application\** (15 minutes)
6. *Reflection\** (15 minutes)

### Procedures

#### At the Opening Circle

1. *Invitation\**: (5 minutes)

Welcome students and introduce the Cuttings Lab.

- a. Explain that students will be rotating through the Cuttings Lab where they will learn how to generate more plants using **asexual** reproduction.

2. *Concept Invention\**: (5 minutes)

- a. Ask students what they already know about genetics and how **traits** are passed from generation to generation.
- b. Then ask students to share what they know about how plants typically reproduce.
- c. Explain that as gardeners, we often produce more plants by sowing seeds in the greenhouse and that the seed is the offspring of the plant. This is sexual reproduction.
- d. Explain that today, students will learn how to produce more plants through **asexual** reproduction and clone them rather than using seeds.
- e. Ask students what they think will happen to the **DNA** when the plants are cloned.
- f. Review garden jobs and closing circle activity: tasting.
- g. Divide students into 4 working groups, and explain that during their garden jobs, students will take a break to take an **asexual cutting** from a **perennial** plant.

In the Field (50 minutes total)

Garden Work Rotation

3. *Application\**: (40 minutes)

Students think about and discuss **asexual propagation** while working in the garden.

- a. Each group rotates through the Cuttings Lab as the other groups work in the garden.
  - i. The first group jumps to **At the Greenhouse Cuttings Lab** step 4. *Concept Invention\** while the other three groups begin their garden work.
  - ii. When the first group moves to step 5. *Application* the next group starts *Concept Invention\** step 4.
  - iii. Eventually, the first group will finish step 4, move on to 5 and loop back to begin 3. *Application*, which is their Garden Work Rotation.
  - iv. It takes a total of 65 minutes of class time to get through steps 3, 4 and 5.

At the Greenhouse

Cuttings Lab

4. *Concept Invention\**: (10 minutes)

Students rotate from their garden jobs to the Cuttings Lab one group at a time.

- a. Gather students near the greenhouse and review that in this lab, they will learn one method of generating more plants through **asexual** reproduction with **cuttings**.
- b. Explain that a **cutting** refers to a small branch that we take from a mature plant and turn into a clone of the plant from which it was taken.

- c. Give examples of some of the **traits** you look for in a mother plant: fragrance, vigor, disease resistance, color of flower etc.
- d. Reference the Visual Aid and explain the process while demonstrating each step.
  - i. Show how to take the strike from the mother plant.
  - ii. Explain the importance of exposing the nodes.
  - iii. Trim the upper leaves.
  - iv. Place the **cutting** at a 45-degree angle in the growing medium.
- e. Prompt students to think about why it would benefit the grower to place the strike at an angle rather than straight down.
- f. Explain that we use perlite because it is sterile.
- g. Review what happens to the **DNA** of the **cutting**.
- h. Show students an example of a rooted **cutting** several months old and a mature, one year old potted up **cutting**.
- i. Ask students why a grower would choose to use **asexual** propagation. Discuss with students that there are three main reasons:
  - i. It is faster than propagating by seed.
  - ii. You can select desirable **traits**.
  - iii. It is cost effective.

5. **Application\***: (15 minutes)

- a. Explain that students will walk through the garden and collect strikes from **perennial** plants to bring back and place in the tray of perlite.
  - i. Have each student take a **cutting** of the **perennial** plant, expose the nodes and trim the upper leaves.
  - ii. Once all students have taken a **cutting**, have each one place their **cutting** in the wooden flat at a 45-degree angle, label it, and have one student water the flat when everyone is finished.
- b. As students are preparing their **cuttings**, ask them the following questions.
  - i. Are these **cuttings** genetically identical to the mother plant? (*yes!*)
  - ii. Why is it important to expose the nodes? (*from the nodes branches, leaves, or roots can grow*).
  - iii. Why do we clip off the upper leaves on a **cutting**? (*to minimize transpiration and help keep the plant moist*)

At the Closing Circle

6. **Reflection\***: (15 minutes)

- a. Have a few students serve a seasonal fruit, vegetable or herb tasting from the garden.



**Vocabulary**

Perennial

Cutting

Asexual reproduction

Traits

DNA

**Contributors**

All lessons at the Edible Schoolyard Berkeley are developed in collaboration with the teachers and staff of the Edible Schoolyard and Martin Luther King Jr. Middle School.

Learning Cycle and Think-Pair-Share discussion routine © The Regents of the University of California. All materials created by BEETLESTM at The Lawrence Hall of Science.

**Resources**

G7-2\_Visual\_Aid.pdf

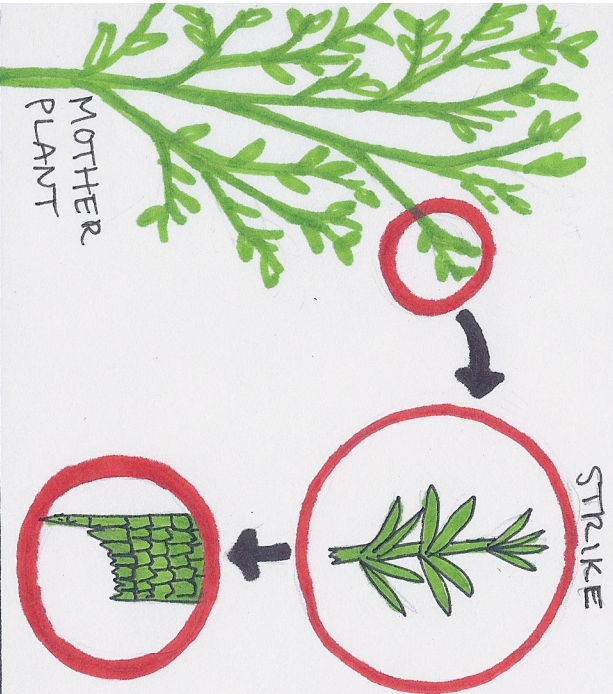
G7-2\_Strike\_Photo.pdf

G7-2\_Finished\_Cuttings\_Photo.pdf

BEETLES\_Learning\_Cycle.pdf (See lesson G6-0)

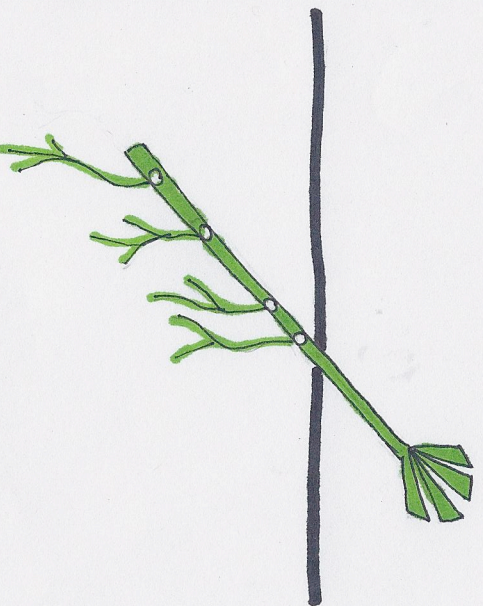
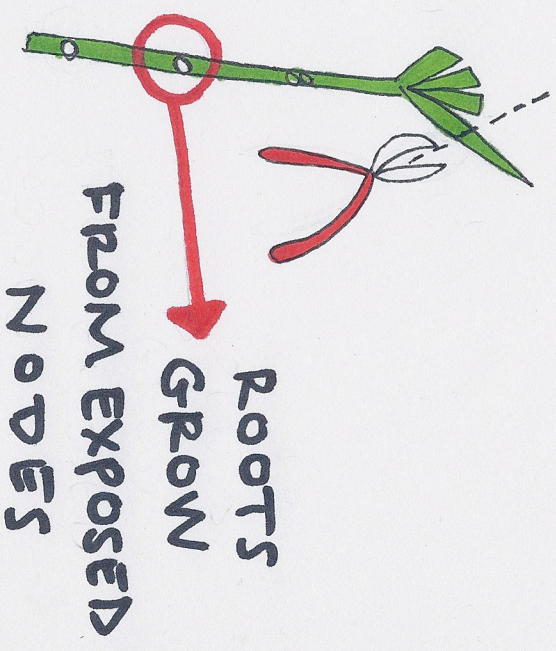
BEETLES\_Discussion\_Routines.pdf (See lesson G6-1)

# ASEXUAL REPRODUCTION WITH CUTTINGS



① TAKE STRIKE FROM MOTHER PLANT

② STRIP LOWER LEAVES TO EXPOSE NODES



③ PUT IN PERLITE AT 45°  
ROOTS GROW AT NODES



