

# The Living Lab: From Ancient Waterways to Modern Roots

## Materials Needed:

- **Growing & Lab Supplies:**

- Nancy B's Science Club® Way to Grow Hydroponics Kit
- LECA (Lightweight Expanded Clay Aggregate) clay balls
- A mature Sansevieria (Snake Plant)
- Seeds: Microgreens (e.g., broccoli, radish, sunflower) and broccoli sprouts
- Sprouting jar with a mesh lid (or a mason jar and cheesecloth)
- Several clear glass jars or vases
- Plant pots with drainage holes
- Standard potting mix
- A countertop water distiller
- Ruler or measuring tape
- Lab notebook or digital journal for observations
- Camera (phone is fine) for photo documentation

- **Pest Control Potion Supplies:**

- Unscented liquid Castile soap
- Essential oils (e.g., peppermint, tea tree, or neem oil)
- A small spray bottle

- **Research & Learning Tools:**

- Access to the internet for research
- Access to a library or online databases for articles and books

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## Introduction: The Big Picture

Welcome to your Living Lab! This unit isn't just about growing plants; it's about becoming a scientist, historian, and engineer. We're going to explore how managing water has shaped human history, from ancient empires to modern kitchens. You will build and manage multiple growing systems, test your own plant-care creations, and discover the connections between history, biology, and technology. Let's get our hands dirty!

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## Module 1: Foundations - History, Water, and a Plant's First Steps (Approx. 2-3 hours)

### Learning Goals for this Module:

- Understand the historical significance of water management for agriculture.
- Prepare distilled water and understand its role in controlled experiments.
- Begin the process of Sansevieria propagation.

### Activity 1: The Water Source

1. Set up your countertop water distiller. Read the instructions carefully.
2. Distill a gallon of water. While it's working, move on to the next activity.
3. **Journal Prompt:** Why would a scientist want to use distilled water for a hydroponics

experiment instead of tap water? Brainstorm at least three reasons. Think about variables and controls.

## Activity 2: A Plant of One's Own

We need plants for our experiments! Let's create new Sansevieria plants from the one you have. This is called propagation.

### 1. Method 1 (Water Propagation):

- With adult supervision, use clean, sharp scissors or a knife to cut a healthy leaf from the mother Sansevieria plant.
- Cut that leaf into 2-3 inch sections. Pay close attention to which end is the "bottom" (the part that was closer to the roots). This is very important!
- Place the "bottom" end of each cutting into a jar with about an inch of your freshly distilled water.
- Place the jars in a spot with bright, indirect light.

### 2. Method 2 (Soil Propagation - for comparison):

- Take one or two of your leaf cuttings and let them sit out for a day to "callous over" where you cut them. This helps prevent rot.
- The next day, plant the calloused end about an inch deep into a pot with potting mix. Water lightly.

### 3. Journal Entry: Create a new section in your journal called "Propagation Log." Note the date, the methods you used, and take initial photos. Form a hypothesis: Which method do you think will produce roots faster? Why? You will track this over the next few weeks.

## Research Task: Ancient Water Movers

1. Research the concept of a "hydraulic empire." What does this term mean?
2. Focus your research on the **Middle Postclassic Period** in Mesoamerica, specifically the Aztec civilization and their capital, Tenochtitlan.
3. Investigate the **chinampas**. How were these "floating gardens" constructed? How did they use water to create one of the most intensive and successful agricultural systems in history?
4. **Creative Connection:** In your journal, draw a diagram of a chinampa. Write a paragraph explaining how chinampas are an early, large-scale form of hydroponics or semi-hydroponics.

## Module 2: Setting Up the Experiments (Approx. 3-4 hours over a week)

### Learning Goals for this Module:

- Set up three distinct growing systems for microgreens.
- Prepare LECA and transfer a plant to a semi-hydroponic system.
- Begin tracking and comparing plant growth across different environments.

### Activity 1: The Great Microgreen Race

We will grow the same type of microgreen seeds in three different ways to see which method works best for you.

#### 1. System 1 (Hydroponics Kit):

- Assemble your Nancy B's Science Club® Way to Grow Hydroponics kit. Follow the instructions to prepare the nutrient solution using your distilled water.
- Plant one type of microgreen seed in the kit as directed.

**2. System 2 (Sprouting Jar):**

- Put two tablespoons of broccoli sprout seeds (or other sprouting seeds) into your sprouting jar.
- Follow standard sprouting procedure: rinse the seeds with cool water twice a day, draining them thoroughly each time.

**3. System 3 (Soil):**

- Fill a small pot or tray with potting mix.
- Sprinkle the same microgreen seeds you used in the hydroponics kit evenly over the soil. Lightly press them down and mist with water.

**4. Journal Entry:** Create a "Microgreen Race" section. Record the start date for all three systems. Take photos. What are your predictions? Which will sprout first? Which will grow fastest? Which will be easiest to maintain?**Activity 2: LECA and Semi-Hydroponics**

Once your Sansevieria cuttings have roots that are at least an inch long (this can take a few weeks to a month!), it's time to move one to a semi-hydroponic home.

- 1. Prepare the LECA:** LECA balls are dusty and need to be prepared. Rinse them thoroughly in a colander until the water runs clear. Then, soak them in a bucket of water for at least 6-12 hours.
- 2. The Transfer:**
  - Choose one of your newly rooted Sansevieria cuttings from the water propagation jar.
  - Gently place the rooted cutting in a clear glass vase or a pot with no drainage holes.
  - Carefully backfill the vase with your rinsed LECA balls, making sure the plant is stable and the roots are covered.
  - Fill the vase with distilled water until it reaches about 1/3 of the way up the LECA balls. The idea is that only the very bottom roots touch the water, and the LECA wicks moisture up to the rest.
- 3. Journal Entry:** Document the transfer with photos. We will compare the growth of this plant to the one you propagated in soil. This is a long-term experiment!

**Module 3: Care, Observation, and Innovation (Ongoing)****Learning Goals for this Module:**

- Develop and test a natural pest-control solution.
- Practice systematic observation and data collection.
- Harvest and analyze the results of the microgreen experiment.

**Activity 1: The "Bubble Bath" Potion**

Houseplants can sometimes get pests like spider mites or gnats. Let's create a gentle, effective, and great-smelling solution to help keep them clean and pest-free.

- 1. The Recipe:** In your spray bottle, combine 1 cup of distilled water, 1 teaspoon of Castile soap, and 3-4 drops of peppermint or tea tree essential oil. Shake well.
- 2. The Test:** Lightly spray the leaves of your mature Sansevieria plant (do not spray your new, delicate propagations or seedlings yet). Observe the plant over the next few days. Does the spray seem to harm the leaves? Does it leave a residue?
- 3. Research Task:** Why does this work? Research the science behind using soap (an emulsifier) and essential oils (which have insecticidal properties) for plant pest control. Write a brief summary in your journal.

## Activity 2: The Daily Scientist

For the next 2-3 weeks, your main job is to be an observer.

### 1. Check-in Daily:

- Rinse your sprouts.
- Check the water levels in the hydroponics kit and the LECA vase.
- Mist your soil-based microgreens.
- Check on your Sansevieria propagations.

### 2. Log Data Twice a Week: In your journal, record your observations for ALL experiments.

- Measure the height of the microgreens.
- Note any new root or leaf growth on the propagations.
- Take photos to track progress visually.
- Record any problems, questions, or new ideas you have.

## Activity 3: The Harvest!

When your microgreens are 2-3 inches tall, it's time to harvest! Use scissors to snip them just above the soil/growing medium. Harvest your broccoli sprouts from the jar.

- **Taste Test:** Compare the taste and texture of the microgreens from the hydroponics kit and the soil. Is there a difference?
- **Yield Analysis:** Which method produced the most microgreens? Which was the fastest? Which required the most daily effort?

## Final Project: The Living Lab Showcase

Your task is to synthesize everything you have learned and experienced into a final presentation. You can create this as a slideshow, a video tour of your experiments, or a detailed scientific poster.

### Your presentation must include:

1. **The Historical Connection:** An explanation of hydraulic empires and how the Aztec chinampas represent a bridge between ancient history and modern hydroponics.
2. **The Experiments:** A summary of each of your experiments (Propagation, Microgreens, Semi-Hydroponics).
  - State your initial hypothesis for each.
  - Show your data (photos, measurements, observations).
  - State your conclusions. Was your hypothesis correct? What did you learn? What would you do differently next time?
3. **Innovation Station:** A review of your "bubble bath" pest-control recipe. Explain the science behind it and the results of your test.
4. **Reflection:** A final summary of what you found most interesting, most challenging, and what you want to learn next. What is the future of growing food with and without soil?