

Experiments with Pregnant Onion

(*Ornithogalum caudatum* = *O. longibracteatum*)



Several large pregnant onions will be needed. Bulbil production is highest in the large mother bulbs. Basic horticulture/gardening abilities will be required as well. These experiments can be modified for different levels of students. In the simplest forms, these projects are a great way to introduce formal scientific inquiry to younger kids and families. Pregnant onions also lend themselves to advanced studies in genetics and plant physiology.

Pregnant Onion

Some National Science Education Standards (NSES) are listed for convenience. Teachers can make adjustments to focus on other standards. These experiments incorporate the Science Teaching Standards, as well.

- NSES Unifying Concepts and Processes Standards
 - K-4, 5-8, & 9-12: Evidence, models, and explanation. Change, constancy, and measurement. Form and function.
- NSES Table 6.1 - Science as Inquiry Standards
 - K-4, 5-8, & 9-12: Abilities necessary to do scientific inquiry. Understanding about scientific inquiry.
- NSES Table 6.3 - Life Science Standards
 - K-4: Characteristics of organisms. Life cycle of organisms.

- 5-8: Structure and function in living systems. Reproduction and heredity. Diversity and adaptations of organisms.
- 9-12: Behavior of organisms
- NSES Table 7.1 - Examples in Mathematics
 - K-4: Measure, collect, and organize data
 - 5-8: Represent situations verbally, numerically, graphically, geometrically, or symbolically
 - 9-12: Use functions that are constructed as models of real world problems

I. Experiment 1 - Examine the development of bulbils.

- Hypothesis - Speculate the various factors of bulbil formation. Predict the qualities of mature bulbils, like: diameter, length, weight, number produced, days required, etc.
- Procedure - Write a formal plan with consistent techniques
- Equipment - Hand lens, flashlight, ruler, scale, pots, soil mix, garden tools, spreadsheet/chart program, etc
- Observation - Measure, record, and analyze the growth and development of bulbils on the mother bulb.
- Conclusion - Express data (charts, graphs, and functions), and compare the hypothesis to the actual results.
- Follow up - This data can be used as a control for comparative experiments in which conditions are altered.



Left: Indentation on mother bulb and the bulbil that caused the dent. Both are wrapped in a papery tunic.

Right: Bulbils sprouting and bursting through the tunic.



- II. Experiment 2 - Comparative study of bulbil production in mother bulbs with different planting depths. One planted normally (control) with the bulb on the surface, and the other planted with the bulb underground.
- Hypothesis - Speculate the effects of burying a caudate bulb.
 - Procedure - Write a formal plan with consistent techniques
 - Equipment - Hand lens, flashlight, measuring tape, scale, pots, soil mix, garden tools, spreadsheet/chart program, etc.
 - Observation - Measure, record, and analyze the overall growth, general health, flowering, and production of bulbils
 - Conclusion - Express data (charts, graphs, and functions), and compare the hypothesis to the actual results.
 - Follow up - Later experiments can vary other cultural conditions of the mother bulbs (soil, moisture, light, nutrients, pollutants) and compare the responses to those varied conditions.



Mature bulbils hanging onto the mother bulb. The surface of the bulb looks lumpy and "pregnant" even in areas where the bulbils are not visible yet. Once they fall from the mother bulb, bulbils set roots and begin to sprout. Large pregnant onions have a cascade of bulbils, which form dense rings of sprouting babies around the mother bulbs.

III. Experiment 3 - Comparative study of growth of bulbils gathered at different stages of development.

- Hypothesis - Speculate the effects of growing immature bulbils. Choose bulbils from four different stages:
 - i. Barely visible in the bulb
 - ii. Bulging the surface of the bulb
 - iii. Developed but before tunic is broken
 - iv. After tunic is broken (control group)
- Procedure - Write a formal plan with consistent techniques
- Equipment - Hand lens, microscope, measuring tape, scalpel/knife, tweezers/tongs, scale, pots, soil mix, garden tools, spreadsheet/chart program, etc.
- Observation - Measure, record, and analyze the growth and development of bulbils
- Conclusion - Express data (charts, graphs, and functions), and compare the hypothesis to the actual results.
- Follow up - Observe, measure, record, and analyze how the mother bulbs heal from the wounds caused when immature bulbils were removed.
- Follow up2 - Remove tissue from mother bulbs and place in a culture. Observe, measure, record, and analyze rates of mitosis for the cells in the cultures. Compare mitosis rates in pregnant onions to other plants.
- Advanced study - Determine the genes responsible for pregnant onion's rapid asexual reproduction. If these genes can be isolated, they might prove helpful in transgenic plant studies. This could be a powerful conservation tool for many of pregnant onion's distant and endangered cousins in the orchid and lily families. The gene could also prove useful to agriculture, commercial horticulture, and pharmacology.



The fragrant flowers are produced by the dozens. If pollinated, the seed collected can be used in comparative studies with bulbils.



