8th Grade Biology
Plant Propagation Techniques

Objective: Students will apply their understanding of the biology behind asexual plant reproduction by employing simple propagation techniques common in the horticultural industry to successfully 'clone' plants. Techniques will be cutting (stem and leaf), layering, and division. *Time permitting or during another class period, students will also view a demonstration of the technique known as grafting.*

Materials:
Various plants for propagating, scissors, pruners, small pots/containers, sterile potting soil, glass jars or clear plastic cups of water, mist spray bottle, clear plastic bags, labels (optional: sample established plants which demonstrate successful propagation, rooting hormone)

*Lesson may be done indoors or out depending on season. Some techniques will take longer than others so samples best left in classroom for students to observe.

55 min class
16 students split into 4 groups

10-15 min Intro:
Briefly introduce students to broad range of career opportunities in the plant industry: agriculture, horticulture, floriculture, hort therapy, botanist, ethnobotany, taxonomist, landscape architect (garden design), botanical artist, nursery grower, plant breeder, etc.

Briefly introduce sexual vs. asexual reproduction in plants – what are advantages of each? Why would a horticulturist need to know about both options? What is it about the biology of plants that makes asexual reproduction easy, while in animals it's very rare? Draw on student background knowledge – plants have more undifferentiated cells in their bodies than animals, allowing them to regenerate new parts, etc.

Plants are smart! Show them a mother-of-thousands plant or Kalanchoe *(Bryophyllum daigremontiana,* native to Madagascar) as example of plant which can only reproduce asexually – it lost the ability to make seeds even though it will still bloom. After it blooms the mother plant dies, leaving all the baby plantlets behind. Why did it evolve to do this? What evolutionary advantage does this give the plant? Strawberries are example of plants that can reproduce both ways: via runner pips but also by making seeds. Why both?

Kalanchoe Note: A gene which normally is only used in making seeds has been altered in such a way that it's useless for seed-making. Thanks to the changes, though, this gene *can* be expressed in leaves. So instead of forming embryonic plants in seeds, it forms embryonic plants in the *leaves*, skipping the whole pollination-and-seed stage entirely. From:
http://plantsarethestrangestpeople.blogspot.com/2007/11/evil-genius-kalanchoe-daigremontiana.html
Original details here: https://www.sciencedaily.com/releases/2007/10/071002144306.htm

Introduction to Grafting

What is Grafting?

It is the combining of two or more sections of plant material from different plants. It utilizes the natural process by which plants heal after being wounded.

Damage to the ***cambium*** (a layer of meristematic material just below the bark) causes it to produce ***callus*** tissue, which protects the damaged area. If properly matched (cambium layer to cambium layer) the callus will unite and eventually take up the function of transporting water and nutrients and thus allow growth to continue.

Ancient Greeks and Egyptians observed accidental grafting occurring in nature and humans have utilized this phenomenon for their benefit ever since.

Why Graft?

Not all plants can be grown from seed. For example, apple (*Malus*) will not grow true to type. An alternative might be to take cuttings and root them in soil, but most apple varieties will not root easily from cuttings. Therefore, we have to borrow the roots of another tree (called the rootstock) and graft a ***scion*** of the desired variety onto it. Sometimes, we might simply want a different variety to the one we already have.

Rootstocks

Must be closely related.
May have desirable characteristics (e.g. dwarfing effect).

What can be Grafted?

Subjects must be closely related – no, you cannot have an orange tree growing on an apple, but you can graft an orange onto a lemon. Also, pears (*Pyrus*) will grow on rootstocks of quince (*Cydonia*) and medlars (*Mespilus*) upon hawthorn (*Crataegus*).

Types of Graft

There are many types of graft (a good reference is **The Grafter's Handbook by R. J. Garner**) and different types of plant require different treatment. We are working with apples and pears today and I will demonstrate one of the most commonly used grafts for these subjects: the **Whip-and-Tongue Graft.**

For Immediate Release

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Village Tree Advisory Board partners with Growing Haldane

Haldane School Garden plants newly grafted pear tree thanks to Tree Advisory Board member and horticulturist Charles Day

June 2018 (Cold Spring, NY) ~ Ever wondered about those nursery ads proclaiming you, too, can magically grow five varieties of fruit on just one space-saving tree in your backyard? Haldane's 8th grade biology students wondered too, so when their teacher, Katlyn Morley reached out to the school garden this year about teaching students hands-on plant propagation techniques including grafting, PTA Garden Committee member Kory Riesterer knew just who to ask for help: her fellow Village Tree Advisory Board member Charles Day. Day also happens to be a horticulturist at Wave Hill Gardens in the Bronx with past experience grafting fruit trees in his previous professional life as an orchardist. He was happy to give students a grafting demonstration and the Garden Committee was happy to purchase a young pear tree as 'rootstock'. All they had to do was wait for the right time of year: spring!

The simple technique Day showed students was the 'Whip-and-Tongue' graft. As with most grafting methods, a dormant branch (called a 'scion') from a different variety of pear, is sliced in such a way as to match a similar cut made on the 'rootstock' pear tree. The wounding triggers the tree's natural healing response, which is the production of callus by the cambium layer, located just under the bark. By matching the cambium layers of both scion and rootstock, the callus will form a seal and eventually bind the scion to the rootstock and form a fully functioning branch. For the graft to be successful, it must be securely tied together and made entirely waterproof. No moisture can be lost from the scion until it is united with the rootstock, so in addition to wrapping the graft with special grafting tape, Day also showed students how to seal the wound with special grafting wax, then told them they'd have to wait a while for nature to take its course: about six weeks.

While Day was demonstrating grafting, Riesterer had instructed students on other plant propagation techniques such as layering, division, and leaf and stem cuttings using plants found growing in the school garden. Then during Haldane's annual Discovery Day in June this year, the 8th graders themselves presented what they'd learned, showing off examples of their own newly propagated plants. The highlight came when Charles Day returned to 'unwrap' the grafted pear so everyone could see if those scions took: success!

Asexual Plant Propagation

Adapted from Sources: https://extension.umaine.edu/gardening/manual/propagation/plant-propagation/ https://aggie-horticulture.tamu.edu/ornamental/a-reference-guide-to-plant-care-handling-and-merchandising/propagating-foliage-flowering-plants/

What you need to be successful…

Propagation Media: A good propagation medium is made up of components that provide optimum aeration, drainage and moisture holding characteristics. These are usually made up from combinations of peat moss, perlite, vermiculite, sand or similar materials. The primary role of a propagation medium is to provide support and moisture while the plant is developing. These requirements are quite different from those of a potting medium, which may have to sustain a mature or growing plant over a long period of time.

***Many plants will easily root in water. However, the roots that form can be extremely fibrous and stringy. Plants rooted in water often have a difficult time becoming established after they are transplanted to a container.*

Moisture: The propagation medium should be thoroughly moistened before use. Be sure to apply water slowly to obtain uniform distribution. A well-moistened medium will make it easier to stick cuttings later on.

Light: Light is an important environmental factor in plant propagation. Generally speaking, low light levels cause plants to root slowly. However, high light intensities can stress cuttings, causing them to burn or drop leaves. Diffused sunlight generally provides enough light for optimum rooting without causing injury to cuttings.

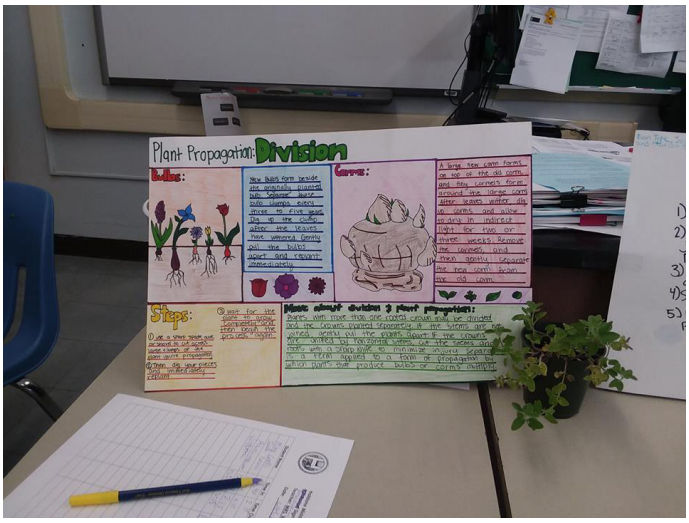
Humidity: Since cuttings do not have roots, they cannot replace the water lost through transpiration. Therefore it is important to maintain high humidity around the cuttings to cut down on the amount of moisture lost to the atmosphere. These conditions can be provided by placing a clear piece of plastic over the propagation pot. This causes condensation to form on the underside of the plastic that provides the necessary humidity.

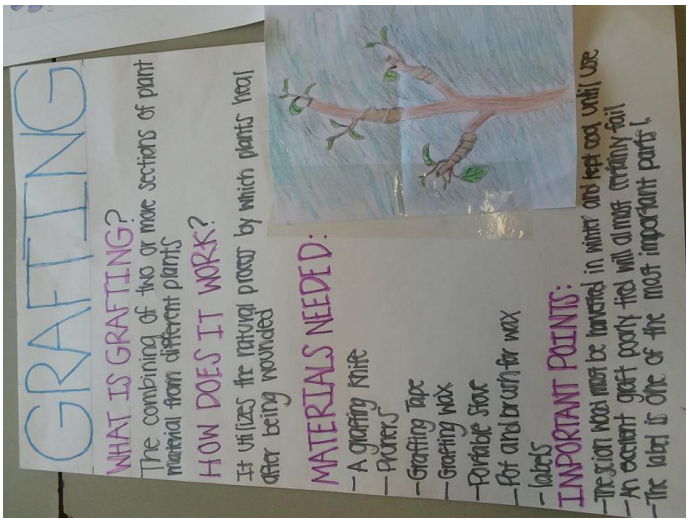
Temperature: For best results, maintain day temperatures at 70 degrees F. During winter months, soil can be as much as 10-20 degrees less than air temperature, so provide bottom heat when possible.

Rooting Hormones: Rooting hormones are often used to promote root formation. These materials provide supplemental auxin, a naturally occurring plant hormone that is responsible for root development. The basal end of the cutting is dipped into the chemical prior to sticking it into the propagation medium.


Garrison Woods, Inc.


Special
Thanks
to
Jeff
Carolyn


Plant Propagation: Division
Bulbs:
Corm:
Steps:


GRAFTING
WHAT IS GRAFTING?
The combining of two or more sections of plant material from different plants
HOW DOES IT WORK?
It utilizes the natural process by which plants heal after being wounded
MATERIALS NEEDED:
- A grafting knife
- Pruners
-Grafting tape
-Grafting wax
-Portable stove
-Pot and brush for wax
- labels
IMPORTANT POINTS: