7

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplar for Science

Quarter 2
Lesson
6

Lesson Exemplar for Science Grade 7
Quarter 2: Lesson 6 (Week 6)
S.Y. 2024-2025

Development Team

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SiMERR National Research Centre

SCIENCE (BIOLOGY) / QUARTER 2 / GRADE 7

I. CURRICULUM CONTENT, STANDARDS, AND LESSON COMPETENCIES	
A. Content Standards	Learners learn that: 1. Familiarity and proper use of a compound microscope are essential to observe cells. 2. The organelles of plant and animal cells can be identified using a compound microscope. 3. Cells are the basic unit of life and mitosis, and meiosis are the basic forms of cell division. 4. Fertilization occurs when a male reproductive cell fuses with a female reproductive cell. 5. Sexual reproduction is the basis of heredity. 6. The level of biological organization provides a simple way of connecting the simplest part of the living world to the most complex. 7. Identifying trophic levels helps understand the transfer of energy from one organism to another as shown in a food pyramid.
B. Performance Standards	By the end of the Quarter, learners demonstrate understanding of the parts and function of a compound microscope and use this to identify cell structure. They recognize that the cell is the basic unit of life and that some organisms are unicellular and some are multicellular. They explain that there are two types of cell division, and that reproduction can occur through sexual or asexual processes. They use diagrams to make connections between organisms and their environment at various levels of organization. They explain the process of energy transfer through trophic levels in food chains.
C. Learning Competencies and Objectives	***Learning Competency*** 1. differentiate sexual from asexual reproduction in terms of: a) number of parents involved, and b) similarities of offspring to parents ***Lesson Objectives*** 1. Differentiate asexual reproduction and sexual reproduction. 2. Identify the advantages and disadvantages of asexual reproduction. 3. Enumerate the types of asexual reproduction.
D. Content	● Sexual Reproduction ● Asexual Reproduction ● Comparison between Sexual and Asexual Reproduction

	• Additional information • Significance or application
E. Integration	SDG 2 (Zero Hunger): Cellular reproduction in agriculture (asexual (e.g., vegetative propagation in crops) and sexual (e.g., cross-breeding) methods) SDG 4 (Quality Education): Cellular reproduction and genetics for biology education and research SDG 15 (Life on Land): Cellular reproduction for conservation and management of terrestrial ecosystems, endangered species, and genetic diversity SDG 14 (Life Below Water): Cellular reproduction in marine biology, the conservation of aquatic species, and the management of marine resources

II. LEARNING RESOURCES

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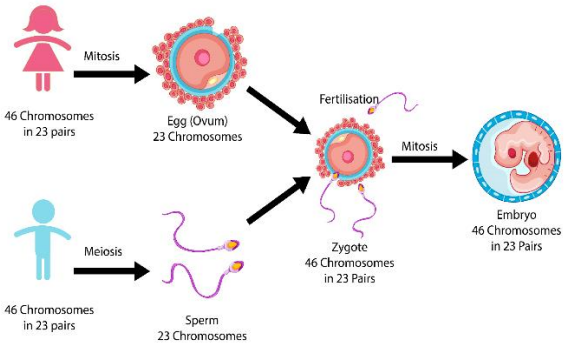
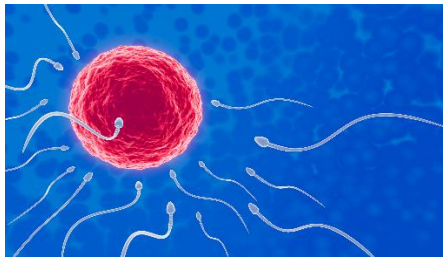
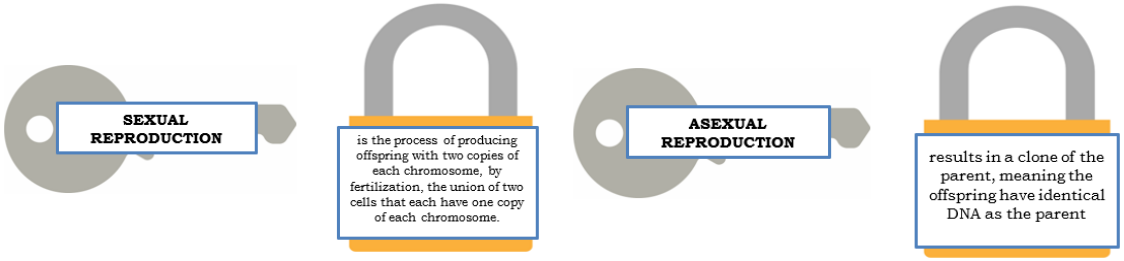
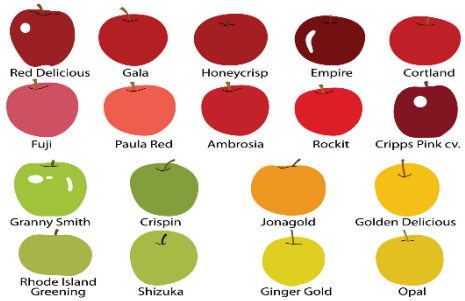
- Scoville, H. (2019, April 29). 5 types of asexual reproduction. ThoughtCo. https://www.thoughtco.com/types-of-asexual-reproduction-1224623
- Vegetative plant propagation. (n.d.). Science Learning Hub. https://www.sciencelearn.org.nz/resources/1662-vegetative-plant-propagation
- Lumen Learning. (n.d.). Natural and Artificial Asexual Reproduction | Biology for Majors II. https://courses.lumenlearning.com/wm-biology2/chapter/natural-and-artificial-asexual-reproduction/
- Lumen Learning. (n.d.). Sexual Reproduction in Plants | Biology for Majors II. https://courses.lumenlearning.com/suny-wmopen-biology2/chapter/sexual-reproduction-in-plants/

III. TEACHING AND LEARNING PROCEDURE		NOTES TO TEACHERS
A. Activating Prior Knowledge	**DAY 1** **Short Review** Sexual Reproduction Review *Let the students define sexual reproduction*  Link: https://www.vecteezy.com/vector-art/1432724-reproduction-process-of-human-infographic *Let the students define fertilization.*  Link:https://www.vecteezy.com/photo/6667793-the-sperm-is-directed-towards-the-egg-to-do-human-mating-a-pre-fertilization-model-between-an-egg-and-a-sperm-3d-rendering	
B. Establishing Lesson Purpose	**1. Lesson Purpose** **Essential Questions:** 1. What is the fundamental difference between sexual and asexual reproduction? 2. What is asexual reproduction, and why is it beneficial? 3. How do the types of asexual reproduction differ? 4. In what situations might asexual reproduction be more advantageous than sexual reproduction for an organism? **2. Unlocking Content Area Vocabulary** **Instruction:** The teacher will unlock the content area vocabulary to guide the students about the terms used throughout the lesson.	

		
C. Developing and Deepening Understanding	**DAY 2-3** **SUB-TOPIC 1: Sexual and Asexual Reproduction** **1. Explicitation** **SEXUAL REPRODUCTION** **Sexual reproduction** occurs when a female gamete (or sex cell) unites with a male gamete. The offspring is a genetic recombination of the mother and the father. Half of the offspring's chromosomes come from its mother and the other half come from its father. This ensures the offspring are genetically different from their parents and even their siblings. **Advantages of Sexual Reproduction** The main advantage of sexual reproduction is that offspring inherit half their DNA from each parent. Offspring are not likely to inherit the same DNA from the same parents. Different DNA means that each offspring has a different set of traits. This results in genetic variation among the offspring.  **a. Genetic Variation** Genetic variation occurs in all organisms that reproduce sexually. Due to genetic variation, individuals within a population have slight differences. These differences might be an advantage if the environment changes. Some individuals might have traits that enable them to survive unusually harsh conditions such as a drought or severe cold. Other individuals might have traits that make them resistant to disease.	The teacher may first discuss the lesson about cell cycle and its phases. The cell cycle includes gap phase 1 (G_1), synthesis (S), gap phase 2 (G_2), mitosis, and cytokinesis. G_1, S, and G_2 constitute the interphase, and mitosis and cytokinesis together are called the M phase. Cytokinesis is the phase of the cell when the cytoplasm divides, creating two daughter cells. Link for Lecture: https://vcell.science/project/mitosis

b. Selective Breeding

Selective breeding has been used to develop many types of plants and animals with desirable traits. It is another example of the benefits of sexual reproduction.



Humans have selectively bred apples to create lots of different varieties
Link: https://www.vecteezy.com/vector-art/15637905-sorts-of-apples-isolated-on-white-background

Disadvantages of Sexual Reproduction

Although sexual reproduction produces more genetic variation, it does have some disadvantages. Sexual reproduction takes time and energy. Organisms have to grow and develop until they are mature enough to produce sex cells. Then the organisms have to form sex cells—either eggs or sperm. Before they can reproduce, organisms usually have to find mates. Searching for a mate can take a long time and requires energy. The search for a mate might also expose individuals to predators, diseases, or harsh environmental conditions. In addition, sexual reproduction is limited by certain factors. For example, fertilization cannot take place during pregnancy, which can last as long as two years in some mammals.

Self-Pollination and Cross-Pollination in Plants

In angiosperms, pollination is defined as the placement or transfer of pollen from the anther to the stigma of the same flower or another flower. In gymnosperms, pollination involves pollen transfer from the male cone to the female cone. Upon transfer, the pollen germinates to form the pollen tube and the sperm for fertilizing the egg.

Pollination takes two forms: self-pollination and cross-pollination. Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower, or another flower on the same plant. Cross-pollination is the transfer of pollen from the anther of one flower to the stigma of another flower on a different individual of the same species. Self-pollination occurs in flowers where the stamen and carpel mature at the same time, and are positioned so that the pollen can land on the flower's stigma. This method of pollination does not require an investment from the plant to provide nectar and pollen as food for pollinators.

Methods of Pollination

Pollination by Insects

Bees are perhaps the most important pollinator of many garden plants and most commercial fruit trees. The most common species of bees are bumblebees and honeybees. Since bees cannot see the color red, bee-pollinated flowers usually have shades of blue, yellow, or other colors. Bees collect energy-rich pollen or nectar for their survival and energy needs. They visit flowers that are open during the day, are brightly colored, have a strong aroma or scent, and have a tubular shape, typically with the presence of a nectar guide. A nectar guide includes regions on the flower petals that are visible only to bees, and not to humans; it helps to guide bees to the center of the flower, thus making the pollination process more efficient. The pollen sticks to the bees' fuzzy hair, and when the bee visits another flower, some of the pollen is transferred to the second flower.

Many flies are attracted to flowers that have a decaying smell or an odor of rotting flesh. These flowers, which produce nectar, usually have dull colors, such as brown or purple. They are found on the corpse flower or voodoo lily (*Amorphophallus*), dragon arum (*Dracunculus*), and carrion flower (*Stapelia, Rafflesia*). The nectar provides energy, whereas the pollen provides protein. Wasps are also important insect pollinators, and pollinate many species of figs.

			
carrion plant (*Stapelia gigantea*)	**voodoo lily** (*Amorphophallus konjac*)	**corpse flower** (*Rafflesia*)	**dragon arum** (*Dracunculus vulgaris*)
Link: https://greenhouse.biology.indiana.edu/features/stinky/Stapelia-gigantea.html	Link: https://greenhouse.biology.indiana.edu/features/stinky/Amorphophallus-konjac.html	Link: https://www.onecearth.org/species-of-the-week-rafflesia/	Link: https://plants.ces.ncsu.edu/plants/dracunculus-vulgaris/

Butterflies, such as the monarch, pollinate many garden flowers and wildflowers, which usually occur in clusters. These flowers are brightly colored, have a strong fragrance, are open during the day, and have nectar guides to make access to nectar easier. The pollen is picked up and carried on the butterfly's limbs. Moths, on the other hand, pollinate flowers during the late afternoon and night. The flowers pollinated by moths are pale or white and are flat, enabling the moths to land. One well-studied example of a moth-pollinated plant is the yucca plant, which is pollinated by the yucca moth. The shape of the flower and moth have adapted in such a way as to allow successful pollination. The moth deposits pollen on the sticky stigma for fertilization to occur later. The female moth also deposits eggs into the ovary. As the eggs develop into larvae, they obtain food from the flower and developing seeds.

	
Monarch Butterfly Link: https://www.vecteezy.com/photo/1421095-close-up-of-a-monarch-butterfly-on-flower	**Yucca moth (*Tegeticula sp.*)** Link: https://www.fs.usda.gov/wildflowers/pollinators/pollinator-of-the-month/yucca_moths.shtml

Pollination by Bats

In the tropics and deserts, bats are often the pollinators of nocturnal flowers such as agave, guava, and morning glory. The flowers are usually large and white or pale-colored; thus, they can be distinguished from the dark surroundings at night. The flowers have a strong, fruity, or musky fragrance and produce large amounts of nectar. They are naturally large and wide-mouthed to accommodate the head of the bat. As the bats seek the nectar, their faces and heads become covered with pollen, which is then transferred to the next flower.

Lesser long-nosed bat (Leptonycteris curasoae yerbabuenae)
https://www.fs.usda.gov/wildflowers/pollinators/pollinator-of-the-month/lesser_long-nosed_bat.shtml

Pollination by Birds

Many species of small birds, such as the hummingbird and sun birds, are pollinators for plants such as orchids and other wildflowers. Flowers visited by birds are usually sturdy and are oriented in such a way as to allow the birds to stay near the flower without getting their wings entangled in the nearby flowers. The flower typically has a curved, tubular shape, which allows access for the bird's beak. Brightly colored, odorless flowers that are open during the day are pollinated by birds. As a bird seeks energy-rich nectar, pollen is deposited on the bird's head and neck and is then transferred to the next flower it visits

Ruby-throated Hummingbirds (Archilochus colubris)
https://www.fs.usda.gov/wildflowers/pollinators/pollinator-of-the-month/ruby-throated_hummingbird.shtml

Pollination by Wind

Most species of conifers, and many angiosperms, such as grasses, maples and oaks, are pollinated by wind. Pine cones are brown and unscented, while the flowers of wind-pollinated angiosperm species are usually green, small, may have small or no petals, and produce large amounts of pollen. Unlike the typical insect-pollinated flowers, flowers adapted to pollination by wind do not produce nectar or scent. In wind-pollinated species, the microsporangia hang out of the flower, and, as the wind blows, the lightweight pollen is carried with it. The flowers usually emerge early in the spring, before the leaves, so that the leaves do not block the movement of the wind. The pollen is deposited on the exposed feathery stigma of the flower.

		
English oak (*Quercus robur*) Link:https://mortonarb.org/plant-and-protect/trees-and-plants/english-oak/	**Sugar maple** (*Acer saccharum*) Link:https://mortonarb.org/plant-and-protect/trees-and-plants/sugar-maple/	**lodgepole pine** (*Pinus contorta*) Link:https://www.britannica.com/plant/conifer/Sporophyte-phase

Pollination by Water
Some weeds, such as Australian sea grass and pond weeds, are pollinated by water. The pollen floats on water, and when it comes into contact with the flower, it is deposited inside the flower.

Pollination by Deception
Other orchids use sexual deception. *Chiloglottis trapeziformis* emits a compound that smells the same as the pheromone emitted by a female wasp to attract male wasps. The male wasp is attracted to the scent, lands on the orchid flower, and in the process, transfers pollen. Some orchids, like the Australian hammer orchid, use scent as well as visual trickery in yet another sexual deception strategy to attract wasps. The flower of this orchid mimics the appearance of a female wasp and emits a pheromone. The male wasp tries to mate with what appears to be a female wasp, and in the process, picks up pollen, which it then transfers to the next counterfeit mate.

Chiloglottis trapeziformis
https://www.threatenedspecieslink.tas.gov.au/pages/chiloglottis-trapeziformis.aspx

ASEXUAL REPRODUCTION
In **asexual reproduction**, one parent organism produces offspring without meiosis and fertilization. Because the offspring inherit all their DNA from one parent, they are genetically identical to each other and their parent.

a. Advantages of Asexual Reproduction
Asexual reproduction enables organisms to reproduce without a mate. Asexual reproduction also enables some organisms to produce a large number of offspring rapidly.

b. Disadvantages of Asexual Reproduction
Although asexual reproduction usually enables organisms to reproduce quickly, it does have some disadvantages. Asexual reproduction produces offspring that are genetically identical to their parent. Another disadvantage of asexual reproduction involves genetic changes, called mutations, that can occur. If an organism has a harmful mutation in its cells, the mutation will be passed to asexually reproduced offspring. This could affect the offspring's ability to survive.

Comparison between Sexual and Asexual Reproduction

Information	Asexual Reproduction	Sexual Reproduction
Number of organisms involved	One parent only	Two parents are required to mate
Cell division	Cells divide by mitosis or fission, budding, or regeneration	Cells divide by Meiosis
Advantages	Time Efficient; no need to search for mate, requires less energy	Variation, Unique., an organism is more protected

Disadvantages	No variation - if the parent has a genetic disease, the offspring does too.	Requires two organisms, requires more energy
Evolution	There is very little chance of variation with asexual reproduction.	Sexual reproduction leads to genetic variation in new generations of offspring. This is fundamental to evolution.
Involvement of sex cells	No formation or fusion of gametes (sex cells)	Formation and fusion of gametes (sex cells) occurs
Found in	Lower organisms	Higher invertebrates and all vertebrates Invertebrates
Unit of reproduction	May be the whole parent body, a bud, a fragment, or a single somatic cell	Gamete
Time taken	Asexual reproduction is completed in a very short period of time.	Sexual reproduction can take several months to complete.
Number of offspring	Two or more	One or more

Additional Information:

Hermaphroditism

Hermaphroditism occurs in animals where one individual has both male and female reproductive systems. Invertebrates such as earthworms, slugs, tapeworms, and snails are often hermaphroditic. Hermaphrodites may self-fertilize, but typically, they will mate with another of their species, fertilizing each other and producing offspring. Self-fertilization is more common in animals with limited mobility or lack of motility, such as barnacles and clams. Many species have specific mechanisms to prevent self-fertilization because it is an extreme form of inbreeding and usually produces less fit offspring.

			
Earthworms	**Slug**	**Snail**	**Clownfish**

2. Worked Example

Sort it Out! (Paired Activity)

See the activity sheet for the cards and table.

A. Instruction: Cut out the cards and paste it into the correct columns in the table below.
B. Instruction: Cut and paste the card that contains the description for each category for the Advantage and Disadvantage of Sexual and Asexual Reproduction.

Examining the Differences in the Natural World

Instruction: Write whether the provided characteristic can be found in sexual, asexual, or both.

Characteristics	Sexual/Asexual/Both
a. Results in low genetic variation of the species	
b. Results from the combining of sperm and egg cells	
c. Passes genetic information from one generation to the next	
d. All members of the population are genetically very similar and less able to survive environmental changes	
e. The offspring receive half their genetic make-up rom each parent	
f. Produces diverse offspring	
g. One organism can continue the population of their species without a mate	
h. Creates more individuals of the species	
i. Allows for more genetic variation in the offspring	
j. Require the fusion of the sperm and egg cell to make a zygote.	

3. Lesson Activity

Is it Sexual or Asexual Reproduction?

A. Instruction: decide which type of reproduction is being described by the following statements. Write **A** if it is asexual reproduction and **S** if it is sexual reproduction.

_____ 1. Two parents contribute genetic information
_____ 2. Offspring are exact genetic copies (clones) of the parent
_____ 3. Does not involve gametes
_____ 4. Offspring are unique from their parents and from each other
_____ 5. One parent contributes to the genetic information of the offspring.
_____ 6. Gametes from two parents fuse.
_____ 7. Reproduction is by forming new individuals that are released from the “parent”
_____ 8. Offspring have little to no genetic variation
_____ 9. Offspring receive little or no parental care
_____ 10. Parents tend to care for their young, increasing the chances that offspring will survive

SUB-TOPIC 2: Types of Asexual Reproduction

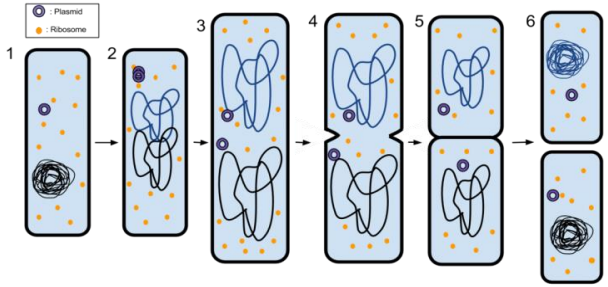
1. Explicitation

Asexual reproduction, the simplest and most primitive method of reproduction, involves a single parent and produces a clone, an organism that is genetically identical to the parent. A parent passes all of its genetic material to the next generation. All prokaryotic and some eukaryotic organisms reproduce asexually.

Types of Asexual Reproduction

a. Binary Fission

Binary fission is a type of asexual reproduction wherein a cell divides to produce two identical cells. Each of these two cells has the potential to grow to the size of the original cell. Almost all prokaryotes undergo a type of asexual reproduction called binary fission. Binary fission is very similar to the process of mitosis in eukaryotes. However, since there is no nucleus and the DNA in a prokaryote is usually just in a single ring, it is not as complex as mitosis. Binary fission starts with a single cell that copies its DNA and then splits into two identical cells.

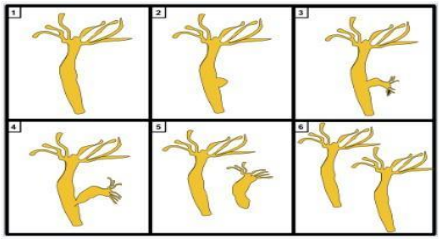


Binary fission steps. The figure shows how bacteria reproduce through binary fission. (1) Chromosome, duplicated. (2-4) Chromosomes segregating. (5) Septum forms in the middle of the cell. (6) Two cells are produced.

Link for Video: https://youtu.be/MgIt1SnGSmM

b. Budding

Another type of asexual reproduction is called budding. Budding is when a new organism, or the offspring, grows off the side of the adult through a part called a bud. The new baby will stay attached to the original adult until it reaches maturity, at which point it breaks off and becomes its own independent organism. A single adult can have many buds and many offspring at the same time.



Stages of budding in hydra: (1) the hydra prior to bud formation, (2-4) bud growing out, (5) daughter Hydra detaches by cleaving, (6) new Hydra that is a clone of the parent.

Link for Video: https://youtu.be/a5oHMjGqjyo

c. Fragmentation

Some species are designed to have many viable parts that can live independently found on one individual. These species can undergo a type of asexual reproduction known as fragmentation. Fragmentation happens when a piece of an individual breaks off, and a brand-new organism forms around that broken piece. The original organism also regenerates the piece that broke off. The piece may be broken off naturally or could be broken off during an injury or other life-threatening situation.

Link for Video: https://youtu.be/m12xsf5g3Bo

Starfish

https://www.vecteezy.com/photo/33027807-clownfish-and-blue-malawi-cichlids-swimming-near-coral-ai-generated

d. Spore formation (sporogenesis)

Spore formation or sporogenesis is a form of asexual reproduction that involves spores. Spores, from "sporā", meaning "seed" and "genesis", meaning "birth" or "origin", are dormant, reproductive cells that are similar to seeds by serving as dispersal units. The spores, though, aren't seeds in a way that they lack the embryo produced by the fusion of male and female gametes. Spores are thick-walled and highly resistant to unfavorable conditions, like high temperatures and low humidity. When the conditions are suitable, they germinate to give rise to new individuals. Vascular plants and fungi are examples of asexual organisms that reproduce by spore formation.

			
Log Mushrooms	**Enoki Mushrooms**	**Oyster Mushroom**	**Bolete Mushroom**

e. Parthenogenesis

Parthenogenesis (from Greek "Parthenos", meaning "virgin" and "genesis', meaning "birth", "creation", "origin") is when an offspring comes from an unfertilized egg. Lack of available partners, an immediate threat to the female's life, or other such trauma may result in parthenogenesis being necessary to continue the species. This is not ideal, of course, because it will only produce female offspring since the baby will be a clone of the mother. That will not fix the issue of lack of mates or carrying on the species for an indefinite period of time.

Komodo Dragon
https://www.vecteezy.com/photo/7542128-a-komodo-dragon-is-sunbathing-before-starting-its-daily-activities

Some animals that can undergo parthenogenesis include insects like bees and grasshoppers, lizards such as the Komodo dragon, and very rarely in birds.

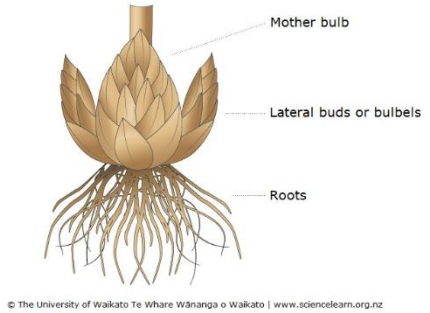
Link for video: https://youtu.be/dNoY9ribw4A

f. Vegetative Propagation

Vegetative propagation is a form of asexual reproduction in plants. It is when a new plant emerges from vegetative parts, such as specialized stems, leaves, and roots. Then, they form their root system and grow. Horticulturists use this form of reproduction in propagating economically important plants. The process does not involve pollination. Rather, new plants are grown from vegetative parts with specialized reproductive functions. Many forms of vegetative propagation can be classified into two major types: natural means and artificial means. Examples of natural means are those emerging from runners (stolons), bulbs, tubers, corms, suckers (root sprouts), and plantlets. As for artificial means, examples arise from cutting, grafting, layering, tissue culture, and offset.

Natural vegetative propagation

Natural vegetative propagation occurs when an axillary bud grows into a lateral shoot and develops its roots (also known as adventitious roots). Plant structures allowing natural vegetative propagation include bulbs, rhizomes, stolons, and tubers.



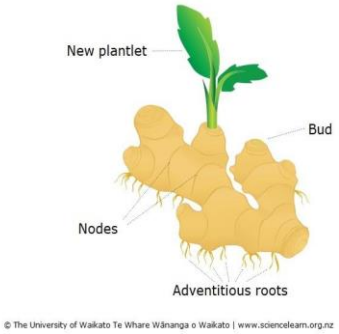
a) Bulbs

Bulbs, such as daffodils, form lateral buds from the base of the mother bulb, which produce new smaller bulbs or bulbels in subsequent years.

		
Garlic https://www.vecteezy.com/photo/30672123-photo-of-garlic-with-no-background-with-white-back	**Lilies** https://www.vecteezy.com/photo/30327817-white-lilies-on-a-black-background-close-up-generative-ai	**Onion** https://www.vecteezy.com/photo/2979926-onion-on-white-background

b) Rhizomes

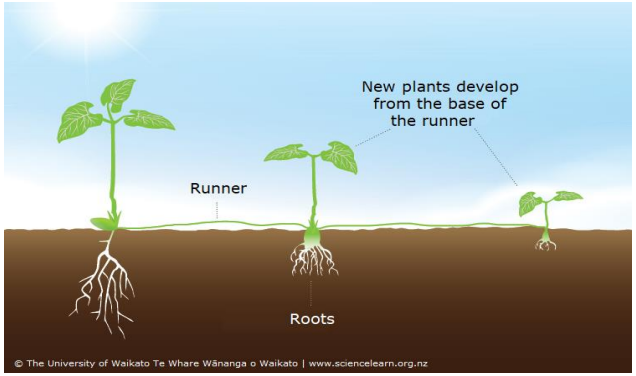
Rhizomes are root-like stems that grow horizontally under the ground. New roots and shoots form at the nodes with shoots growing upwards to form new plantlets. Lateral buds grow out to form new rhizomes. Examples include iris and root ginger.



		
Bamboo https://www.vecteezy.com/photo/1927750-fresh-green-bamboos-in-thailand	**Ginger** https://www.vecteezy.com/photo/31781712-beautiful-iris-flower-in-the-garden-generative-ai	**Bearded Iris** https://www.vecteezy.com/photo/31781712-beautiful-iris-flower-in-the-garden-generative-ai

c) Stolons/Runners

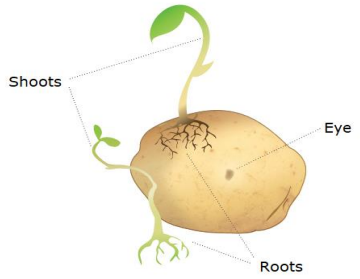
Stolons or runners are horizontal stems that grow above the ground, for example, strawberries. Tiny plantlets form along the stolon, and roots form where they touch the ground. The new plant becomes independent when the connection with the parent plant breaks.



		
Strawberry https://www.vecteezy.com/photo/3134221-strawberry-closeup-on-the-garden-in-the-garden-ripe-red-berries	**Bermuda Grass** https://www.vecteezy.com/photo/23213934-deep-rainforest-full-green-trees-at-tropical-place	**Spider Plant** https://www.vecteezy.com/photo/3163005-bright-spring-leaves-on-the-tree

d) Tubers

Tubers are swollen portions of an underground stem that store food so a plant can lie dormant over the winter, for example, potatoes. Axillary buds, commonly known as 'eyes', form over the surface of the tuber and produce shoots that grow into a new plant the following year.



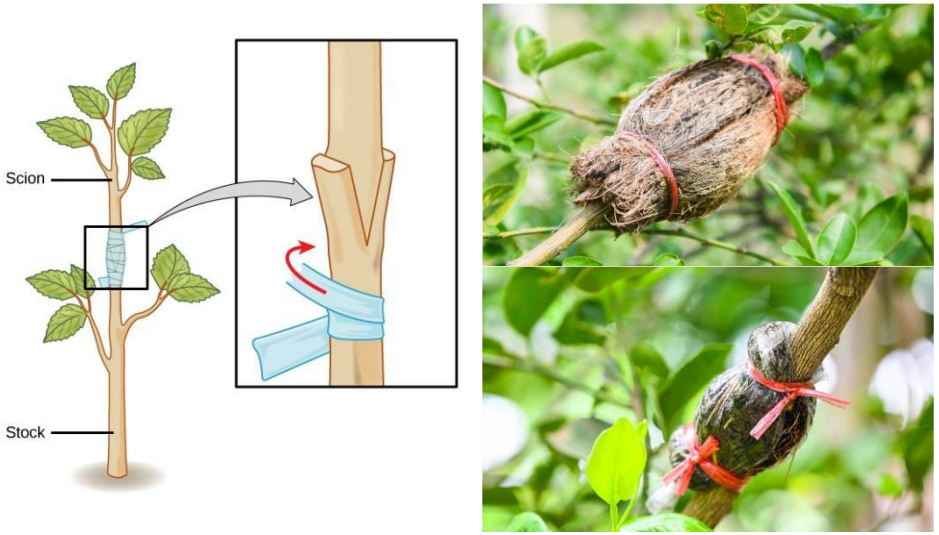
	
Potato https://www.vecteezy.com/photo/5930479-fresh-potato-plant-harvest-of-ripe-potatoes-agricultural-products-from-potato-field	**Sweetpotato** https://www.vecteezy.com/photo/7234624-pile-of-fresh-purple-yams-organic-for-sale-in-market

Artificial vegetative propagation

Horticulturalists and gardeners also use vegetative propagation methods that plants don't use naturally. These methods involve taking a piece of one parent plant and causing it to regenerate itself into a new plant.

a) Grafting

Grafting has long been used to produce novel varieties of roses, citrus species, and other plants. In grafting, two plant species are used; part of the stem of the desirable plant is grafted onto a rooted plant called the stock. The part that is grafted or attached is called the scion. Both are cut at an oblique angle (any angle other than a right angle), placed in close contact with each other, and are then held together. The vascular systems of the two plants grow and fuse, forming a graft. After a period of time, the scion starts producing shoots and eventually starts bearing flowers and fruits. Grafting is widely used in viticulture (grape growing) and the citrus industry. Scions capable of producing a particular fruit variety are grated onto rootstock with specific resistance to disease.



Grafting is an artificial method of asexual reproduction used to produce plants combining favorable stem characteristics with favorable root characteristics. The stem of the plant to be grafted is known as the scion, and the root is called the stock.

Link: https://www.vecteezy.com/photo/8726290-lime-propagation-grafting-tree-plant-on-lemon-tree-branch-in-organic-agriculture-farm
https://www.vecteezy.com/photo/15624658-lime-propagation-grafting-tree-plant-on-lemon-tree-branch-in-organic-agriculture-farm

b) Cutting

A cutting is a piece that has been cut off a mother plant and then caused to grow into a whole plant. Often this involves a piece of stem that is treated with hormones to encourage new roots to form before planting. Sometimes root cuttings with buds on them will produce new shoots when pressed directly into soil.

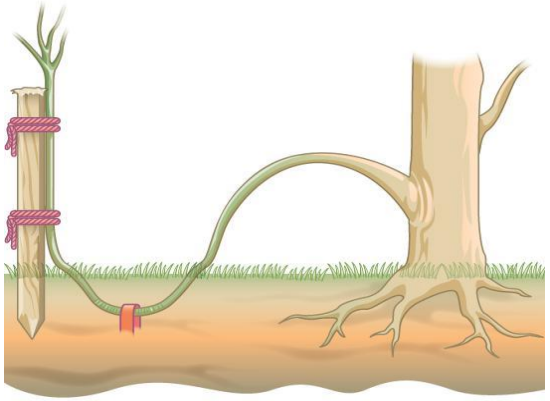
Plant cuttings for seedlings

Link: https://www.vecteezy.com/photo/2611560-plant-a-young-mexican-kale-cuttings-in-a-black-bag-for-seedlings

c) Layering

Layering is a method in which a stem attached to the plant is bent and covered with soil. Young stems that can be bent easily without any injury are preferred. Jasmine and bougainvillea (paper flower) can be propagated this way.

In some plants, a modified form of layering known as air layering is employed. A portion of the bark or outermost covering of the stem is removed and covered with moss, which is then taped. Some gardeners also apply rooting hormones. After some time, roots will appear, and this portion of the plant can be removed and transplanted into a separate pot.



In layering, a part of the stem is buried so that it forms a new plant.

Additional Information:

Plant Tissue Culture/Micropropagation

Micropropagation (also called plant tissue culture) is a method of propagating a large number of plants from a single plant in a short time under laboratory conditions.

This method allows the propagation of rare, endangered species that may be difficult to grow under natural conditions, are economically important, or are in demand as disease-free plants.

A part of the plant, such as a stem, leaf, embryo, anther, or seed, can be used to start plant tissue culture. The plant material is thoroughly sterilized using a combination of chemical treatments standardized for that species. Under sterile conditions, the plant material is placed on a plant tissue culture medium that contains all the minerals, vitamins, and hormones required by the plant.

2. Worked Example

Asexual Reproduction on the Go!

Instruction: Cut out the diagrams below and paste it in the Diagram column of the chart. *See the activity sheet for the diagrams and chart.*

3. Lesson Activity

Let's Explore Plant Reproduction!

Instruction: Figure 1 shows four plants that reproduce without seeds. Look at it and complete the table below.

Diagram	Plant part used in reproduction	Plant that reproduces this way	How does reproduction occur?
A			
B			
C			
D			

	Figure 1  **Diagram A**  **Diagram B**  **Diagram C**  **Diagram D**	
1. Making Generalizations	**1. Learners' Takeaways** **Sexual vs. Asexual Reproduction** The student will do the activity using the link: https://learn.genetics.utah.edu/content/basics/reproduction/ If some students cannot access the internet, here is the lifted activity from the link. Living things use lots of different strategies for producing offspring, but most strategies fall neatly into the categories of either sexual or asexual reproduction. Asexual reproduction generates offspring that are genetically identical to a single parent. In sexual reproduction, two parents contribute genetic information to produce unique offspring. Sexual and asexual reproduction have advantages and disadvantages—which is why some organisms do both! Instruction: Read the provided description of the organism and tell whether you think the organism is under sexual reproduction, asexual reproduction, or both. *See the activity sheet.* **2. Reflection on Learning** **My Learning, My Reflection!** Instruction: give a brief explanation on the following questions. 1. What is sexual reproduction, and how does it differ from asexual reproduction? 2. Can you name some common examples of sexually reproducing organisms and asexually reproducing organisms? 3. Why is there less genetic variation in asexual reproduction? 4. How do the reproductive methods of plants differ from those of animals? 5. In what situations might sexual reproduction be more advantageous that asexual reproduction?	

IV. EVALUATING LEARNING: FORMATIVE ASSESSMENT AND TEACHER'S REFLECTION		NOTES TO TEACHERS
A. Evaluating Learning	**DAY 5** **1. Formative Assessment** Instruction: Encircle the correct answer. 1. Asexual reproduction requires a) only one parent to produce offspring b) two parents to produce offspring c) a combination of parents to produce offspring d) two clones to produce offspring 2. Which of the following is definitely not an example of a asexual reproduction? a) Breeders cross different dogs to develop a new breed of dog b) Geneticists grow a field of blight-resistant wheat using the cells of a single plant c) Bread mold spreads on a slice of bread at the back of the fridge d) New raspberry shoot sprouts in the lawn near the raspberry patch 3. If an organism breaks apart as a result of injury and each fragment develops into a new individual, this is called a) binary fission. b) budding. c) spore formation. d) fragmentation. 4. Which of the following is an example of vegetative reproduction? a) A single lily bulb once planted becomes a large colony of identical lilies in three summers b) A new baby fern shows up your back yard, just like the fern your neighbors have next door c) A new starfish grows from the severed tip of a tentacle d) Strep throat bacteria quickly colonize in your body and make you sick 5. One of the key advantages of asexual reproduction is a) offspring compete for food and space b) large numbers of offspring reproduce quickly c) extreme temperatures can wipe out entire colonies d) offspring are genetic clones	**ANSWER KEY:** 1. A 2. A 3. D 4. A 5. D 6. B 7. D 8. D 9. A 10. C 11. D 12. A 13. A 14. B 15. B

6. One of the disadvantages of asexual reproduction is
    a) species cannot survive when predators increase
    b) large colonies can out-compete other organisms for nutrients and water
    c) large numbers of offspring reproduce very slowly
    d) extreme temperatures can wipe out entire colonies
7. Which statement best describes why genetic variation is beneficial to populations of organisms?
    a) Individuals look different from one another.
    b) Only one parent is needed to produce offspring.
    c) Populations of the organism increase more rapidly.
    d) Species can better survive environmental changes.
8. What type of asexual reproduction includes stolons?
    a) budding
    b) cloning
    c) animal regeneration
    d) vegetative reproduction
9. Hydra reproduce through _____, where the offspring grows from the body of the parent organism.
    a) Budding
    b) Cloning
    c) Rhizomes
    d) Fragmentation
10. Describe the difference between sexual and asexual reproduction.
    a) Sexual reproduction requires one parent, but asexual requires two.
    b) Sexual reproduction produces identical offspring, but asexual produces offspring that are a combination of both parents.
    c) Sexual reproduction requires two parents, but asexual requires one.
    d) Sexual reproduction is faster than asexual reproduction.
11. Which organism would you classify as sexually reproducing?
    a) A strawberry plant that reproduces through runners in the ground
    b) A starfish that reproduces by breaking off and regenerating parts of its body
    c) An amoeba that splits through binary fission
    d) A chicken egg that is fertilized by a rooster

	12. A gardener noticed that the offspring of his strawberry plants looked identical, while all of the flowering plants looked different. Which is likely true of the plants? a) The strawberries reproduced asexually, while the flowering plants reproduced sexually. b) The strawberries reproduced sexually, while the flowering plants reproduced asexually. c) Both the strawberries and flowering plants reproduced sexually. d) Both the strawberries and flowering plants reproduced asexually. 13. What process do asexual organisms use to reproduce? a) Mitosis b) Meiosis c) Fertilization d) Osmosis 14. How do the number of chromosomes in an asexually reproducing plant compare to its parents? a) They are double the number. b) They are the same. c) They are half the number. d) They are one-fourth the number. 15. In sexual reproduction, offspring inherit their genetic traits from: a) Only one parent b) Both parents c) Environment			
B. Teacher's Remarks	*Note observations on any of the following areas:*	**Effective Practices**	**Problems Encountered**	
	strategies explored			
	materials used			
	learner engagement/ interaction			
	Others			

C. Teacher's Reflection	*Reflection guide or prompt can be on:* ▪ *principles behind the teaching* *What principles and beliefs informed my lesson?* *Why did I teach the lesson the way I did?* ▪ *students* *What roles did my students play in my lesson?* *What did my students learn? How did they learn?* ▪ *ways forward* *What could I have done differently?* *What can I explore in the next lesson?*	