

## Asexual Reproduction – Grade Six

### Ohio Standards Connection:

#### Life Sciences

#### Benchmark B

Describe the characteristics of an organism in terms of a combination of inherited traits and recognize reproduction as a characteristic of living organisms essential to the continuation of the species.

#### Indicator 5

Describe that in asexual reproduction all the inherited traits come from a single parent.

### Lesson Summary:

*The purpose of this lesson is to clarify that asexual reproduction produces single-parent offspring. Students will use plants and yeast to demonstrate vegetative propagation and budding in a laboratory. Students will also draw and learn about five different types of asexual reproduction.*

**Estimated Duration:** *Three hours*

### Commentary:

Asexual reproduction is common in the plant and animal kingdoms, but often overlooked by teachers and students. This lesson helps students understand and remember asexual reproduction by providing a wide range of common examples. It also provides an opportunity for students to grow asexual propagates in the laboratory, providing a lasting memory of the experience.

This lesson was field tested by teachers across the state of Ohio. Some of the comments about this lesson were:

- "Most of my students had no idea what asexual reproduction meant prior to the lesson."
- "The labs were especially helpful in reinforcing the skills the students learned."

### Pre-Assessment:

Have students complete worksheet Attachment A, *Pre-Assessment*.

### Scoring Guidelines:

- Promote student discussion of answers after assessment has been completed. Use Attachment B, *Pre-Assessment Answers* to facilitate the discussion.
- Have students correct their papers with a different color of ink or pencil, so that you can assess their understanding before and after class discussion.



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### **Post-Assessment:**

- Use Attachment C, *Post-Assessment* to test student understanding of asexual reproduction.

### **Scoring Guidelines:**

- Collect papers and grade using answers and rubric in Attachment D, *Post-Assessment Answers*.

### **Instructional Procedures:**

1. Search the Internet and textbooks for photographs and diagrams of organisms that reproduce asexually, including fission, vegetative propagation, budding, fragmentation, and parthenogenesis. Other types of asexual reproduction occur, but these are the most common types. See the Technology Connections section for suggested Web sites.
2. Give the pre-assessment.
3. Discuss the pre-assessment and have students share their examples. Challenge the students to come up with the correct definitions and examples of organisms that participate in different types of asexual reproduction. Direct students to take notes on the basic types of asexual reproduction.
4. Distribute Attachment E, *Asexual Reproduction Resource Page*, to help students understand and review material.
5. Tell students that they will get to observe asexual reproduction in the classroom. See Attachment F, *Asexual Reproduction Laboratories*, for three examples of projects that students can do, or that you can demonstrate to the class. These projects demonstrate only fission and vegetative propagation, since they are the easiest to demonstrate in a classroom setting. You may choose any or all of the three projects for your classroom, as time permits. Projects may also be split among student groups.

### **Instructional Tip**

Vegetative propagation takes several weeks to demonstrate. You may want to begin the experiment weeks before the lesson or let the experiment run for several weeks after the lesson. You should have students record periodic observations of the propagates.

6. As labs are completed, have students keep observations in a notebook. The students should attempt to answer the questions that are posed with each lab. These questions can be discussed with the class as the labs are conducted or after all labs are done.
7. Proceed to the post-assessment.

### **Safety Caution:**

Growing plants in the classroom may expose students to mold and mold spores. Check with students and their parents to ensure that no student has a known mold allergy before beginning the experiments. If students have mold allergies, DO NOT CONDUCT THIS EXPERIMENT.



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### **Differentiated Instructional Support:**

Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- You may have students locate pictures or photographs of organisms from the Internet that reproduce asexually. Students should name these organisms and the types of asexual reproduction in which they participate.

### **Extensions:**

- Have students explore other types of asexual reproduction on the Internet.
- Have a contest to see who can produce the most offspring from a potato, geranium or other vegetative reproducer. Students will begin to understand that some parts of the plant (cambium) are required for successful asexual propagation.

### **Homework Options and Home Connections:**

- Have students visit a greenhouse, botanical garden or arboretum in the spring to view propagation of plants by cuttings.
- Have students identify plants in their homes which reproduce by asexual reproduction.

### **Interdisciplinary Connections:**

#### **English Language Arts**

- **Reading Applications: Informational, Technical and Persuasive Text**  
**Indicator 3:** Compare and contrast important details about a topic, using different sources of information, including books, magazines, newspapers and online resources.

### **Materials and Resources:**

*The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site's main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.*

*For the teacher:* Plastic bags, journal, petri dish, potato, spider plant or geranium, sugar, toothpicks, yeast, microscope slide, light microscope.

*For the student:* Plastic bags, journal, petri dish, potato, spider plant or geranium, sugar, toothpicks, yeast, microscope slide, light microscope.

### **Vocabulary:**

- asexual reproduction
- budding



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- fission
- fragmentation
- single parent
- parthenogenesis
- vegetative propagation

### **Technology Connections:**

There are numerous Web sites that are appropriate for this lesson. Access Web sites for the United States Department of Agriculture at <http://www.usda.gov> and the National Biological Inventory Initiative at <http://www.nbio.gov>, and search for the term "asexual reproduction".

### **Research Connections:**

Marzano, R. et al. *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement*. Alexandria: Association for Supervision and Curriculum Development, 2001.

Nonlinguistic representations help students think about and recall knowledge. This includes the following:

- Creating graphic representations (organizers);
- Making physical models;
- Generating mental pictures;
- Drawing pictures and pictographs;
- Engaging in kinesthetic activity.

### **Attachments:**

Attachment A, *Pre-Assessment*

Attachment B, *Pre-Assessment Answers*

Attachment C, *Post-Assessment*

Attachment D, *Post-Assessment Answers*

Attachment E, *Asexual Reproduction Resource Page*

Attachment F, *Asexual Reproduction Laboratories*



## Asexual Reproduction – Grade Six

### Attachment A Pre-Assessment

Name \_\_\_\_\_

1. Identify three ways a picture could be duplicated.

A.

B.

C.

Match the following types of asexual reproduction and their examples.

A. fission

B. fragmentation

C. budding

D. parthenogenesis

F. vegetative propagation

\_\_\_\_\_ 2. Cell division that forms a bud and as it grows, forming an identical copy of its parent, then separating from the parent to become independent.

\_\_\_\_\_ 3. Paramecium or protists

\_\_\_\_\_ 4. Single-celled organisms that reproduce by splitting in two.

\_\_\_\_\_ 5. Spider plant and geraniums

\_\_\_\_\_ 6. Growing a new plant without a seed.

\_\_\_\_\_ 7. Hydra

\_\_\_\_\_ 8. An animal produces offspring from eggs that were not fertilized.

\_\_\_\_\_ 9. An animal that grows from a separated piece of a parent animal.

10. On the reverse side of this paper, describe the five types of asexual reproduction; fission, fragmentation, budding, parthenogenesis, vegetative propagation. Include examples of organisms that use each kind of asexual reproduction.



## Asexual Reproduction – Grade Six

### Attachment B Pre-Assessment Answers

1. Copy machine, photography, drawing, tracing.
2. C, budding
3. A, fission
4. A, fission
5. F, vegetative propagation
6. F, vegetative propagation
7. C, budding
8. D, parthenogenesis
9. B, fragmentation

10. The five types of asexual reproduction are:

#### Fission

Single celled organisms, such as paramecium and bacteria, which reproduce by splitting in two. This is often the only mode of reproduction for these organisms.

#### Fragmentation

Some animals can grow from a separate piece of parent animal. This happens in only the simplest animals, such as some flatworms. These animals may also reproduce sexually.

#### Vegetative propagation

New plants can be produced from sections of parent plants that are cut off. Cambium cells from stems, roots and leaves of a parent plant can take root and sprout. New plants reproduced in this way are genetically identical to the parent plant. We see this in spider plants and willow trees, for example. Note that these plants also reproduce sexually, usually sperm and egg which produce seeds.

#### Budding

Cell division produces a bud. As the bud grows, it forms an identical copy of its parent, then separates from the parent and becomes independent. An example is a hydra. These organisms may also reproduce sexually. The "choice" between sexual and asexual reproduction is often mediated by environmental conditions.

#### Parthenogenesis

Some animals may produce eggs that develop directly into offspring without fertilization. Common examples occur in insects, reptiles and fishes. Often, these organisms may also reproduce sexually. The "choice" between sexual and asexual reproduction is typically mediated by environmental conditions.

## Asexual Reproduction – Grade Six

### Attachment C Post-Assessment

**Part I.** Match the types of asexual reproduction and examples.

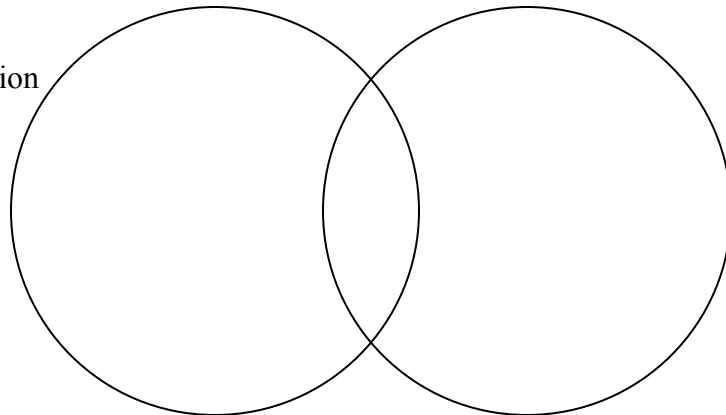
- A. fission
- B. fragmentation
- C. budding
- D. parthenogenesis
- F. vegetative propagation

- \_\_\_\_\_ 1. Cell division that forms a bud and as it grows, forming an identical copy of its parent, then separating from the parent to become independent.
- \_\_\_\_\_ 2. Paramecium or protists
- \_\_\_\_\_ 3. Single-celled organisms that reproduce by splitting in two.
- \_\_\_\_\_ 4. Spider plant and geraniums
- \_\_\_\_\_ 5. Growing a new plant without a seed.
- \_\_\_\_\_ 6. Hydra
- \_\_\_\_\_ 7. An animal produces offspring from eggs that were not fertilized.
- \_\_\_\_\_ 8. An animal that grows from a separated piece of a parent animal.

**Part II.**

9. Using a Venn diagram, compare and contrast two of the five types of asexual reproduction. Put shared characteristics where the circles overlap and write different characteristics in the parts of the circles that do not overlap.

- 1. fission
- 2. vegetative propagation
- 3. budding
- 4. parthenogenesis
- 5. fragmentation



**Part III.**

10. On the reverse of this page, describe what do all five types of asexual reproduction have in common.



## Asexual Reproduction – Grade Six

### Attachment D Post-Assessment Answers

#### Part I.

1. C, budding
2. A, fission
3. A, fission
4. F, vegetative propagation
5. F, vegetative propagation
6. C, budding
7. D, parthenogenesis
8. B, fragmentation

#### Part II.

9. Many answers are possible. At a minimum, students should refer to reproduction by a single organism in the shared portion of the Venn diagram, and should write something unique about each mode of reproduction in the appropriate circles outside of the shared area.

#### Part III.

10. All five types of asexual reproduction have a single individual producing offspring without the need of another individual.



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### Attachment E Asexual Reproduction Resource Page

Any of the following could be used in the science lab to reinforce content.

<b>Organism</b>	<b>Type of Asexual Reproduction</b>	<b>Description</b>
<b>Whiptail lizards</b>	Parthenogenesis	A female whiptail lizard may produce eggs that develop into genetically identical versions of itself. In some species, there are entire clonal populations of this lizard. Most whiptail lizard species do reproduce sexually, though.
<b>Bacteria</b>	Fission	A single-celled organism that has no nuclei or cell walls and reproduce by splitting in two.
<b>Spider plant</b>	Vegetative Propagation	Spider plants reproduce new plants by the division of cells from roots or runners. These can be placed in water or soil to produce another plant. Spider plants also reproduce sexually.
<b>Strawberries</b>	Vegetative Propagation	Strawberries reproduce new plants by the division of cells from runners or roots. Strawberries also reproduce sexually.
<b>Some flatworms</b>	Fragmentation	Some flatworms can grow by cell division from a fragmented section of its body.
<b>Paramecium</b>	Fission	Paramecium is a single-celled organism that reproduces by splitting in two.
<b>Mint</b>	Vegetative Propagation	Division of the roots reproduces new mint. Mint also reproduces sexually.
<b>Blue-green algae</b>	Fission	A single celled organism that reproduces by splitting in two.
<b>Protists</b>	Fission	Protists have a nucleus and are therefore <i>eukaryotic</i> . Some protists contain chloroplasts and make their own food, and others don't. But all reproduce by fission-the process of splitting in two.
<b>Hydra</b>	Budding	Cell division forms a bud that is an identical copy of its single parent that separates from the parent and becomes independent.



## **Asexual Reproduction – Grade Six**

### **Attachment F Asexual Reproduction Laboratories**

These laboratories will demonstrate vegetative propagation and fission. Other types of asexual reproduction do not lend themselves to classroom laboratories.

#### **Safety Caution:**

Growing plants in the classroom may expose students to mold and mold spores. Check with students and their parents to ensure that no student has a known mold allergy before beginning the experiments. If students have mold allergies, **DO NOT CONDUCT THIS EXPERIMENT.**

#### **Lab 1- Vegetative Propagation**

Depending on circumstances, this activity could be a teacher demonstration or a student activity.

#### **Questions to consider:**

Will the spider plant sprout roots and develop into a new plant? Why would asexual reproduction be beneficial to these plants?

- Procedure:
1. Cut a baby, with 5 cm of stem attached, from a spider plant.
  2. Carefully place stem of the plant into a cup of water.
  3. Place on a well-lit shelf, in a room with proper ventilation.
  4. Label and date.
  5. Check daily for any signs of mold (changes in smell, water color, decay of plant). If signs of mold are present, discard the plant.
  6. Completely change the plant's water weekly.
  6. Record findings.
  7. Plant when roots have formed.



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### Lab II- Budding

Depending on circumstances, this activity could be a teacher demonstration or a student activity.

#### Questions to consider:

Will the yeast grow buds under the microscope?

Why would asexual reproduction be beneficial to these organisms?

- Procedure:
1. Place a 2 ml of yeast grains and a 1 ml of sugar in a petri dish.
  2. Add 4 ml warm water and let sit covered in a warm place for 10 minutes.  
Yeast multiply fastest at 24 to 27C or 75 to 81F.
  3. Smear a yeast sample on a slide plate with a sterile toothpick.
  4. Cover.
  5. Look under a 40x microscope or project on to computer using microscope hook-up.
  6. Record drawings of the yeast budding.
  7. Properly discard yeast.



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### Attachment F (continued) Asexual Reproduction Laboratories

#### Lab III- Vegetative Propagation

##### Questions to consider:

Will the potato grow a plant that will eventually produce another potato?

Can these plants reproduce sexually?

##### Procedure:

1. Select a potato with many eyes (dormant shoot buds).
2. Slice the potato in half.
3. Using toothpicks suspend half the potato in a clear plastic container with the fresh cut side of the potato facing the bottom of the container. Make sure that most, not all, of the potato is below water.
4. Fill the jar with tap water.
5. Label and date the jar.
6. Place on well lit shelf, in room with proper ventilation.
7. Check daily for any signs of mold (changes in smell, water color, decay of plant). If signs of mold are present, discard the plant.
8. Do not let water go below about half the potato, and completely change the plant's water weekly.
9. Record findings.