



# SCIENCE CHAMPION

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**6**  
Teacher Guide

Builds conceptual understanding, reasoning skills, and critical thinking through science learning



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Science Champion – Teacher Guide 6



The star of education

member of mentari group

# Preface



is a science learning book specially designed to help pupils acquire scientific knowledge and understanding, develop skills, values, and attitudes. The scope of topics discussed at each level is arranged according to the science syllabus at the elementary level.



uses a very systematic learning method through the Inquiry approach that has been tested and proven to be an effective approach at improving student's competences in mastering science. The inquiry approach is used by Singapore to improve students' competences which is proven through their consistency as the top rank at PISA (Program for International Student Assessment) and TIMSS (Trends in Mathematics & Science Studies). The development of material for each topic is arranged in stages, starting from the easiest material to more complex material (spiral progression).



gives special emphasis on developing conceptual understanding and critical thinking skills to build a firm foundation in science. After the introduction of new concepts, students are invited to apply what they have learned in collaborative science activities. This book is equipped with a number of activities that will stimulate students' interest in the topic and consolidate their knowledge and understanding.



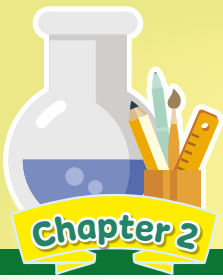
makes science learning meaningful and fosters a love of science learning in children with the use of colorful and engaging visuals as well as age-appropriate language.

**Be a science champion!**

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# Animal Reproduction



## Overview

Chapter 2 focuses on the two modes of reproduction in animals: asexual reproduction and sexual reproduction. Asexual reproduction does not require the union of the reproductive cells of two parent organisms. On the other hand, sexual reproduction occurs when the female reproductive cell of an organism unites with the male reproductive cell of an organism of the same species. In this chapter, the students will study the different reproductive organs of animals and their functions. They will learn through games, hands-on activities, research assignments, and cooperative learning group discussions.



## Lessons

1. Asexual Reproduction
2. Sexual Reproduction



## Learning Goals

1. Describe asexual reproduction in animals.
2. Cite examples of animals that undergo asexual reproduction.
3. Describe the different types of asexual reproduction in animals, such as hydras, corals, starfishes, and bees.
4. Describe sexual reproduction in some animals.
5. Cite examples of animals that undergo sexual reproduction.
6. Describe the different modes of sexual reproduction in animals such as butterflies, mosquitoes, frogs, cats, and dogs.

# Asexual Reproduction in Animals

Textbook Page Numbers: 28–35

Time Allotment: 3 sessions

## Learning Goals

At the end of the lesson, the students should be able to:

1. describe asexual reproduction in animals;
2. cite examples of animals that undergo asexual reproduction; and
3. describe the different types of asexual reproduction in animals, such as hydras, corals, starfishes, and bees.

## Teaching Notes

### Key Concepts

- 1 Asexual reproduction is a mode of reproduction wherein a single parent produces offspring. There are different modes of asexual reproduction, namely, budding, fission, fragmentation, and parthenogenesis.
- 2 Budding is a form of asexual reproduction in which a new organism develops from an outgrowth or bud of an animal's body.
- 3 Fission, also called binary fission, is a form of asexual reproduction wherein a parent body divides into two or more identical offspring.
- 4 Fragmentation is a form of asexual reproduction wherein an organism splits into fragments and each of these fragments develops into a mature and fully grown organism that is identical with the original organism.
- 5 Parthenogenesis is a form of asexual reproduction wherein the offspring develops from unfertilized eggs.



asexual reproduction, budding, fission, fragmentation, parthenogenesis

## Materials

worksheet 2.1, photo of crown-of-thorns starfish, filter papers, disposable petri dishes, tweezers, dechlorinated water, single-edge razor blades, live earthworms, small containers

## Learning Instructions

### Engagement

- 1 Discuss with the students the chapter overview and lesson overview on pages 27 and 28 of the textbook.
- 2 Distribute copies of worksheet 2.1 to the students. Have the students fill in the *What I Know* column in the worksheet by answering the following questions:
  - (a) What is asexual reproduction?
  - (b) What animals reproduce through asexual reproduction?
- 3 Call on some students and let them share their answers in class. Discuss their answers.
- 4 Show a photo of the crown-of-thorns starfish. Call on some students and let them describe the starfish. Discuss their descriptions.
- 5 Ask the students: How does this starfish reproduce? Discuss their answers.
- 6 Explain that the crown-of-thorns is a starfish that preys upon hard coral polyps, which house different aquatic organisms. It had been a problem in many coral reefs so people had decided to eradicate them. When they cut the starfish into thirds, the starfish died. However, when they cut them into two, 75 percent of the time, they got two new crown-of-thorns starfish. Starfish reproduce through fragmentation, a method of asexual reproduction.

- 7 Have the students fill in the *What I Want to Know* column in worksheet 2.1.
- 8 Explain the lesson objectives in *Learning Goals* on page 28 of the textbook.

### Exploration

- 9 Have the students answer the question in *Explore!* on page 28 of the textbook.
- 10 Call on some students and let them share their answers in class. Discuss their answers.
- 11 Organize the students into groups with four members each. Have the groups do the *Science at Work* activity on page 32 of the textbook. Give the groups time to complete the activity.
- 12 Ask the groups to answer the questions at the end of the activity.
- 13 Call on some groups and let them share in class their answers to the questions. Discuss their answers.

### Explanation

- 14 Introduce the term asexual reproduction. Let the students recall their definition of the term in worksheet 2.1. Discuss their definitions.
- 15 Organize the students into four groups. Assign each group the following topics:
  - Group 1: budding
  - Group 2: fission
  - Group 3: fragmentation
  - Group 4: parthenogenesis
- 16 Ask each group to research about the topic assigned to them. Provide them with the following guide questions for research:
  - (a) How does the method of asexual reproduction take place?
  - (b) Are two parent organisms required?
  - (c) Is the offspring identical with or different from its parent?
  - (d) What are examples of organisms that reproduce through this method?
- 17 Call on each group and let them present their research findings in class. Discuss their findings.
- 18 Organize the students into pairs. Ask each pair to prepare two questions about each type of asexual reproduction.

19 Let each pair find another pair to answer their questions. If both pairs are unable to answer the questions, then they must research about it in the school library.

### Elaboration

20 Discuss the information in *Science Bank* on pages 29 and 31 of the textbook.

21 Ask the students to review the concepts summarized in *Looking Over* on page 33 of the textbook.

### Evaluation

22 Test the students' understanding of the lesson. Have them do the *Enhance Your Skills* exercise on pages 34–35 of the textbook. Discuss their outputs.

23 Ask the students to answer the question in *Everyday Science* on page 35 of the textbook.

24 Organize the students into pairs. Have each pair discuss their answers.

25 Call on some pairs and let them share their answers in class. Discuss their answers.

26 Ask the students to fill in the *What I Learned* column in worksheet 2.1.

## Suggested Activities

- 1 Ask the students to think about an animal that reproduces sexually. Tell the students to write a 3-paragraph essay describing the animal and explaining how it reproduces. Tell the students to include a photo of the animal in their essay. Organize the students into groups with three members each. Have each student share their essay with their fellow group members. Tell them to read and peer review the work of their group mates.
- 2 Organize the students into pairs. Have each pair participate in a tell-rephrase-repeat activity. In the activity, student 1 will recall an idea that he or she has learned about the lesson on asexual reproduction. Student 2 will rephrase what his or her partner has said. Student 1 will repeat what Student 2 has said. They will continue until Student 1 has given 10 ideas he or she has learned.



## Quiz

Name : \_\_\_\_\_ Date : \_\_\_\_\_

Grade : \_\_\_\_\_ Score : \_\_\_\_\_

Directions: Write T on the line before the number if the statement is correct. Otherwise, change the underlined word to make the sentence correct. Write the correct word/phrase on the line before the number.

- \_\_\_\_\_ 1. Asexual reproduction is a mode of reproduction wherein a single parent produces offspring.
- \_\_\_\_\_ 2. Asexual reproduction makes large numbers of offspring impossible.
- \_\_\_\_\_ 3. Fission is a form of asexual reproduction in which a new organism develops from an outgrowth of an animal's body.
- \_\_\_\_\_ 4. Queen bees are born from unfertilized eggs.
- \_\_\_\_\_ 5. Budding is a form of asexual reproduction in which a parent body divides into two or more identical offspring.
- \_\_\_\_\_ 6. Fragmentation is a form of asexual reproduction in which an organism splits into fragments and each of these fragments develops into a mature and fully grown organism that is identical with the original organism.
- \_\_\_\_\_ 7. Sea anemones reproduce by fragmentation.
- \_\_\_\_\_ 8. Parthenogenesis is a form of asexual reproduction in which the offspring develops from unfertilized eggs.
- \_\_\_\_\_ 9. Corals and hydras reproduce through parthenogenesis.
- \_\_\_\_\_ 10. Hammerheads produce their young through budding.



## Worksheet 2.1

Name : \_\_\_\_\_ Grade : \_\_\_\_\_

Topic : \_\_\_\_\_ Date : \_\_\_\_\_

### K-W-L Chart

Directions: Write in the first two columns what you think you already know (K) and what you want to know (W) about the topic. After completing the lesson, write in the third column what you learned (L).

What I Know	What I Want to Know	What I Learned

# Sexual Reproduction in Animals

Textbook Page Numbers: 36–50

Time Allotment: 3 sessions

## Learning Goals

At the end of the lesson, the students should be able to:

- 1 describe sexual reproduction in some animals;
- 2 cite examples of animals that undergo sexual reproduction; and
- 3 describe the different modes of reproduction in animals such as butterflies, mosquitoes, frogs, cats, and dogs.

## Teaching Notes

### Key Concepts

- 1 Sexual reproduction requires the union of male and female reproductive cells—the sperm cell and egg cell, respectively.
- 2 External fertilization often takes place in aquatic surroundings where both egg and sperm are released into the water. When the sperm unites with the egg, fertilization takes place.
- 3 Spawning is a form of external fertilization in which females release eggs and males release sperm in the same area and at the same period of time.
- 4 Internal fertilization takes place when the sperm fertilizes the egg inside the female's body.
- 5 In oviparity, the undeveloped fertilized egg is laid outside the female's body. It receives nourishment from the yolk that is a part of the egg.
- 6 In viviparity, the fertilized egg is more protected than in oviparity because the offspring is nourished inside the female's body.

- 7 The female reproductive systems of cats and dogs are made up of the ovaries, fallopian tubes, vagina, vulva, and cervix.
- 8 The male reproductive systems of cats and dogs are made up of the testes, vas deferens, prostate gland, penis, and scrotum.



## Vocabulary

internal fertilization, external fertilization, fertilization, oviparity, sexual reproduction, spawning, viviparity

## Materials

worksheet 2.2, computer with Internet connection, reference materials, picture of a flatworm

## Learning Instructions

### Engagement

- 1 Discuss with the students the lesson overview on page 36 of the textbook.
- 2 Distribute copies of worksheet 2.2 to the students. Organize the students into pairs. Have each pair fill in the *What I Know* column in the worksheet by answering the following questions:
  - (a) What is sexual reproduction?
  - (b) What animals reproduce through sexual reproduction?
- 3 Call on some students and let them share their answers in class. Discuss their answers.
- 4 Have the students fill in the *What I Want to Know* column in worksheet 2.2.
- 5 Explain the lesson objectives in *Learning Goals* on page 36 of the textbook.

## Exploration

- 6 Have the students answer the question in *Explore!* on page 36 of the textbook.
- 7 Call on some students and let them share their answers in class. Discuss their answers.
- 8 Organize the students into groups with four members each. Have the groups do the *Science at Work* activity on page 43 of the textbook. Give the groups time to complete the activity.
- 9 Have the groups answer the questions at the end of the activity.
- 10 Call on some groups and let them share their answers in class. Discuss their answers.

## Explanation

- 11 Show a picture of a flatworm (*Macrostomum hystrix*) in class. Ask the students to describe the flatworm. Discuss their descriptions.
- 12 Ask the students: How does this flatworm reproduce? Discuss their answers.
- 13 Explain that the flatworm has a male reproductive organ called penis. Often, the flatworm inserts its penis to another flatworm to inseminate it. However, in the absence of a mate, the flatworm injects itself with sperm. Even when the flatworm is alone, it is able to reproduce through sexual reproduction.
- 14 Ask the students: What are other examples of animals that reproduce sexually? Discuss their answers.
- 15 Write the following names of animals on the board: fish, frog, butterfly, mosquito, dog, and cat.
- 16 Describe animals from the following list, and have the students guess which animals are being described.
  - (a) Mates get into a mating procedure called amplexus to make sure that the sperm reaches the eggs.  
*Answer: Frogs*
  - (b) Their eggs are covered and protected by a jelly-like substance.  
*Answer: Frogs*
  - (c) Their reproductive cells are fertilized outside their bodies.  
*Answers: Frogs, fishes*



(d) They are oviparous, meaning they lay fertilized eggs.

*Answers: Butterflies, mosquitoes*

(e) They are viviparous, meaning their fertilized eggs are nourished inside the female's body.

*Answers: Dogs, cats*

(f) The male and female reproductive organs are at the abdomen.

*Answers: Butterflies, mosquitoes*

(g) They have reproductive organs such as testes, penis, uterus, and vagina.

*Answers: Cats, dogs*

17 Have the students check their answers using the textbook.

18 Write the word sexual reproduction on the board. Let the students recall their definition of the term in worksheet 2.1. Discuss their definitions.

19 Organize the students into six groups. Assign each group the following topics:

Group 1: fish

Group 2: frog

Group 3: butterfly

Group 4: mosquito

Group 5: cat

20 Ask each group to research about the method of reproduction of the animal assigned to them. Provide them with the following guide questions:

(a) How does the animal reproduce?

(b) What are the body parts required for reproduction?

(c) Are two parent organisms required?

(d) Is the offspring identical with or different from its parent?

21 Have each group present their research findings in class. Discuss their findings.

22 Discuss the differences between internal and external reproduction: oviparity and viviparity, based on the groups' reports.

### **Elaboration**

23 Discuss the information in *Science Bank* on pages 37 and 41 of the textbook.

- 24 Ask the students to review the concepts summarized in *Looking Over* on pages 44–45 of the textbook.
- 25 Ask the students to write a paragraph summarizing the concept map in *Linking Together* on page 47 of the textbook.
- 26 As homework, ask the students to read the article in *Making Connections* on page 50 of the textbook. Discuss the article with the students.

### Evaluation

- 27 Test the students' understanding of the lesson. Have them do the *Enhance Your Skills* exercise on pages 45–46 of the textbook. Discuss their outputs.
- 28 Organize the students into pairs. Have each pair answer the question in *Everyday Science* on page 46 of the textbook.
- 29 Call on some pairs and let them share their answers in class. Discuss their answers.
- 30 Have the students answer *Chapter Test* on pages 48–49 of the textbook. Discuss their answers.
- 31 Ask the students to fill in the *What I Learned* column in worksheet 2.1.

## Suggested Activities

- 1 Organize a visit to a farm. Tell the class to list down ten animals in the farm that reproduce asexually and another ten that reproduce sexually. Organize them into pairs. Have each of them share their answers with their partners.
- 2 Organize the students into groups with four members each. Tell them to create a mind map as a group. Have one student write or draw a picture in the middle of a piece of paper. Each member takes a turn to draw ideas related to the picture. They can also connect with ideas that have been introduced in the picture. Have each group explain their mind map to another group.



## Quiz

Name : \_\_\_\_\_ Date : \_\_\_\_\_

Grade : \_\_\_\_\_ Score : \_\_\_\_\_

Directions: Match the description in column A to the correct term in column B. Write on the line before the number the letter that corresponds to the correct term.

### Column A

### Column B

- |  |                          |
|--|--------------------------|
| ___ 1. It begins with the union of male and female reproductive cells.   | A spawning               |
| ___ 2. It often takes place in aquatic surroundings where both egg and sperm are released into the water.  | B sea cucumber           |
| ___ 3. It is a form of external fertilization in which females release eggs and males release sperm in the same area and at the same period of time. | C oviparity              |
| ___ 4. In this type of fertilization, the egg is fertilized by the sperm inside the female's body.   | D viviparity             |
| ___ 5. In this mode of reproduction, the undeveloped fertilized egg is laid outside the female's body  | E mosquito               |
| ___ 6. In this mode of reproduction, the offspring is nourished inside the female's body.  | F internal               |
| ___ 7. It is an animal that reproduces sexually by external fertilization.   | G progesterone           |
| ___ 8. It is a substance that an animal releases to get a response from another animal.  | H sexual reproduction    |
| ___ 9. It is composed of sperm and nutrients.  | I pheromone              |
| ___ 10. It is the hormone that helps prepare the uterus for pregnancy.   | J estrogen               |
|  | K spermatophore          |
|  | L external fertilization |



## Worksheet 2.2

Name : \_\_\_\_\_ Grade : \_\_\_\_\_

Topic : \_\_\_\_\_ Date : \_\_\_\_\_

### K-W-L Chart

Directions: Write in the first two columns what you think you already know (K) and what you want to know (W) about the topic. After completing the lesson, write in the third column what you learned (L).

What I Know	What I Want to Know	What I Learned

## A. Textbook

### Explore!

page 28

The types of asexual reproduction include budding, fission, fragmentation, and parthenogenesis.

page 36

Butterflies, cats, and mosquitoes reproduce sexually.

### Science at Work

page 32

- 1 Each of the three fragments develops into a new organism.
- 2 Worms reproduce via fragmentation.
- 3 Annelids (including earthworms) reproduce via fragmentation. The fragments regenerate the missing parts, thereby becoming whole again.

pages 43–44

- 1 The answer depends on the students' research.
- 2 Sexual reproduction ensures genetic diversity. When the offspring are more diverse, the animal species has a better chance of surviving in an unpredictable and changing environment.
- 3 Asexual reproduction does not require another organism of the opposite sex. Therefore, organisms can live alone and still reproduce.
- 4 Answers may vary.  
Sample answer: No. Organisms reproduce according to their kind and their mode of reproduction best suited for them.

### Enhance Your Skills

pages 34–35

Across

- 4 fragmentation
- 5 fission
- 6 asexual
- 8 offspring

Down

- 1 drone
- 2 budding
- 3 fertilization
- 7 corals

pages 45–46

Oviparous animals: snake, geese, crocodile, butterfly, fish, frog, salamander

Viviparous animals: goat and giraffe

### Everyday Science

page 35

Starfish reproduce by fragmentation, a form of asexual reproduction in which an organism splits into fragments and each of these fragments develops into a mature and fully grown organism. Cutting and throwing the cut parts into the ocean increase the chances that the starfish will reproduce and multiply.

page 46

Mosquitoes may lay eggs on stagnant water. When they multiply, there will be higher chances that diseases such as malaria and dengue fever will spread.

### Chapter Test

pages 48–49

- |     |      |
|-----|------|
| 1 B | 6 B  |
| 2 D | 7 A  |
| 3 A | 8 D  |
| 4 C | 9 A  |
| 5 D | 10 B |

## B. Teacher's Manual

### Quiz

#### Lesson 1

- 1 T
- 2 possible

- 3 budding
- 4 drones
- 5 fission
- 6 T
- 7 fission
- 8 T
- 9 budding
- 10 parthenogenesis

## **Lesson 2**

- 1 H
- 2 L
- 3 A
- 4 F
- 5 C
- 6 D
- 7 B
- 8 I
- 9 K
- 10 G



## Test Item Bank

Circle the letter that corresponds to the correct answer.

- Which of the following is a form of asexual reproduction in which the offspring develops from unfertilized eggs?
  - budding
  - fission
  - fragmentation
  - parthenogenesis
- Which of the following is a form of asexual reproduction in which a parent body divides into two or more identical offspring?
  - budding
  - fission
  - fragmentation
  - parthenogenesis
- Which of the following refers to animals that give birth to live offspring?
  - amplexus
  - estrus
  - oviparous
  - viviparous
- What is the substance released by an insect to attract another insect for mating purposes?
  - estrogen
  - estrus
  - pheromone
  - progesterone
- What is the role of the vas deferens in male cats?
  - It produces and secretes testosterone.
  - It produces and releases sperm cells.
  - It carries the sperm to the urethra.
  - It creates the liquid portion of the semen.
- What is the role of the ovaries in female cats?
  - They produce progesterone and estrogen.
  - They transfer the egg cells to the uterus.
  - They serve as the passageway of the egg cells.
  - They cause fertilization of the egg cell.



- 7 Which group of animals reproduce sexually by external fertilization?
- a. cats, goats, monkeys
  - b. crabs, oysters, shrimps
  - c. chickens, mosquitoes, sea turtles
  - d. bees, hydras, sharks
- 8 Which group of animals can reproduce asexually?
- a. cats, goats, monkeys
  - b. crabs, oysters, shrimps
  - c. chickens, mosquitoes, sea turtles
  - d. bees, hydras, sharks
- 9 A female animal lays eggs that eventually hatch. Which of the following is a possible identity of the animal?
- a. cat
  - b. camel
  - c. mosquito
  - d. sea anemone
- 10 Females release eggs and males release sperms simultaneously in the same area. Which of the following may be a possible identity of these animals?
- a. butterfly
  - b. lizard
  - c. sea anemone
  - d. sea cucumber