



Ask A Biologist activity for classroom and home  
By Angelina Alameda

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## About the Author

**Angelina Alameda** is a graduate of Arizona State University with a bachelor's degree in Elementary Education.

## Learn more

This is a companion activity for these articles:

**Secrets of a Superorganism**  
[askabiologist.asu.edu/explore/secrets-superorganism](http://askabiologist.asu.edu/explore/secrets-superorganism)

**A Closer Look At Castes**  
[askabiologist.asu.edu/leafcutter-castes](http://askabiologist.asu.edu/leafcutter-castes)

**Leafcutter Ant Colony**  
[askabiologist.asu.edu/leafcutter-ant-colony](http://askabiologist.asu.edu/leafcutter-ant-colony)

# Experiment Overview

Many animals survive by living in large communities. They rely on each other to survive and depend on cooperation among the community members.

Ants are great examples of how individuals in a group can work together to protect the survival of the community. How do they do this? Well, ants have specialized jobs or tasks within the colony. (Bee colonies are similar in that way.) What makes a large community so successful is its ability to work as a system.

Through research and games, you will learn how the different castes of leafcutter ant work together to provide for the colony.

However, not all ants will function the same way. The strategies that different species (even different leafcutter species) use to obtain the four requirements for survival—water, food, shelter, and space—can be different.

## Before you begin

Think about what you know about ants and about the life of an ant.

Over the next three days you will be working in groups of 3-4 to research the caste system of the leafcutter ant and how they make sure they have the essentials of survival: water, food, shelter, and space.

Work cooperatively with your group and follow your teacher's directions. Be sure to record any work and learning in your notebook. Each member of your group is accountable for participating and contributing to your research.

Clean up and leave materials the way you found them at the end of the day.

## Procedure

### Day 1: Watch and Play (<http://youtu.be/-rzA1LRR4Hg>)

While watching the Leafcutter Ants in the Panama Rainforest video you will take notes and record your data for the following items:

1. Name two of the ant jobs you hear the video mention
2. List 4 facts that you learned from the video
3. Write down 2 questions that you have after watching this video.

### Play and analyze: Leafcutter Relay (*instructions included in supplemental materials, page 8*)

As a class, you will complete the Leafcutter relay. Afterward, you will analyze the interactions of your group.

- What would happen if something were to alter the leafcutter system?
- What events might disrupt the ant colony and what effect would it have on the colony in the long run?

## What you need

Make sure to get the following from your teacher:

- Leafcutter ant vocabulary crossword puzzle
- Diagram of leafcutter ant with labeled body parts
- Blank diagram of leafcutter ant
- Various pictures of leafcutter ants
- Leafcutter relay handout
- Green construction paper
- Scissors
- Markers or crayons
- Leafcutter ant photos

You will also need:

- Classroom computers or laptops
- Pencils

# Experiment Overview *(continued)*

## Day 2: Web research—Community

1. Read the Ask A Biologist story **A Closer Look at Castes** ([askabiologist.asu.edu/leafcutter-castes](http://askabiologist.asu.edu/leafcutter-castes))
2. Create a data table that shows the different castes of ants living in a leafcutter ant colony.
3. Add illustrations and definitions to the table to demonstrate your knowledge of the leafcutter ant's caste system.

## Day 3: Web research—Ask a Biologist

Complete the crossword puzzle (*included in supplemental materials, page 10*) by reading the articles **Secrets of a Superorganism** ([askabiologist.asu.edu/explore/secrets-superorganism](http://askabiologist.asu.edu/explore/secrets-superorganism)) and **Leafcutter Ant Colony** ([askabiologist.asu.edu/leafcutter-ant-colony](http://askabiologist.asu.edu/leafcutter-ant-colony)).

1. Begin by completely reading the article as a group
2. Afterward, read the questions on the crossword puzzle and then read the article again, noting where you found potential answers or useful information within the text.

*Or*

Jigsaw the article: Assign different questions to different members of your group. If you jigsaw this assignment, make sure to discuss as a group where each answer was found.

Repeat for the second article and for any information in **A Closer Look at Castes**, which you read on Day 2.

## Day 4: Does an ant have knees?

1. Label the anatomy of an ant (different body parts) using the anatomy worksheet (*included in supplemental materials, page 12*). Clearly label and color the diagram.
2. Think about the question "Does an ant have knees?" Record your answer in your notebook.
3. Work with your group to record kid-friendly definitions to the following vocabulary terms: Brood, caste, colony, division of labor, forage, larva, organism, pupa.

## Day 5: Create Your Own Diagram

1. Review all the research your group has completed over the course of the week.
2. Based on the research you have completed, work as a group to illustrate and diagram the leafcutter ant colony. If you were to find a colony in the rainforest what would it look like? What features would it have? What is the environment like and how does that effect the ant colony? Consider the different castes of ants living in the colony and their jobs. Remember to consider the four essentials to life: water, food, shelter, and space.
3. Make sure your work is neat, easily read and understood, labeled when needed and aligned to the research you have completed. Be able to justify your diagram with evidence.
4. Work on your illustrations for an additional day if needed.

# Teaching Tips

This lesson is intended to take place over the span of a few days, depending on your class.

The resources provided here are not all-inclusive. Encourage students to find other sources of information to supplement their research when they have completed all the requirements of the lesson.

If time is a concern, consider using the final activity as the students' assessment. It should demonstrate what the students have learned about the leafcutter ant. To check individual understanding, have each student write a few paragraphs explaining the different components of their group's illustration and ask them to cite their evidence so that you can see their thinking.

## Objectives

- Students will understand the concept of social hierarchy and division of labor and how it applies to the leafcutter ant community.
- Students will analyze how each ant role affects the function of the colony as a whole.
- Students will evaluate the leafcutter system by making a claim about the importance of ant cooperation and supporting that claim using evidence.

## Tips for Classroom Implementation

- Ideally groups would be working in a computer lab. However, if computers are limited, explore the web pages as a class or provide printouts of the articles for each student.
- For group work, assign each student with a specific task to ensure that they are given equal opportunity to participate and contribute to the group. Examples of group jobs could be a scribe, group monitor, materials monitor, and reader (if groups want to read aloud). Adjust positions as you see fit.
- Make sure that the leafcutter relay is completed in a large flat area to avoid injury. Let the students know what they will be doing ahead of time so that they can wear appropriate shoes.

## Time Required

45-60 minutes for 5 days.

## Classroom set-up

Arrange students so that they can easily work in groups of 3-4.

Each activity should be prepared with directions and all materials needed for the activities.

Ensure that you have access to computers for students to complete the Web activities. If computer access is limited then consider printing the online articles and web pages for your students to use. If you have access to a smart board then the video could be shown to the whole class.

## Day 1 Materials

- Leafcutter Ant Relay Instructions (*included in supplemental materials, page 8*)
- 1 computer per group or watch the video as a whole class
- Notebooks
- Pencils
- Leafcutter Ants in the Panama Rainforest video: <http://youtu.be/-rzA1LRR4Hg>

## Teaching Tips *(continued)*

### Day 2 Materials

- One computer per group or print outs of Ask A Biologist article, **A Closer Look at Castes** ([askabiologist.asu.edu/leafcutter-castes](http://askabiologist.asu.edu/leafcutter-castes))
- Notebooks
- Pencils

### Day 3 Materials

- One computer or two print outs per group of both articles:
  - **Secrets of a Superorganism** ([askabiologist.asu.edu/explore/secrets-superorganism](http://askabiologist.asu.edu/explore/secrets-superorganism))
  - **Leafcutter Ant Colony** ([askabiologist.asu.edu/leafcutter-ant-colony](http://askabiologist.asu.edu/leafcutter-ant-colony))
- One copy of the crossword puzzle for each student (*included in supplemental materials, page 10*)
- Pencils

### Day 4 Materials

- One copy of the Ant Anatomy worksheet per student (*included in supplemental materials, page 12*)
- Notebooks
- Pencils
- Dictionaries, if extra support is needed

### Day 5 Materials

- Large construction paper or poster board for each group
- Pencils
- Coloring utensils

## Extensions

Challenge the students to research the infrastructure of the average city. What does almost every community have? (e.g., fire department, police station, grocery store, water supply, etc.)

Students can design a community for people that meet the four basic needs; water, food, shelter, and space.

- Does this community have a caste system?
- What does that look like?

Have students compare the superorganism of an ant colony to the body of an organism. Do any castes align with organ types or specific activities? Students can use a table to compare the functions of a colony and a body that are similar and how either a caste or an organ system or action handles that function.

# Science Standards

Standards for grades 3 through 6.

## Arizona Science Standards

### Strand 1: Inquiry Process

*Grade 4*

#### **Concept 1: Observations, Questions, and Hypotheses**

Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.

PO 1. Formulate a relevant question through observations that can be tested by an investigation.

#### **Concept 2: Scientific Testing (Investigating and Modeling)**

Design and conduct controlled investigations.

PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.

#### **Concept 4: Communication**

Communicate results of investigations.

PO 1. Communicate verbally or in writing the results of an inquiry.

### Strand 4: Life Science

#### **Concept 3: Organisms and Environments**

Understand the relationships among various organisms and their environment.

P.O. 1 (Grade 4) describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population.

PO 5. (Grade 5) Describe how environmental factors (e.g., soil composition, range of temperature, quantity and quality of light or water) in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive.

#### **Concept 4: Diversity, Adaptation and Behavior**

Identify plant and animal adaptations

PO 1. (Grade 3) Identify adaptations of plants and animals that allow them to live in specific environments.

# Science Standards *(continued)*

## Common Core Standards

### Key Ideas and Details

**CCSS.ELA-Literacy.RI.3.1:** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. Also good for grades in between 3rd and 6th.

**CCSS.ELA-Literacy.RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts.

### Craft and Structure

**CCSS.ELA-Literacy.RI.3.4:** Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 (up to 6) topic or subject area.

### Integration of Knowledge and Ideas

**CCSS.ELA-Literacy.RI.3.7:** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

### Range of Reading and Level of Text Complexity

**CCSS.ELA-Literacy.RST.3 to 6-8.10:** By the end of the year, read and comprehend informational texts at the appropriate text complexity band independently and proficiently. (Material good for high end 3rd grade to 6th grade).

## Next Generation Science Standards

### 3-LS Interdependent Relationships in Ecosystems

3-LS2-1: Construct and argument that some animals form groups that help members survive.

# Day 1—Leafcutter Ant Relay

supplemental materials

Adapted from the Cincinnati Zoo & Botanical Garden Leaf-cutter Ant Relay

## Grade

3rd-4th (meets standards)

## Time

60 minutes

## Materials

- 6 pairs of scissors
- 6 markers or crayons (brown preferred)
- 20 sheets of green construction paper with large leaves traced on
- A large space to run the relay race (like a gym or a field)

## Procedure

### Step one

Have students write in their science notebooks: What do they know about ants? How do members of the colony depend on one another? How do they feel about ants?

Then, as a class, go through the Leafcutter Ant Colony page on Ask A Biologist (<http://askabiologist.asu.edu/leafcutter-ant-colony>).

Review the different castes within the ant colony and the duties of each. Discuss the ways the colony must work together to farm fungus for their brood.

### Step two

Divide the class into two equal teams (10 to 15 students per team). On each team, assign students to the following roles

- 1 queen
- 1 larva
- 1 caretaker
- 1-2 gardeners
- 2-3 foragers
- 1 soldier
- 1 spider (yep, a spider)

Put the green construction paper at the starting line.

The foragers each take a pair of scissors and wait near the starting line.

The gardeners, caretakers, queens, and larvae stay at the other end of the course in the “nest area.”

Each gardener gets a brown crayon or marker.

## Objective

Learn about the caste system and how it helps leafcutter ants function as a colony.

## Background

Leafcutter ants are found in the South American rainforest. They collect leaves, but they do not eat them. Instead, they are farmers, like humans. They use the bits of leaves to grow fungus gardens (fungus gets energy from the decomposing leaves). The ants then eat the fungus. Like all ant colonies, work is divided among different ants that have different jobs. These jobs are called castes.



## Step three

Review the rules of the game:

The goal is to feed more fungus to your queen and larva than the other team does. The winning team will have the most fungus after all paper leaves have been cut out and delivered.

- **Foragers** will take a paper from the paper pile, cut a leaf out, and carry it with both hands over their heads (this also ensures they put down the scissors). They carry it to the nest and pass it to the gardeners. Then they return to the starting line to cut a new leaf and repeat the process.
- **Gardeners** are not allowed to move. They must wait for the forager to approach and then take the leaf. When a gardener gets a leaf, they draw an X on it (making it into “fungus”) and they pass it to the caretaker.
- **The Caretaker** decides to give the leaf either to the queen or to the larva.
- **Spiders** are intruders! They try to tag the foragers while the foragers carry leaves. If the foragers are tagged, they must return to the starting line before trying to go to the nest again.
- **Soldiers** must protect the foragers and keep the spider from tagging them. Be careful not to push or shove people. The soldiers just need to stay between the spider and the forager. The spider can only tag the forager if the soldier is not between them.

## Step four

Play!

## Step five

Once a winner has been decided, go out and try to observe some ants in the field. Which caste of ants are you seeing? Are they carrying anything? How might you find where the other castes are? What happens when you break their marching line with a stick or other object?

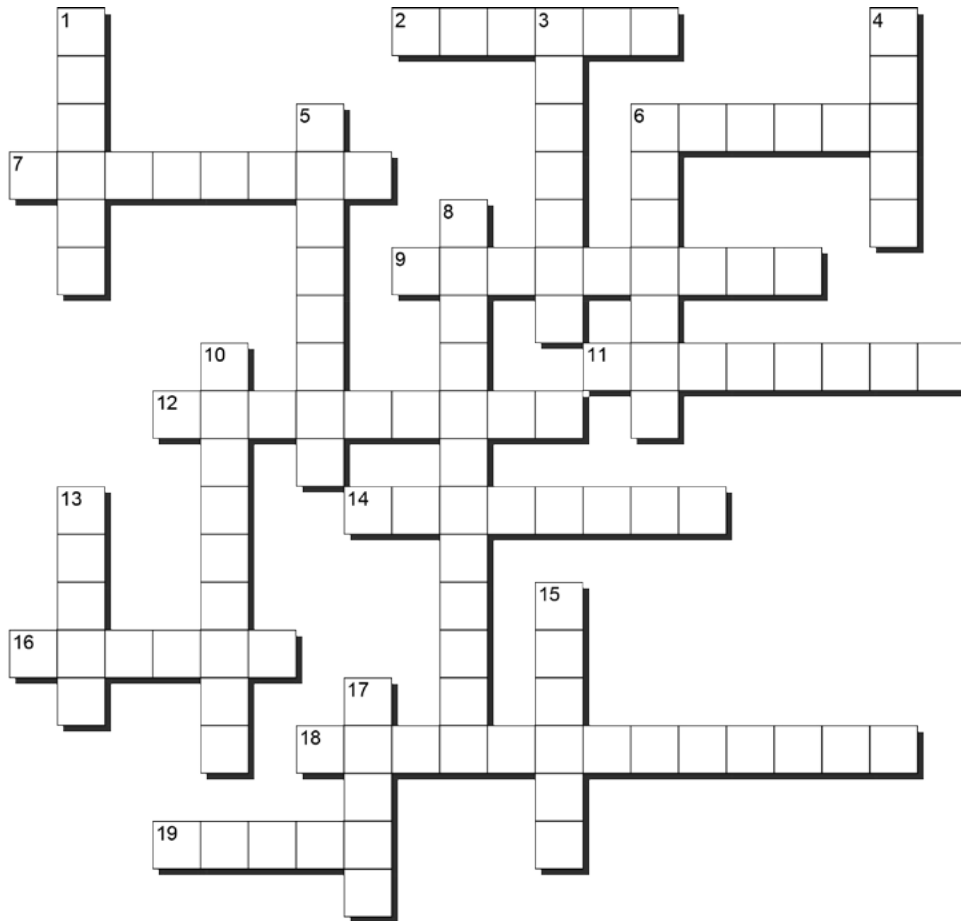
The class can plan any additional activities they may want to do to learn more about ant behavior.

## Step six

Discuss the role of ants in nature. Do they do anything beneficial for plants or for soil? Do they change their environment? What parts of the ant colony are living?

Again, have students write in their science notebooks.

- What do they know about ants?
- How do members of the colony depend on one another?
- Based on the activity, does it make sense for ants to split up jobs the way that they do?
- How do they feel about ants?
- How do ants differ from other organisms? How are they the same?
- Have them write down three questions that they have about ants.

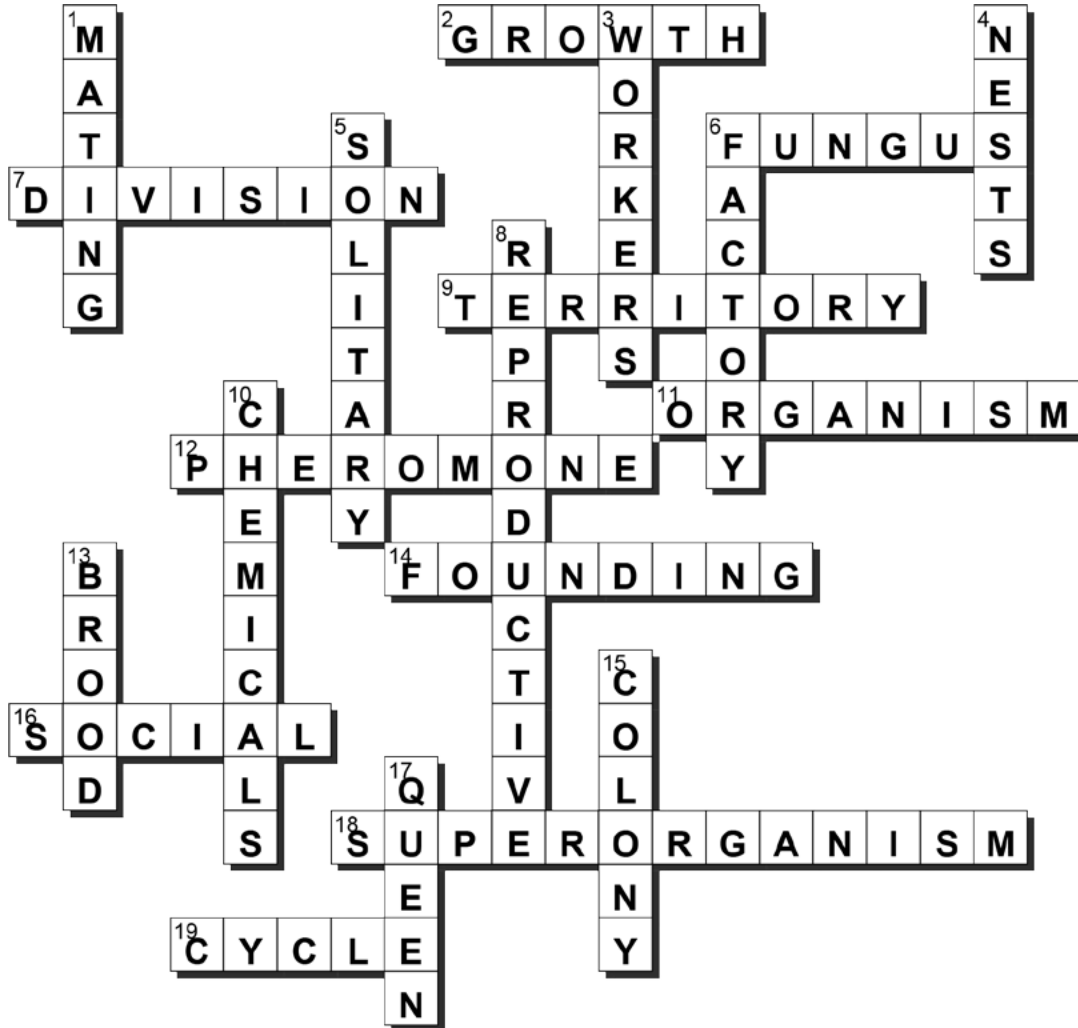


[Across]

2. During the \_\_\_\_\_ stage, an ant colony grows larger by producing more workers.
6. The food of leafcutter ants.
7. \_\_\_\_\_ of labor occurs when different individuals specialize on different jobs.
9. Area around an ant nest that is off-limits to neighboring ants.
11. A living thing capable of growth and reproduction.
12. A chemical signal used for communication.
14. An ant colony begins in the \_\_\_\_\_ stage of its life cycle.
16. Ants and other \_\_\_\_\_ animals live in groups.
18. An ant colony that behaves like a single organism.
19. Ant colonies undergo a sequence of changes, or life \_\_\_\_\_.

[Down]

1. After \_\_\_\_\_, queen ants start new colonies.
3. These female ants perform tasks other than reproduction.
4. Ants build their \_\_\_\_\_ in a variety of places.
5. Unlike ants, \_\_\_\_\_ animals live alone.
6. Like a \_\_\_\_\_, an ant colony converts resources (food) into products (more ants).
8. Colonies in the \_\_\_\_\_ stage of their life cycle produce new queens and males.
10. Ant nestmates use \_\_\_\_\_ to recognize one another.
13. Immature forms of an ant (eggs, larvae, and pupae).
15. Ants live and work together in a \_\_\_\_\_.
17. \_\_\_\_\_ ants lay eggs.



[Across]

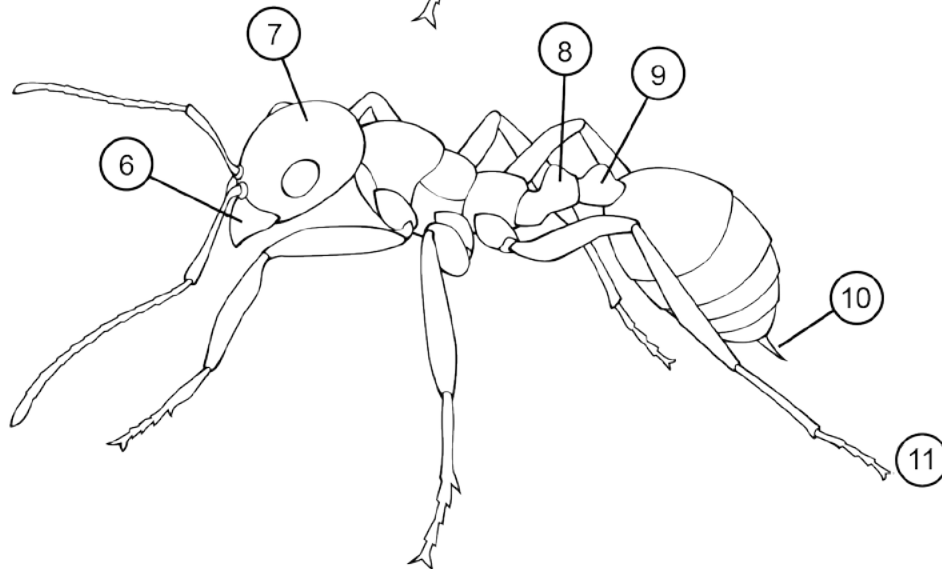
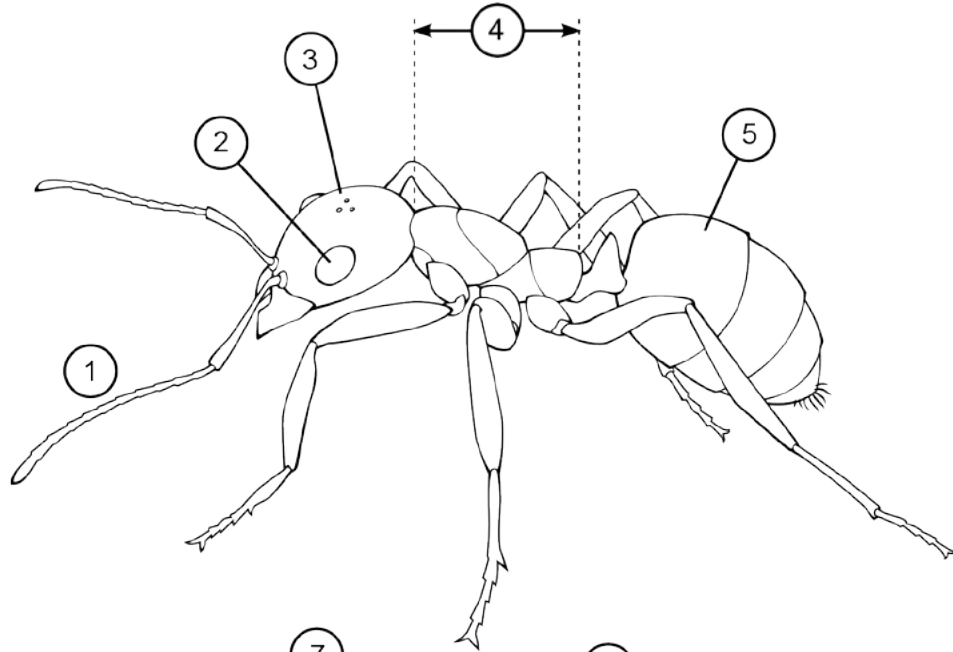
SOLUTION

[Down]

- 2. GROWTH
- 6. FUNGUS
- 7. DIVISION
- 9. TERRITORY
- 11. ORGANISM
- 12. PHEROMONE
- 14. FOUNDING
- 16. SOCIAL
- 18. SUPERORGANISM
- 19. CYCLE

- 1. MATING
- 3. WORKERS
- 4. NESTS
- 5. SOLITARY
- 6. FACTORY
- 8. REPRODUCTIVE
- 10. CHEMICALS
- 13. BROOD
- 15. COLONY
- 17. QUEEN

Try some of the other puzzles on Ask a Biologist:  
[askabiologist.asu.edu/activities/quizzes](http://askabiologist.asu.edu/activities/quizzes)



- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_
- 5. \_\_\_\_\_
- 6. \_\_\_\_\_

- 7. \_\_\_\_\_
- 8. \_\_\_\_\_
- 9. \_\_\_\_\_
- 10. \_\_\_\_\_
- 11. \_\_\_\_\_

1. Antennae
2. Compound Eyes
3. Ocelli
4. Mesosoma
5. Gaster
6. Mandibles
7. Head
8. Petiole
9. Post-petiole
10. Sting
11. Leg

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Try some of the other worksheets on Ask a Biologist:  
[askabiologist.asu.edu/activities/coloring](http://askabiologist.asu.edu/activities/coloring)