

M E R R I L L

# LIFE SCIENCE





M E R R I L L  
**LIFE SCIENCE**



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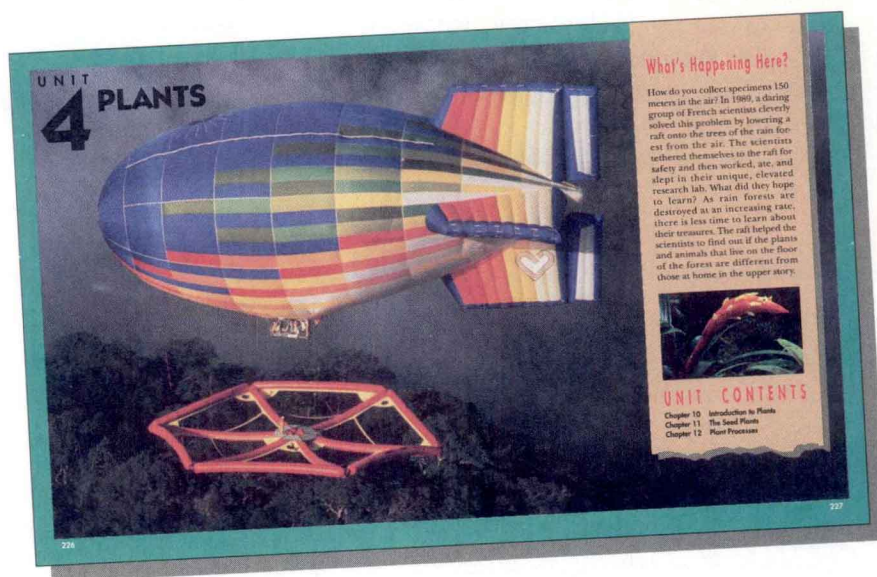


# USING MERRILL LIFE SCIENCE

Life Science is an everyday experience. It's a subject you're familiar with because every part of your day is based upon principles of life science... the simple act of walking involves your muscles to move your body, your nervous system to tell your muscles what to do and where you want to go, and your circulatory system to transport nutrients, energy, and oxygen to all parts of your body. Depending on where you walk, you may encounter a variety of insects, plants, and animals that are living their lives also based upon principles of life science. **Merrill Life Science** will help you understand life science principles and recognize how they affect you and the life around you everyday.

## a quick tour of your textbook

What's happening here? Have you ever seen a raft setting on the tops of trees? Each unit begins with thought-provoking photographs that will make you wonder. The unit introduction then explains what is happening in the photographs and how the two relate to each other and to the content of the unit. What is a raft doing on the tops of trees? Read the opener to Unit 4 to find out.



*It's clearly organized to get you started and keep you going.*



**CHAPTER 2 The Cell**

It is true that most cells are too small to be seen without some help. The plant cell on the opposite page has been magnified. But there are some cells that can be seen using just your eyes. The largest known living cells are the yolks of bird eggs—not the white, just the yolk. How large is the cell of a chicken egg?

**FIND OUT!**

Do this simple activity and find out that some cells can be seen without a microscope.

Break a chicken egg into a dish and look at the yolk. How large is it? Estimate its diameter. Use a metric ruler to measure the diameter of your chicken yolk cell. Then use a hand lens to take a closer look at the yolk. Other cells that can be seen easily are large fish eggs. Discuss reasons why different cells have different sizes.

**Gearing Up**

**Previewing the Chapter**

Use this outline to help you focus on important ideas in this chapter.

**Section 2-1 Cells: The Units of Life**

- The Microscope: A Tool
- The Cell Theory

**Section 2-2 Cell Structure**

- An Overview of Cells
- Cell Membrane
- Cytoplasm
- Nucleus
- Organelles in the Cytoplasm
- Plant and Bacterial Cells

**Section 2-3 Cell Organization**

- How Cells Differ
- From Cell to System

**Section 2-4 Tissues and Tissues**

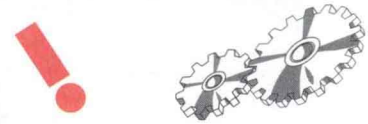
- Organ Transplants
- Spare Parts for Broken Hearts

**Previewing Science Skills**

- In the **CONCEPTS**, you will make a concept map, compare and contrast, and interpret scientific illustrations.
- In the **INQUIRY**, you will observe, compare, diagram, and draw conclusions.
- In the **VIDEO**, you will observe, identify, and diagram.

**What's next?**

Now that you have looked at an extremely large cell, learn how the microscope helped in the discovery of cells of all sizes and in the development of the cell theory. You will also learn about microscopes that help reveal the detailed parts of cells. At the end of the chapter, you will see that many-celled organisms are organized with tissues, organs, and systems.



As you begin each new chapter, use the **Gearing Up** to preview what topics are covered and how they are organized. You will also preview the skills you will use in this chapter.

After you've performed the **FIND OUT** activity and previewed the chapter, you're ready to further explore the topics ahead. Read **What's next** to see what's ahead.

**2-1 Cells: The Units of Life**

**New Science Words**

compound light microscope  
electron microscope  
cell theory

**Objectives**

- Discuss the history leading to the cell theory.
- Explain the difference between the compound light microscope and electron microscope.
- State the cell theory.

**The Microscope: A Tool**

Cells are the smallest units that carry out the activities of life in organisms. Yet, as important as they are, you certainly don't see individual cells when you look at most plants or animals. You need a magnifying device, such as a magnifying glass or a microscope, to see most cells. One in Figure 2-1 is like trying to see individual bricks in a wall from three blocks away. If you start to walk toward the wall, it becomes easier to see individual bricks. When you get right up to the wall, you can see each brick in detail. A microscope performs a similar function. A microscope has one or more lenses that make an enlarged image of an object. Through these lenses, you are brought closer to the leaf, and you see the individual cells that carry out life processes.

**Figure 2-1** Individual plant cells become visible when the leaves on the wall are looked at with the help of a microscope.

Chapters are organized into three to five numbered sections. The **Objectives** at the beginning of the numbered section tell you what major topics you'll be covering and what you should expect to learn about them. The **New Science Words** are also listed in the order in which they appear in the section.



Experience science by observing, experimenting, and asking questions.



### ACTIVITY 13-1

#### Determining Symmetry

**Problem:** What type of symmetry do some animals have?

**Materials:**  
• paper and pencil

**Procedure:**  
1. Observe each animal pictured on this page. Decide if the animal has radial symmetry, bilateral symmetry, or does not have symmetry at all. Record your answers in the data table. If you need help, refer to Section 13.1.  
2. Explain how you decided what type of symmetry each animal has in the column labeled "Reason."

**Data and Observations** Sample Data

Animals	Symmetry	Reason
Jellyfish	Radial	Students' reasons
Crayfish	Bilateral	should
Sponge	No symmetry	reflect
Spider	Bilateral	Information
Starfish	Radial	found
Oyster	Bilateral	on pages
Snail	Bilateral	303 and 304
Sea anemone	Radial	
Sea urchin	Radial	

**Analysis:**  
1. Which animals have radial symmetry?  
2. Which animals have bilateral symmetry?  
3. Which animal has no symmetry?  
4. If an animal has an anterior and a posterior end, what kind of symmetry does it have?

**Conclude and Apply:**  
5. What advantages might radial symmetry give an animal?  
6. What advantages might bilateral symmetry give an animal?  
7. How is type of symmetry related to characteristics of each animal phylum?

13-1 WHAT IS AN ANIMAL? 305

Science is more than words in a book. The two Activities and the MINI-Labs in each chapter give you the chance to further explore and investigate the science topics covered in your textbook.

In the **Activities**, you'll use household items and laboratory equipment as you follow the easy, step-by-step procedure. At the end of each Activity are questions that ask you to analyze what you've done.

## MINI-Lab

**What organisms are found in an ecosystem?**

Choose an ecosystem you are familiar with, such as a stream, garden plot, or pond, and identify the organisms found there. Make a list of all the populations you can see in the ecosystem. What is the niche of each species in the community?

Most **MINI-Labs** are designed so you can do them on your own or with friends outside of the science classroom using materials you find around the house. Doing a **MINI-Lab** is an easy and fun way to further your knowledge about the topics you're studying.

### FLEX Your Brain

**TOPIC:**  
1. What do I already know?  
2. \_\_\_\_\_  
3. \_\_\_\_\_  
4. \_\_\_\_\_  
5. \_\_\_\_\_

**Q:**  
Ask a question  
\_\_\_\_\_

**A:**  
Guess an answer  
\_\_\_\_\_

**How sure am I? (circle one)**  
Not sure 1 2 3 4 5 Very sure

1. Fill in the topic your teacher gives you.  
2. Jot down what you already know about the topic.  
3. Using what you already know (Step 2), form a question about the topic. Are you unsure about one of the items you list in #1? Do you want to know more? Do you want to know what, how, or why? Write down your question.  
4. Guess an answer to your question. The next few steps will help you refine the reason for your answer.

**Flex Your Brain** is a unique activity you can use to sharpen your critical thinking skills. Starting from what you already know about a science topic, you will apply a simple ten-step procedure to extend your knowledge about the topic from a perspective that interests you.

Each **Problem Solving** feature gives you a chance to solve a real life problem.

### PROBLEM SOLVING

#### Why Isn't Earth Covered with Pumpkins and Pike?

Assume that there are 70 seeds in one pumpkin and that this is the typical number for the species. The 70 seeds are planted and each seed grows into a plant that produces two pumpkins. The first year 70 seeds are planted. The number of seeds produced in three years can be calculated by multiplying the number of seeds times two pumpkins for each plant times 70 seeds in each pumpkin:

Year 1:  $70 \times 2 \times 70 = 9800$   
 Year 2:  $9800 \times 2 \times 70 = 1\,372\,000$   
 Year 3:  $1\,372\,000 \times 2 \times 70 = 192\,080\,000$  seeds

The largest possible number of offspring produced by one individual is known as the biotic potential of a species.

If the ovaries of a pike contain 42 000 eggs, all the eggs are fertilized and

hatched, all the young survive to reproduce, and one-half of the young are females, how many pike would there be after two more generations?

**Think Critically:** Why is the maximum rate of biotic potential never reached?

Explore news-making issues, concerns about the environment, and how science shapes your world through technology.

**SCIENCE & SOCIETY** 126-4 **Friendly Fires**

**New Science Words**  
controlled burns

**Objectives**

- Describe the role of controlled fires in forests and why the fires are controversial.
- Identify reasons both for and against the use of controlled burns in areas where people live.

**Are Forest Fires Always Bad?**

What comes to your mind first when you think of forest fires? You may think about animals such as deer running terrified through the forest, or blackened stumps rising from scorched ground where nothing can grow. A forest fire looks so stark and damaged, it seems it will never be the same again. What most of us don't realize is that some forests actually require such fires to maintain their character. Some pine species have evolved ways to cope with periods of fire. Jack pine and lodgepole pine trees have cones that don't open to release seeds until they have been heated in a fire!

In some types of forests, biologists conduct controlled burns, managed forest fires that are set periodically to control the amount of vegetation underneath the dominant forest tree species. In areas where natural fires don't occur, deep piles of dead leaves, dropped needles, and dead brush build up on the forest floor. All of this dead organic matter becomes potential fuel if a fire should start. To make sure that this organic matter doesn't build up too much, biologists sometimes start small fires to burn up the material on the forest floor. This is one way biologists hope to prevent major forest fires.

What happens to the forest animals during a controlled burn? Researchers contend that wild animals are unharmed because they move away from areas on fire. Some animals, such as the rare red-cockaded woodpecker, depend upon fires to maintain their habitat. They live in trees. Fires help to keep the hardwoods from growing in the open spaces between the pines.

Controlled burns are usually less intense and produce less heat than uncontrolled forest fires. This is another reason researchers feel that it is better to have a few controlled fires periodically than a large, out-of-control fire. However, even controlled burns sometimes cause damage. If a fire spreads outside the intended area of the burn, it may cause damage to nearby homes and businesses. In the meantime, local residents see damaged forest views every day.

Biologists are very careful to set fires only at times when wind conditions are right. But people who live near wind conditions are right. But people who live near the national forests and parks still are concerned over the need for controlled burns. They believe controlled burns are not "controlled" at all. They also aren't concerned that forest animals are unharmed as a result of these fires.

**SECTION REVIEW**

- Name two reasons why biologists believe controlled forest fires are useful.
- Why are local citizens often opposed to such fires?

**You Decide!**

In popular vacation spots, people often build homes in scenic areas, such as high on a ridge top. Such spots are often in forested areas that are subject to uncontrollable forest fires. Many of these vacation homes are in locations that are difficult for forest firefighters to reach. Should people be permitted to build homes in these areas?




620 ORGANISMS AND THEIR ENVIRONMENTS

264 FRIENDLY FIRES 621

The impact of science on society directly affects you. In the **Science and Society** section in each chapter, you'll learn about an issue that's affecting the world around you. The topics you'll read about are controversial, and you'll explore them from several sides. Then, you'll have a chance to express your opinion in the **You Decide** feature that follows.

In the **Technology** feature in each chapter, you'll read about recent discoveries, newly developed instruments, and applications of technology that have shaped our world and furthered our knowledge.

**EcoTip**

Cells need water to maintain health. Turning off the faucet every time you brush your teeth can conserve as much as five gallons of water that will benefit a living organism somewhere.

Each **EcoTip** suggests a simple step you can take to help improve the environment. **EcoTips** explain how you can get involved in making Earth a better place to live.

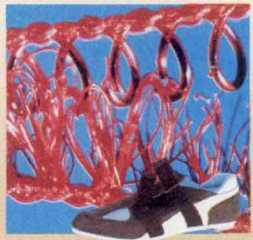
## TECHNOLOGY

**Cockleburrs and Space Shuttles**

One day a Swiss engineer returned from a walk and became interested in the thistles sticking to his socks. He studied the cockleburrs under a microscope and found hundreds of tiny hook and loop structures. As a result of this observation, he invented Velcro.

Nylon filament is woven into loops and coated. Half of the loops are cut to form hooks. Velcro has come to have many uses. It has been used to secure artificial hearts. In the space program, more than 64 500 cm<sup>2</sup> of Velcro tape have been used on each space shuttle. Velcro is also used to strap on blood pressure cuffs, on sneakers, and is found in astronauts' helmets as a nose scratcher.

**Think Critically:** What does this story tell you about how science works?





Discover that you can apply what you've learned as you answer questions and practice your science skills.

At the end of each section are several Section Review questions that help you test your knowledge. The last question challenges you to think critically and **Apply** what you've learned.

The **Skill Builder** feature lets you sharpen your science skills using only paper and pencil. If you need help with these skills, refer to the **Skill Handbook** at the back of the book. Here, you can find complete information about each type of skill covered in the Skill Builders.

### SKILL HANDBOOK

#### Organizing Information

##### Classifying

You may not realize it, but you impose order on the world around you. If your shirts hang in the closet together, your socks take up a corner of a dresser drawer, together, you have used the skill of classifying.

Classifying is grouping objects or events into groups based on common features. When classifying, you first make careful observations of the group of items to be classified. Select one feature that is shared by some items in the group but not others. Place the items that share the same feature in a subgroup. Place other items in subgroups based on other shared features. After you divide on the first feature, divide the items into subgroups, examine the items for other features, and further divide each subgroup into smaller and further smaller groups until the items have no features in common.

How would you classify these socks?

Remember, when you classify, you are grouping objects or events for a purpose.

##### Sequencing

A sequence is an arrangement of things or events in a particular order. A common sequence with which you are familiar is students sitting in alphabetical order. Think also about baking chocolate chip cookies. Certain steps have to be followed in order for the cookies to taste good.

When you are asked to sequence things or events, you must first identify what comes first. You then decide what should come second. Continue to choose things go back over the sequence to make sure each thing or event logically leads to the next.

Suppose you wanted to watch a movie that just came out on videotape. What sequence of events would you have to follow to watch the movie? You would first turn the videotape set to Channel 3 or 4. You would then turn the videotape player on and insert the tape. Once the tape has started playing, you would adjust the sound and picture. Then, when the movie is over, you would rewind the tape and return it to the store.

## Science and MATH

Because of regular exercise during the track season, Hope was able to reduce her at-rest pulse rate from 76 beats per minute to 66. Estimate how many beats Hope is saving her heart muscle per day.

Science is related to every other subject you study. The **Science And** features challenge you to solve math problems, read literature excerpts, and to write about topics you're studying as you make the connections between science and other disciplines.

The **Chapter Review** starts with a summary so you can review the major concepts from each section. Then, you'll apply your knowledge and practice thinking skills as you answer the questions that follow.

### CHAPTER REVIEW

#### CHECKING CONCEPTS

Choose the word or phrase that completes the sentence.

- Birds can fly because they have \_\_\_\_\_  
a. feathers b. keen vision c. wings d. all of these
- Wings of birds can be used for \_\_\_\_\_  
a. flying b. balancing c. landing d. all of these
- \_\_\_\_\_ are glands that produce milk.  
a. Oil glands b. Mammary glands c. Sweat glands d. None of these
- Mammals that eat both plants and animals are called \_\_\_\_\_  
a. herbivores b. omnivores c. carnivores d. none of these
- A \_\_\_\_\_ is an example of a marsupial.  
a. cat b. kangaroo c. all of these d. none of these
- Egg-laying mammals are called \_\_\_\_\_  
a. marsupials b. placental c. monotremes d. all of these
- \_\_\_\_\_ are mammals that have mammary glands with no nipples.  
a. marsupials b. placental c. monotremes d. all of these
- Teeth specialized for tearing are \_\_\_\_\_  
a. canine b. incisor c. molar d. premolar
- \_\_\_\_\_ huddling animals together.  
a. placental b. marsupial c. monotreme d. omnivore
- Humans and monkeys belong to the order \_\_\_\_\_  
a. Primates b. Carnivores c. Euterians d. none of these

#### KEY SCIENCE WORDS

Match each phrase with the correct term from the list of Key Science Words.

a. canines	f. omnivores
b. canine teeth	g. placental mammals
c. digestion period	h. preening
d. herbivores	i. unilateral cord
e. incubate	
f. marsupials	
g. mammary glands	
h. monotremes	
i. omnivores	

#### UNDERSTANDING VOCABULARY

Match each phrase with the correct term from the list of Key Science Words.

- placental
- process of keeping eggs warm
- mammals whose embryos develop inside a uterus
- herbivores birds use for flying
- animals that eat both plants and animals
- glands that produce milk
- teeth that help to chew
- teeth of mammals that eat both plants and animals
- structure containing blood vessels that attach an embryo to the placenta
- pouched mammals

#### OBSERVING AND INFERRING

Look at the diagrams of animal tracks. Decide which track belongs to which type of mammal by using Table 1-1. Fill in the chart. Describe how each animal's foot is adapted to its environment.

Animal	Track	Adaptation
Beaver		
Chipmunk		
Deer		
Mouse		
Monkeys		

#### COMPARING AND CONTRASTING

Compare and contrast the tracks of herbivores, omnivores, and carnivores. How is each track type adapted to the animal's diet?

#### CLASSIFYING

You discover three new species of mammals. The teeth of each species is as follows: Mammal 1—tusks and no placenta; Mammal 2—flaps and web feet; Mammal 3—tusks and tusks. Classify each mammal into its correct group.

#### PROJECT

- Research the link in your area. Find out what they eat and the type of teeth they build.
- Write to the National Wildlife Federation about endangered birds and mammals. What is being done to save these animals?



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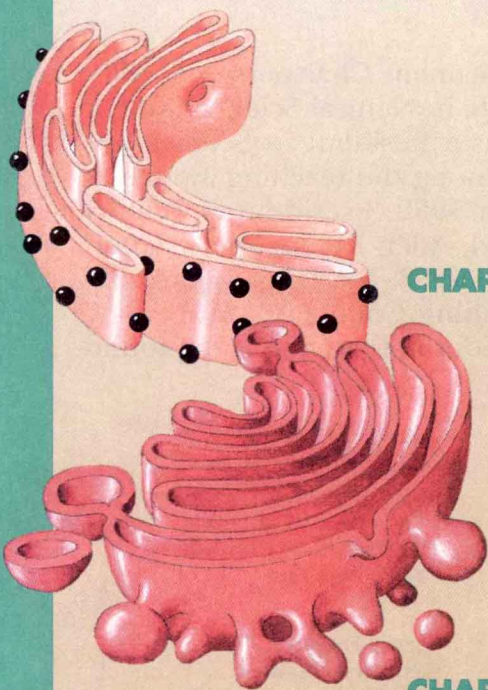
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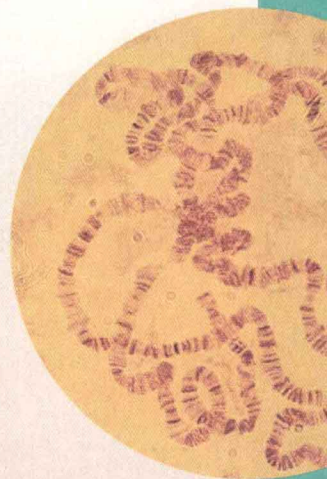
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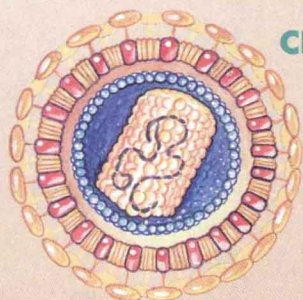






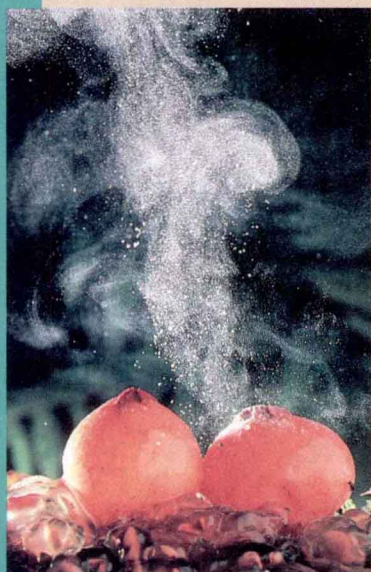
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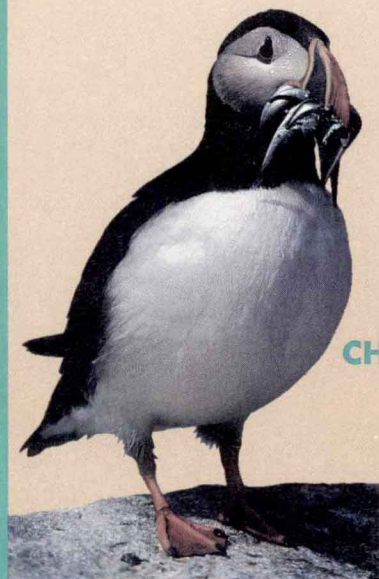
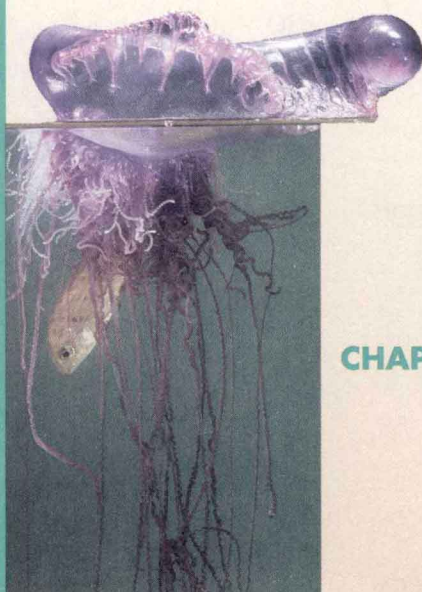
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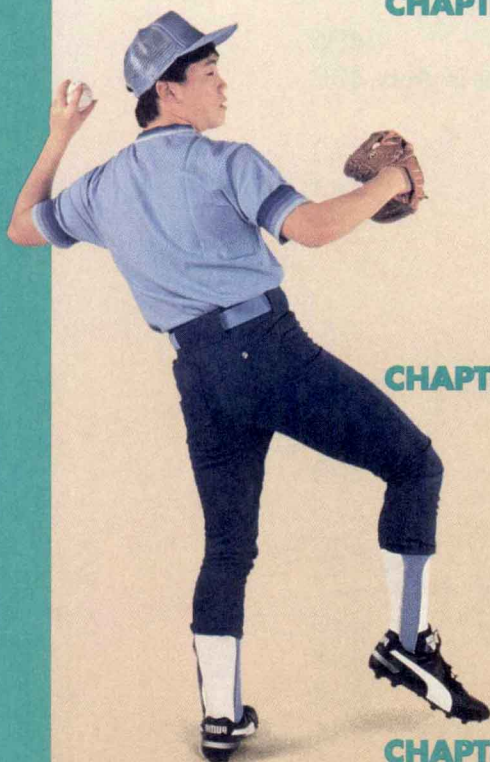
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