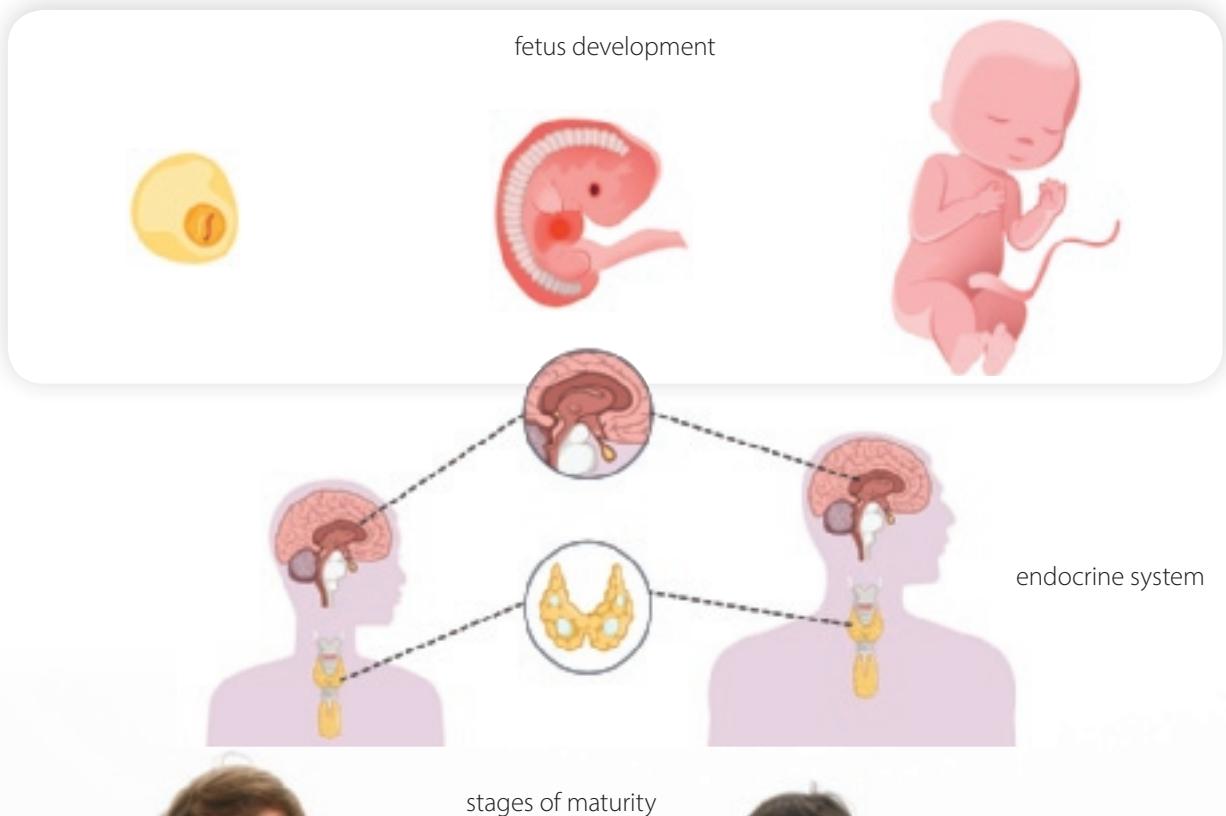


# Human Hormones and Reproduction

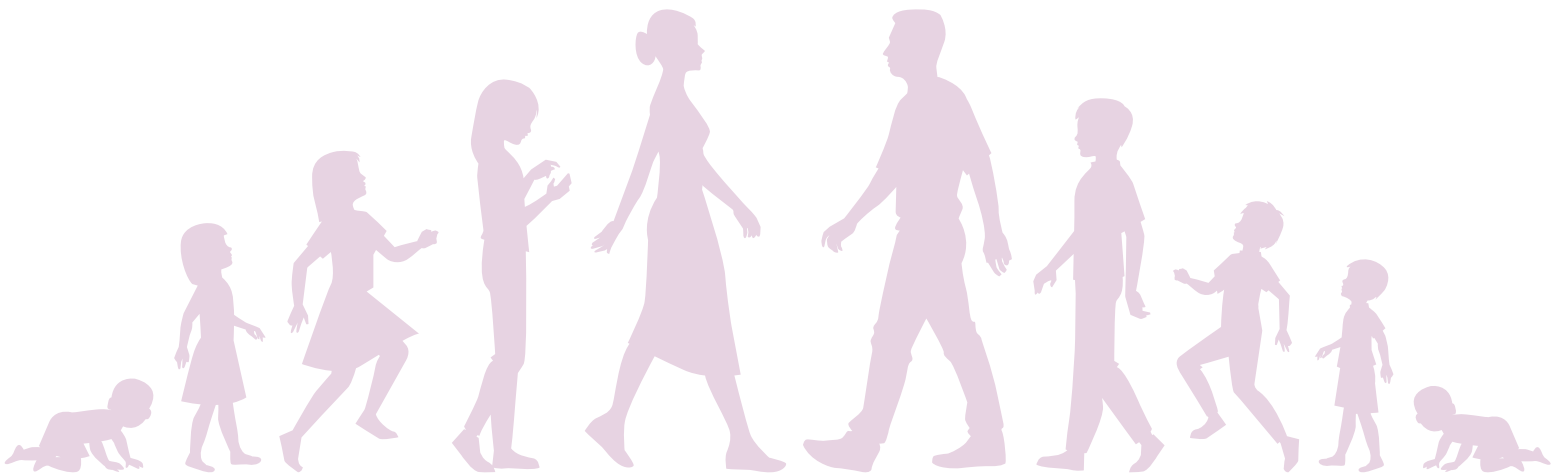
## Teacher Guide





# Human Hormones and Reproduction

## Teacher Guide



Core Knowledge®

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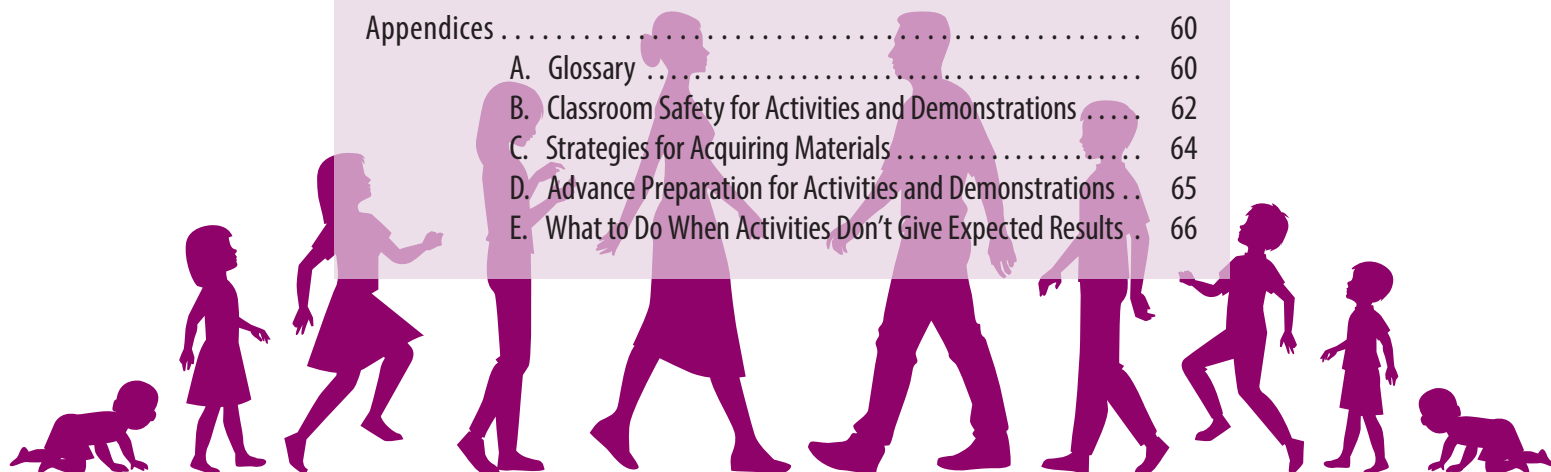
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# **Human Hormones and Reproduction**

## **Teacher Guide**

Core Knowledge Science™ 5

# Introduction

## ABOUT THIS UNIT

### The Big Idea

This unit focuses on the release of hormones throughout the human body and how those changes prepare the body for sexual reproduction.

Students will be familiar with the circulatory system, the main pathway for the flow of hormones through the human body. What they may not be familiar with are the different ways in which hormones are released; the different body structures, such as glands, that release hormones; and the effects of hormones on the body. The release of hormones is necessary both for day-to-day body functions and for the growth and development of the human body.

In this unit, students will consider the endocrine system, the hormones released, and the hormones' role in human growth and development. Depending on the phase of life, the endocrine system will release hormones that trigger growth and development. With the onset of puberty, the human body will develop so that it may reproduce through sexual reproduction.

Students also build on their understanding from previous grades about human body structures and their functions. Students also discover how the human body changes from birth, through childhood, through puberty, and to adulthood.

### Note to Core Knowledge Teachers

Thanks to ongoing research in the field, our understanding of how children learn continues to evolve. In the subject area of science, students benefit not just from reading about concepts and ideas, but from hands-on experiences. Following the release of the Next Generation Science Standards (NGSS), the Core Knowledge Foundation used this opportunity to update and enhance the science portion of the *Core Knowledge Sequence*.

While there have been some shifts in the grade levels at which certain topics are recommended, the fundamental principles of pedagogy inherent to the Core Knowledge approach, such as the importance of building a sequential, coherent, and cumulative knowledge base, have been retained.

Although the NGSS guidelines do not reference teaching about the human body, the Core Knowledge Foundation considers student knowledge of this topic, and health, an important part of students' instruction and learning. As a result, this unit can be used in conjunction with the other CKSci units at this grade level or on its own.

#### Online Resources



To learn more about the changes and to access resources for this unit, please use the links found in the Online Resources Guide:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

This science unit embodies Core Knowledge's vision of best practices in science instruction and knowledge-based schooling, such as the following:

- building students' knowledge of core ideas in life, physical, and Earth sciences, as well as engineering design
- developing scientific practices that give students firsthand experience in scientific inquiry, engineering, and technology
- connecting scientific learning to concepts across various disciplines, such as mathematics and literacy

## Related NGSS Dimensions\*

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This unit, *Human Hormones and Reproduction*, provides the opportunity to further reinforce the following NGSS Dimensions:

### Science and Engineering Practices:

- Developing and using models
- Engaging in argument from evidence

### Crosscutting Concepts:

- Cause and effect
- Stability and change

#### Online Resources



For detailed information about the NGSS References, follow the links in the Online Resources Guide for this unit:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

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\*NEXT GENERATION SCIENCE STANDARDS (NGSS) is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and their endorsement is not implied.

#### Sources:

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

National Research Council. 2012. *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Committee on a Conceptual Framework for New K–12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.



### What Students Should Already Know

The concept of progressions, articulated in the National Research Council's *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, is very much aligned to the Core Knowledge principle of building new knowledge on prior knowledge. According to the NRC, students build “progressively more sophisticated explanations of natural phenomena” over the course of many years of schooling. “Because learning progressions extend over multiple years, they can prompt educators to consider how topics are presented at each grade level so that they build on prior understanding and can support increasingly sophisticated learning.” In schools following NGSS recommendations, teachers can build on the “prior understandings” captured in the following summaries of NGSS Disciplinary Core Ideas:

#### LS1.A: Structure and Function

- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.

### What Students Need to Learn

For this unit, the *Core Knowledge Science Sequence* specifies the following content and skills. Specific learning objectives are provided in each lesson throughout the unit.

#### Lesson 1: Growth and Change

- Summarize observable characteristics of stages of the human maturation cycle.

#### Lesson 2: Glands and Hormones

- Define *hormone* and *gland*.
- Describe components of the endocrine system.

#### Lesson 3: The Hypothalamus, Pituitary, and Adrenal Glands

- Explain the function of the pituitary gland.
- Explain the function of the adrenal glands.

## Lesson 4: The Thyroid and the Pancreas

- Explain the function of the thyroid.
- Explain the function of the pancreas.

## Lesson 5: Human Adolescence

- Define *adolescence*.
- Characterize changes that occur during puberty for males and females.

## Lesson 6: The Reproductive System

- Summarize the structures of the female human reproductive system and their functions.
- Summarize the structures of the male human reproductive system and their functions.

## Lesson 7: Sexual Reproduction

- Define *sexual reproduction*.

## What Teachers Need to Know

Supportive information on the content standards and the science they address is provided throughout the lessons at points of relevance:

**Know the Standards:** These sections, found later in this Teacher Guide, explain what to teach and why, with reference to NGSS and Core Knowledge expectations, as well as connections to relevant math and reading language arts standards.

**Know the Science:** These sections provide supporting, adult-level, background information or explanations related to specific science concepts, examples, or Disciplinary Core Ideas.

## USING THE STUDENT READER

Student Reader



The *Human Hormones and Reproduction* Student Reader has seven chapters and a student Glossary providing definitions to Core Vocabulary words. Engaging text, photographs, and diagrams encourage students to draw upon their own experiences and the world around them to understand scientific concepts. In addition to Core Vocabulary, the Student Readers include a feature called Word to Know, which provides background information to help students understand key terms, and may sometimes include additional informational boxes, such as Think About.

Independent reading or group read-aloud: While the text in the Student Readers is written for independent reading, we encourage group read-alouds and engagement with the text. The Teacher Guide provides Guided Reading Supports to prompt discussion, clarify misconceptions, and promote understanding in relation to the Big Questions.

## USING THE TEACHER GUIDE

### Pacing

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The *Human Hormones and Reproduction* unit is one of six units in the Grade 5 CKSci series. We encourage teachers who are using the full series to complete all units during the school year. Each Core Lesson requires thirty to forty-five minutes of instruction time. The time it takes to complete a full lesson depends on class size and individual circumstances. Each lesson concludes with a Check for Understanding, providing the teacher with an opportunity for formative assessment.

At the end of this unit introduction, you will find a blank Pacing Guide on page 10, which you may use to plan how you might pace the lessons, as well as when to use the various other resources in this unit. We strongly recommend that you preview the unit in full before beginning and create your pacing guide before teaching the first lesson. As a general rule, we recommend that you spend no more than ten days teaching the *Human Hormones and Reproduction* unit so that you have time to teach the other units in the Grade 5 CKSci series.

If you are familiar with the previous units at this grade level, you may notice that this unit differs slightly in organization from the NGSS units in the CKSci program. Lessons in the NGSS CKSci units are comprised of multiple segments that build to students' demonstration of a complex Performance Expectation. Because *Human Hormones and Reproduction* is not designed to support any specific NGSS Performance Expectation, the instructional episodes are not grouped into multipart lessons. As such, they are identified simply as *lessons* instead of *lesson segments*.

### The Core Lessons

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- Lesson time: Most Core Lessons constitute one classroom session of thirty to forty-five minutes. Some activities and performance tasks might require setting aside a longer block of time.
- Lesson order: The lessons are coherently sequenced to build from one to the next, linking student engagement across lessons and helping students build new learning on prior knowledge.

<b>Unit Big Question:</b> How do humans change as they mature?		<b>Lesson Big Questions</b>
<b>Lesson 1</b>	Growth and Change	How do humans change as they mature?
<b>Lesson 2</b>	Glands and Hormones	What is the endocrine system?
<b>Lesson 3</b>	The Hypothalamus, Pituitary, and Adrenal Glands	What do the hypothalamus, pituitary, and adrenal glands do?
<b>Lesson 4</b>	The Thyroid and the Pancreas	What do the thyroid and pancreas do?
<b>Lesson 5</b>	Human Adolescence	What are puberty and adolescence?
<b>Lesson 6</b>	The Reproductive System	What are the parts of the human reproductive system, and how do they function?
<b>Lesson 7</b>	Sexual Reproduction	What is sexual reproduction?

## Activity Pages

### Activity Pages



AP 1.1  
AP 2.1  
AP 3.1  
AP 4.1  
AP 5.1  
AP 6.1  
AP 7.1  
AP 7.2

Black line reproducible masters for Activity Pages, as well as an Answer Key, are included in Teacher Resources on pages 50–59. The icon shown to the left appears throughout the Teacher Guide wherever Activity Pages (AP) are referenced.

Lesson 1—Growth and Change from Infancy to Childhood (AP 1.1)

Lesson 2—Structures of the Endocrine System (AP 2.1)

Lesson 3—Parts of the Endocrine System (AP 3.1)

Lesson 4—More Parts of the Endocrine System (AP 4.1)

Lesson 5—Growth and Change from Childhood to Puberty (AP 5.1)

Lesson 6—Body Changes for Sexual Reproduction (AP 6.1)

Lesson 7—Internal or External Fertilization? (AP 7.1)

Lesson 7—Growth and Change from Puberty to Adulthood (AP 7.2)

## Online Resources for Science

### Online Resources



For each CKSci unit, the Teacher Guide includes references to online resources (including external websites and downloadable documents) to enhance classroom instruction. Look for the icon on the left.

Use this link to download the CKSci Online Resources for this unit:

**[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)**

## Teaching Strategies

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### **Start with the familiar.**

Lead with an experience. Begin each lesson with a demonstration, activity, or question about a phenomenon to engage students and focus their attention on the topic. Start with the familiar. Every science topic introduced to students relates in some way to their known world and everyday experiences. The purpose of every lesson is to build a bridge between what is familiar to students and broader knowledge about the way the world works.

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### **Ask driving questions.**

The unit is governed by a Big Question, and each lesson poses a more specific subquestion as students are introduced to new science content. Use these questions to engage students in conversation and help them think about how their own real-world experiences relate to the topic.

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### **Encourage scientific thinking.**

Approach the lessons with students not as learning about science but as learning about the world with a scientific mind. Science learning models science practice.

Throughout the lessons, encourage students to ask questions about what they observe, do, and read. Record relevant questions in a prominent place in the classroom. Guide students back to these questions as opportunities to answer them emerge from readings, demonstrations, and activities.

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### **Use continuous Core Vocabulary instruction.**

During instruction, emphasize Core Vocabulary terms and their meanings in context rather than relying on isolated drill for memorization of definitions. Through scaffolded questioning, encourage students to come up with definitions in their own words and to use the words in their own sentences.

Core Vocabulary words for each lesson, as well as Language of Instruction, other key terms teachers are encouraged to use in discussing topics with students, are provided at the start of each lesson. You can find Core Vocabulary and Language of Instruction definitions in the Glossary on pages 60–61.

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### **Emphasize observation and experience.**

Lessons employ various ways for students to learn, including watching, listening, reading, doing, discussing, and writing.

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### **Use science practices.**

Give students opportunities to discover new content knowledge through investigation and to use their new knowledge both in problem-solving exercises and as evidence to support reasoning. Students learn what science and engineering practices are by engaging in those same practices as they learn.

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### **Make frequent connections.**

Use a combination of demonstrations and reading materials, rich with examples, to help students recognize how the science concepts they are learning apply in their everyday lives. Prompt students to relate lesson content to their own experiences, to relate the new and unfamiliar to the familiar, and to connect ideas and examples across disciplines.

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**Monitor student progress.**

Use verbal questioning, student work, and the Check for Understanding assessments at the end of each lesson to monitor progress during each lesson and to measure understanding at the conclusion of the unit. Many lessons provide tips to help you support students who need further explanations or clarifications.

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## Effective and Safe Classroom Activities

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### Online Resources



Conducting safe classroom demonstrations and activities is essential to successful elementary science education. The following resources provide Core Knowledge's recommendations for developing effective science classroom activities.

These resources, included at the back of the Teacher Guide on pages 62–66, consist of the following:

- Classroom Safety for Activities and Demonstrations
- Strategies for Acquiring Materials
- Advance Preparation for Activities and Demonstrations
- What to Do When Activities Don't Give Expected Results

These resources may also be accessed within the CKSci Online Resources Guide for this unit, available at

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

## MATERIALS AND EQUIPMENT

The unit requires a large variety of materials to support various ways of learning (including doing, discussing, listening, watching, reading, and writing). Prepare in advance by collecting the materials and equipment needed for all the demonstrations and hands-on investigations.

- Roll paper, poster board, or a bulletin board should be dedicated at the beginning of the unit to serve as a question board to cumulatively document and return to student questions. The question board is referred to in the materials for lessons in which it is used but is not repeated in the materials listed here.
- Internet access and the means to project images/videos for whole-class viewing are also required in many lessons but are not repeated below.

## **Lesson 1 Growth and Change**

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- clock or stopwatch

## **Lesson 2 Glands and Hormones**

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- scales or balance (teacher demo)
- masses for use with scales (teacher demo)

## **Lesson 3 The Hypothalamus, Pituitary, and Adrenal Glands**

- jack-in-the-box (teacher use)
- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)

## **Lesson 4 The Thyroid and the Pancreas**

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- water in a pitcher (teacher demo)
- sugar (teacher demo)

## **Lesson 5 Human Adolescence**

- poster paper (1 per class)
- markers (1 set per class)

## **Lesson 6 The Reproductive System**

- poster paper (1 per class)
- markers (1 set per class)
- student-sized chair (teacher/student demo)

## **Lesson 7 Sexual Reproduction**

- poster paper (1 per class)
- markers (1 set per class)

## HUMAN HORMONES AND REPRODUCTION PACING GUIDE

\_\_\_\_\_’s Class

**Note to Teacher:** When using *Human Hormones and Reproduction* as part of the Grade 5 CKSci series, this unit is intended to be taught as the sixth unit of Grade 5 CKSci.

### Week 1

Day 1

Day 2

Day 3

Day 4

Day 5

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### Week 2

Day 6

Day 7

Day 8

Day 9

Day 10

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### Week 3

Day 11

Day 12

Day 13

Day 14

Day 15

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## UNIT 6

# Human Hormones and Reproduction

### OVERVIEW

**Big Question:** How do humans change as they mature?

Lessons	Lesson Questions	Advance Preparation
1. Growth and Change	How do humans change as they mature?	Read Student Reader, Chapter 1.  Gather materials for student investigation. (See Materials and Equipment, page 9.)
2. Glands and Hormones	What is the endocrine system?	Read Student Reader, Chapter 2.  Gather materials for student investigation.
3. The Hypothalamus, Pituitary, and Adrenal Glands	What do the hypothalamus, pituitary, and adrenal glands do?	Read Student Reader, Chapter 3.  Gather materials for student investigation.
4. The Thyroid and the Pancreas	What do the thyroid and pancreas do?	Read Student Reader, Chapter 4.  Gather materials for demonstration.
5. Human Adolescence	What are puberty and adolescence?	Read Student Reader, Chapter 5.  Gather materials for student investigation.
6. The Reproductive System	What are the parts of the human reproductive system, and how do they function?	Read Student Reader, Chapter 6.  Gather materials for student investigation.
7. Sexual Reproduction	What is sexual reproduction?	Read Student Reader, Chapter 7.  Gather materials for student investigation.

### What's the Story?

The human body has an endocrine system made up of glands that release hormones, chemicals that signal both short-term and long-term changes to the human body. Hormones such as adrenaline function to prepare the human body for immediate responses, such as the fight or flight syndrome. Hormones are also released that affect growth and development of the human body from birth through adolescence. Hormones are also released at the onset of puberty to develop and prepare the body for sexual reproduction.

**In Lessons 1–7,** students read about the endocrine system, hormones, and how hormones interact with the body to provide life functions. Students will also read about the changes the human body undergoes during childhood, through adolescence, and into adulthood. Reading about the endocrine system and body changes in this context is reinforced by student investigations into body changes.

## LESSON 1

# Growth and Change

**Big Question:** How do humans change as they mature?

**Tie to the Anchoring Phenomenon:** This lesson introduces the phenomenon of growth and change in the human body as driven by hormones released by glands in the body.

### AT A GLANCE

#### Learning Objectives

- ✓ Observe growth and changes in the human body from infancy to childhood.
- ✓ Document growth and changes in the human body from infancy to childhood.

#### Instructional Activities

- video and discussion
- reading and discussion
- vocabulary instruction

### Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**gland**      **growth**      **hormone**      **mature**

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**adolescent**      **adult**      **child**      **infant**  
**maturation**

## Instructional Resources

Student Reader



Ch. 1

Activity Page



AP 1.1

**Student Reader, Chapter 1**  
“Growth and Change”

### Activity Page

Growth and Change from  
Infancy to Childhood (AP 1.1)

Make copies for your students  
prior to conducting the lesson.

## Materials and Equipment

**Collect or prepare the following items:**

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- internet access and the means to project images/video for whole-class viewing

## THE CORE LESSON 45 MIN

### 1. Focus student attention on the Big Question.

10 MIN

Online Resources



Show students a time-lapse video of a baby growing and developing to a child. Point out that some changes humans go through, such as hair growth or the clothes they wear, are temporary changes and that other changes, such as skull size, are permanent. Throughout this unit, students will encounter physical changes in humans, and they should keep in mind whether the change is a temporary change or a permanent change. (See **Know the Science**.)

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

Stop the video so that students can discuss any notable changes. To help students focus on permanent physical changes, invite them to note physical changes they recall going through or have seen siblings and friends go through.

Share this Big Question with your class—**How do humans change as they mature?**

## Know the Science

**What other type of growth and development will a human undergo?** In addition to physical growth and movement, humans from infancy to childhood will also have milestones in their language and communications skills, their cognitive development, and their social and emotional development. In cases where milestones are missed, the child may simply be developing later, or there may be underlying conditions to the delayed or missing development.

Write the question on poster paper, and display it where students can refer to it throughout the unit. Invite students ask supporting questions, such as the following:

- » What body parts change?
- » Is growing the same thing as changing?
- » What makes my body change?
- » Can I change back?

Give students sticky notes on which to write their supporting questions, and attach the notes to the poster paper under the Big Question.

## 2. Focus student attention by investigating a phenomenon.

10 MIN

Activity Page



AP 1.1

- Distribute Growth and Change from Infancy to Childhood (AP 1.1).
- The concept of changes to the body will be revisited in Lesson 3 and Lesson 7, so elements introduced in shared classwork such as poster boards could be organized and revisited through the course of the unit.
- Have students complete the first question. Encourage students not only to note more obvious changes such as overall growth, but also to understand that something as simple as sitting up, crawling, or walking also requires muscle development, coordination, and cognitive development.

**CHALLENGE**—The focus of this unit is on physical growth and development, but students may benefit from learning and understanding the myriad changes that they will go through over the next few years. Explain that throughout their lives, students will grow not only physically but also cognitively, emotionally, and socially. Have students research some of the nonphysical changes they will go through as they grow and develop. Have students make posters or infographics to share what they learned. Alternately, student work could be added to the Big Question poster boards for reference throughout the unit.

**SUPPORT**—No two bodies are alike. Have students research the range of heights and weights infants, toddlers, and children fall in throughout the different years. Have students make posters or captioned pictures to share what they learned. Alternately, student work could be added to the Big Question poster boards for reference throughout the unit.

- Have students complete the other questions. Students may have some memories or experiences of learning that they can reference in their answers and discussions.

### 3. Read and discuss “Growth and Change.”

10 MIN

Student Reader



Ch. 1

Read together, or have students read independently, the Student Reader Chapter 1, “Growth and Change.” The selection introduces the unit on human hormones and reproduction.

#### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**gland**

**growth**

**hormone**

**mature**

#### Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

#### Page 1

Invite students to share their experiences of how they’ve seen themselves, siblings, or friends change as they’ve gotten older.

Ask students: How have you changed from when you were a newborn baby to now?

- » Sample answers: I used to crawl, but then I learned to walk. I am much taller and have hair.

Ask: What is the relationship between being mature and growth?

- » Sample answer: Once someone is mature, they stop growing.

#### Page 2

Prompt students to look at the silhouettes of the female and male figures. Ask: How does the human body change over time?

- » Sample answers: People grow taller and larger. Their body shapes change. As they grow, they develop more skills like running and speaking.

Ask: What role do hormones have in this growth and change?

- » Sample answer: Hormones can make parts of the body grow and change.

Make sure students understand that most living things go through some periods of growth and change but that each species does so within its own time frame.

## 4. Teach Core Vocabulary.

5 MIN

### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**gland**

**growth**

**hormone**

**mature**

### Word Work

**gland:** Clarify that humans have several different types of glands that release different types of hormones. In other words, a gland is not a single type of structure like a heart is.

**growth:** Point out that physical growth is just one type of growth humans undergo. Ask students to identify some other ways people grow, such as mentally or emotionally.

**hormone:** Make sure students understand that the human body produces many different chemical substances; the defining characteristic of hormones is that they are substances released within the body to make changes to the body.

**mature:** Point out that the word *mature* when used as an adjective can mean “fully developed,” but when someone says another person is mature for their age, they can also be talking about nonphysical characteristics such as emotional or intellectual maturity. When used as a verb, *mature* means to become fully developed.

## 5. Check for understanding.

10 MIN

Direct students to think about what they read in Chapter 1, and ask: What causes your body to grow and develop as you get older? Have students write a paragraph with their thoughts on the causes of why bodies grow and develop.

» Writing sample answer: When people eat food, their body takes in the nutrients. Organs in the body then respond, and the body starts growing taller and bigger.

Point out to students that the rest of the chapters in this unit will provide more details about what causes the human body to grow and develop.

### Formative Assessment

Review students’ responses to Growth and Change from Infancy to Childhood (AP 1.1). Invite students to share and compare their responses.

See the Activity Pages Answer Key for sample student responses.

Read students’ paragraphs about what causes the body to grow and change. If there is time, give students a chance to exchange their writing with another student, get peer feedback, and make revisions.

## LESSON 2

# Glands and Hormones

**Big Question:** What is the endocrine system?

**Tie to the Anchoring Phenomenon:** This lesson introduces the human endocrine system, giving students an overview of the parts and functions of the endocrine system.

### AT A GLANCE

#### Learning Objectives

- ✓ Identify structures and functions of the endocrine system.
- ✓ Determine causes and effects related to the release of hormones in the human body.

#### Instructional Activities

- reading and discussion
- labeling a diagram

### Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**endocrine system**

**homeostasis**

**metabolism**

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**control**

**feedback**

**feedback loop**

**process**

**secrete**

## Instructional Resources

Student Reader



Ch. 2

Activity Page



AP 2.1

**Student Reader, Chapter 2**  
“Glands and Hormones”

**Activity Page**  
Structures of the Endocrine System (AP 2.1)

Make copies for your students prior to conducting the lesson.

## Materials and Equipment

**Collect or prepare the following items:**

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- scales or balance (teacher demo)
- masses for use with scales (teacher demo)

## THE CORE LESSON 45 MIN

### 1. Focus student attention on the Big Question

5 MIN

Share the Big Question with your class—**What is the endocrine system?** Invite students to propose answers and accept all reasonable responses.

Ask students to try to hold their breath for as long as they can. Once students stop holding their breath and are breathing normally, point out that by holding their breath, they are preventing the body from meeting a need, namely oxygen. Students’ bodies sent signals to other parts of their bodies that directed structures in the body to increase the intake of oxygen. Have students brainstorm some other needs of the body and post them on notes on the poster board.

### 2. Read and discuss “Glands and Hormones.”

25 MIN

Student Reader



Ch. 2

Read together, or have students read independently, the Student Reader Chapter 2, “Glands and Hormones.” The selection introduces the unit on the endocrine system and human hormones.

#### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**endocrine system**

**homeostasis**

**metabolism**

#### Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:



## Pages 3–4

Explain to students that to maintain homeostasis, each body system must be balanced within itself and with the other systems with which it interacts. A deficiency or surplus that affects one system can affect many systems.

**SUPPORT**—Set up a scale or balance with weight on one end. Explain that the weight is the demand for blood sugar.

Ask students: What happens if the demand for blood sugar is high?

» Sample answer: You feel hungry.

Add weights to the empty pan until there is more “food” than demand for blood sugar.

Ask: What happens once the amount of food eaten is greater than the demand?

» Sample answer: You feel full and stop eating.

Point out that a balanced diet, with the right amounts of substances like calcium for bones and vitamins to maintain body functions, can help the endocrine system stay balanced. Eating too much of some foods, such as those high in sugar, fat, or protein, can cause the endocrine system to get out of balance.

Set up a cause-and-effect graphic organizer in the classroom, and under “cause” write “holding breath.” Ask students what the effect of holding their breath was. Continue doing the same with a cause of “I feel hungry,” and ask students what the effect is. Set up a third graphic organizer with the cause of “I eat food,” and ask students what the effect is. Point out that “I feel hungry” leads to an effect of “I eat food,” which then can be a cause with the effect of “I feel full.” This control and regulation loop for meeting body needs is the basis for homeostasis.

Ask: What system helps the body maintain homeostasis?

» Sample answer: the endocrine system

## Pages 5–6

Point out that metabolic needs will change with a person as they grow and change but that there is a basic level that their body needs. Stresses to the body such as exercising or not getting enough sleep can affect their metabolism.

The hormones listed on these two pages are more related to day-to-day functioning. Prompt students to think about a daily function they go through or do. Ask students to use a cause-and-effect graphic organizer to break their function down to a response by their hormones. Accept all plausible answers. You may wish to have students revise their graphic organizers once the applicable chapter on hormones has been covered.

## Page 7

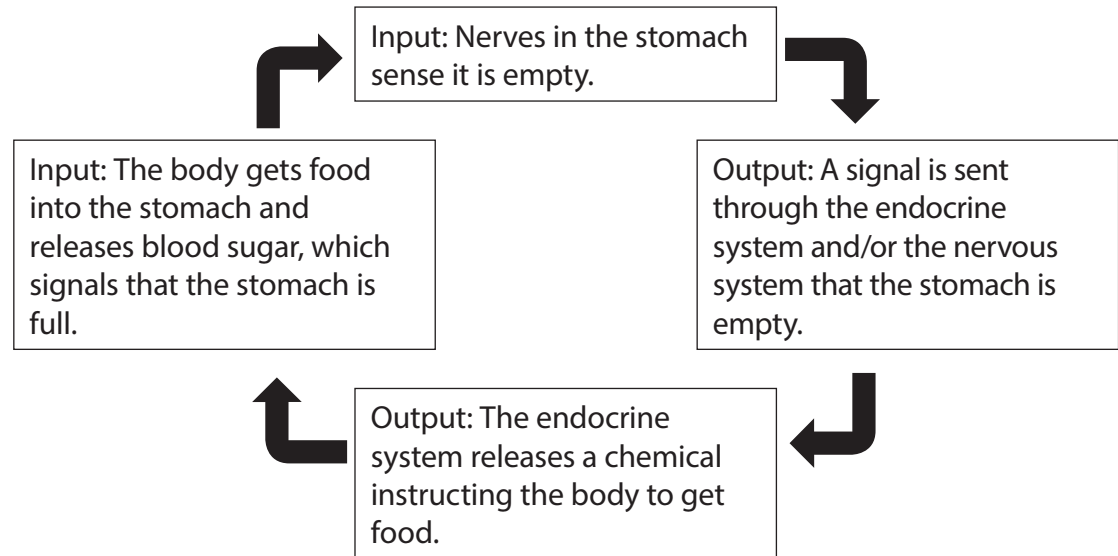
Ask: How are these hormones different from the hormones on the previous pages?

» Sample answer: The hormones listed on this page are more related to long-term functions such as growth and reproduction.

Have students name hormones and glands and classify them as more necessary for day-to-day functioning, growth, or both.

**SUPPORT**—Play a game in which you call out the name of a hormone and have students identify the source of the hormone.

Feedback loops can be thought of in terms of inputs and outputs. The nerves in the empty stomach sense it is empty as an input. An output signal is then sent to the body that the stomach is empty and needs food. The endocrine system receives the signal as an input and then secretes hormones as an output that signals the body to eat. The body then gets food, the stomach fills, and the blood sugar goes up. The body would sense these changes and signal that the stomach is full.



**SUPPORT**—Have students revisit the example of holding their breath and create the feedback loop for that phenomenon.

**EXTEND**—Have students revisit their examples of needs from the start of the lesson and diagram the feedback loops related to those needs.

Point out to students that feedback loops are interconnected to each other. For example, in response to eating food, the body will also slow down some systems to process the food, which in turn makes the person who ate the food sleepy. Because they may sleep, the body will have a response that means they may have trouble falling asleep later in the day due to the nap they took in the middle of the day. (See **Know the Science.**)

## Know the Science

**How many different hormones are there?** One important thing about hormones is that they are produced in one part of the body and have an effect on another part of the body. The human body releases sixty-four different hormones and twelve different steroids through the endocrine system. Most of these chemicals are released by only one gland, but some, like progesterone, can be released by the ovaries, the adrenal glands, or, when pregnant, the placenta. The ones listed in this unit are more primary to the functioning of the human body and are released in larger quantities, but many of the other hormones play small but vital roles in the endocrine system.

### 3. Teach Core Vocabulary.

5 MIN

#### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**endocrine system**

**homeostasis**

**metabolism**

#### Word Work

**endocrine system:** Remind students that as a system, the endocrine system has parts with different functions that all serve the common goal of keeping the human body alive.

**homeostasis:** Remind students that although homeostasis refers to a balanced state, as humans grow and develop those balanced states can change, such as when someone needs more food because they are growing taller.

**metabolism:** Remind students that metabolism can change as they grow and develop.

### 4. Check for understanding.

10 MIN

Activity Page



AP 2.1

Distribute Structures of the Endocrine System (AP 2.1) to students, and have them follow the directions to complete the diagram and table. Have students refer to Chapter 2 as needed. See the Activity Pages Answer Key for sample student responses.

#### Formative Assessment

Return students' attention to the Big Question for this lesson—**What is the endocrine system?** Have students refer to what they read and discussed in Chapter 2, along with the feedback loops, when answering the question.

Review students' work on Structures of the Endocrine System (AP 2.1), and look for evidence that they can identify structures of the endocrine system and functions such as hormones released.

## LESSON 3

# The Hypothalamus, Pituitary, and Adrenal Glands

**Big Question:** What do the hypothalamus, pituitary, and adrenal glands do?

**Tie to the Anchoring Phenomenon:** This lesson provides details about the functions of the hypothalamus, pituitary, and adrenal glands in the endocrine system and the roles they play in the growth and development of the human body.

## AT A GLANCE

### Learning Objectives

- ✓ Observe parts of the endocrine system.
- ✓ Explain how feedback loops work in response to a stimulus.

### Instructional Activities

- reading and discussion
- vocabulary instruction
- labeling a diagram

## Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**adrenal gland**

**hypothalamus**

**pituitary gland**

**NOTE:** The pituitary gland in this lesson and the thyroid gland in the next lesson may be referred to as “pituitary” and “thyroid.” Common usage tends to not use “gland” in naming these structures, though “gland” indicates a class of organ.

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**adrenaline**      **reaction**

## Instructional Resources

Student Reader



Ch. 3

Activity Page



AP 3.1

**Student Reader, Chapter 3**  
“The Hypothalamus, Pituitary, and Adrenal Glands”

**Activity Page**  
Parts of the Endocrine System  
(AP 3.1)

Make copies for your students prior to conducting the lesson.

## Materials and Equipment

**Collect or prepare the following items:**

- jack-in-the-box (teacher use)
- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- internet access and the means to project images/video for whole-class viewing

### Advance Preparation

As an alternative to the jack-in-the-box, consider substituting a balloon to pop or some other low-level surprise. The purpose of the item is to spark an autonomic response from students.

## THE CORE LESSON 45 MIN

### 1. Focus student attention with a demonstration.

5 MIN

Ask students to sit still for a minute and then write down how they feel. Set the jack-in-the-box where the whole class can see it. Ask for silence, and start to turn the crank slowly until the box pops open. Have a discussion with the class about how they felt right before and right after the box popped open.

Some students may note they were not surprised while others may note they were surprised despite knowing what would happen. Have students create a cause-and-effect diagram for the way their body reacted.

Ask students: What is the name of the response when someone is surprised?

» Sample answer: the fight or flight response

### 2. Read and discuss “The Hypothalamus, Pituitary, and Adrenal Glands.”

25 MIN

Student Reader



Ch. 3

Read together, or have students read independently, the Student Reader Chapter 3, “The Hypothalamus, Pituitary, and Adrenal Glands.” The selection describes the functions of these three parts of the endocrine system.

## Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

### Page 9

Work with students to diagram or act out how their bodies reacted to the jack-in-the-box popping out in terms of the interaction of the hypothalamus with the nervous systems, namely sight and hearing. If needed, point out that when students saw or heard the popping out, the nervous system sent a signal to the brain through the hypothalamus. The hypothalamus then secreted a hormone that made their body react to the stimulus, such as being physically startled and their pulse and breathing increasing.

The term *hypothalamus* and its function can be remembered as a mnemonic that its role in the endocrine system is to greet chemical signals sent to the brain. The hypothalamus greets the signals, in effect saying “hi” to the signals, making it the “HI!-pothalamus.”

### Pages 10–11

Revisit the concept of feedback loops as the method by which hormones are regulated. Point out that feedback loops are either negative feedback loops or positive feedback loops. As the body tries to maintain homeostasis, each hormone has a baseline level in the body. In a negative feedback loop, the amount of hormone released is reduced, and in a positive feedback loop, the amount of hormone released is increased. (See **Know the Science.**)

#### Online Resources



Show students a video that covers the basics of feedback loops. A feedback loop is made up of sets of cause-and-effect sequences linked together. Have students break a feedback loop down to a set of linked cause-and-effect chains. Lead students to understand that the end of the chain then becomes the beginning of the loop. (See **Know the Standards.**)

## Know the Science

**Hormones and Feedback Loops**—In a negative feedback the goal is to maintain a stable condition. For example, once someone eats, their blood sugar level goes up, causing a release of the hormone insulin. Once the blood sugar level goes down toward its baseline homeostasis level, insulin ceases being released. Positive feedback loops are far less common. Positive feedback loops involve adding more of a hormone to a baseline level, and the goal is to amplify a condition. For example, during childbirth, the human body releases more of the hormone oxytocin to aid in muscle contractions during labor.

## Know the Standards

**CCC 2 Cause and Effect**—As students break a feedback loop down, have them identify the stimulus that is the root cause for the loop. This will help students determine when the reaction to a stimulus by the feedback loop has resolved.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

**EXTEND**—Have interested students make a feedback loop for some basic, everyday function such as sneezing or crossing the street when a signal is given.

### Pages 12–13

After reading the pages, ask students: What body system forms the path for hormones to move through the body?

» Sample answer: the circulatory system

Ask students: How would a hormone being released that makes the heart beat faster be important in the fight or flight response?

» Sample answer: It helps move blood and oxygen around the body in preparation to fight or run.

The purpose of regulation of hormones through the adrenal glands is to maintain homeostasis. Ask students to think of a time when they could feel their body wanting something, like oxygen. Have them describe what the cause might have been, why they may have felt that way, and the effect that removed or reduced the want.

**EXTEND**—Maintaining homeostasis is vital to a healthy life. Have students research the effect of having too much of one substance in the body, such as too much salt, calcium, other minerals, or water. Ask students to present their findings in terms of the causes and effects too much of their substance has on the human body.

### Page 14

Make sure students understand that while disorders of the endocrine system can be life-threatening, advances in treatment mean that most endocrine system disorders are quite treatable. Additionally, many of the disorders of the adrenal and pituitary glands are rare. For example, acromegaly shows up in about three adults per million. This means that in the United States, six people will be diagnosed with acromegaly in a year.

**SUPPORT**—Given that students' bodies are starting to change as they enter puberty, encourage students with concerns to research disorders with the intent of identifying the disorder, the age at which the disorder is diagnosed, and how the disorder is treated.

## 3. Teach Core Vocabulary.

5 MIN

### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**adrenal gland**

**hypothalamus**

**pituitary gland**

## Word Work

**adrenal gland:** Make sure students understand that the adrenal glands secrete hormones that regulate many body functions.

**hypothalamus:** The word *hypothalamus* comes from Latin borrowed from ancient Greek and presented in a paper in German. *Hypo-* means “under,” and *thalamus* means “chamber.”

**pituitary gland:** Remind students that the pituitary gland sits near the hypothalamus below the brain and acts as the master gland for the human body.

## 4. Check for understanding.

10 MIN

Activity Page



AP 3.1

### Formative Assessment

Distribute Parts of the Endocrine System (AP 3.1). Have students follow the directions to label the diagrams and write their cause-and-effect statements. Review students' work, and see the Activity Pages Answer Key sample answers.

Return to this lesson's Big Question—**What do the hypothalamus, pituitary, and adrenal glands do?** Direct students to think about what they read in Chapter 3 to answer this question. Look for evidence in a class discussion that students recognize the following:

- The hypothalamus receives signals from the nervous system and transmits those signals to and from the brain.
- The hypothalamus directs hormone activity through the pituitary gland.
- The pituitary gland sends hormones out to other glands to signal the release of other hormones through those glands.
- The adrenal glands provide regulation of both day-to-day functions and longer-term functions.

Refer students to this unit's Big Question—**How do humans change as they mature?** Invite students to share what they learned in this lesson that helps them answer the question. Students should recognize that the changes their bodies will go through, both daily and long term, will be coordinated by the endocrine system.



## LESSON 4

# The Thyroid and the Pancreas

**Big Question:** What do the thyroid and pancreas do?

**Tie to the Anchoring Phenomenon:** This lesson provides details about the functions of the thyroid and pancreas in the endocrine system and the roles they play in the growth and development of the human body.

## AT A GLANCE

### Learning Objectives

- ✓ Observe and identify parts of the endocrine system.
- ✓ Explain how feedback loops work in response to a stimulus.

### Instructional Activities

- reading and discussion
- vocabulary instruction
- labeling a diagram

## Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**pancreas**

**thyroid**

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**diabetes**

**duct**

**insulin**

**metabolism**

**rate**

## Instructional Resources

Student Reader



Ch. 4

Activity Page



AP 4.1

### Student Reader, Chapter 4

“The Thyroid and the Pancreas”

### Activity Page

More Parts of the Endocrine System (AP 4.1)

Make copies for your students prior to conducting the lesson.

## Materials and Equipment

### Collect or prepare the following items:

- poster paper (1 per class)
- markers (1 set per class)
- sticky notes (1 pad per class)
- water in a pitcher (teacher demo)
- sugar (teacher demo)
- internet access and the means to project images/video for whole-class viewing

## THE CORE LESSON 45 MIN

### 1. Focus student attention on the Big Question.

5 MIN

Online Resources



Show a video of one family’s experience when their daughter is diagnosed with diabetes.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

Point out that Molly was diagnosed early enough when symptoms were noticeable. Explain that while there isn’t a cure for diabetes, there are many ways to control the effects of diabetes to reduce their impact on a person’s life but that they will need to make some changes to help manage their diabetes.

Share the Big Question with your class—**What do the thyroid and pancreas do?** Display this question where students can refer to it throughout the lesson, and tell students that they will be able to answer it at the end of this lesson.

### 2. Read and discuss “The Thyroid and the Pancreas.”

25 MIN

Student Reader



Ch. 4

Read together, or have students read independently, the Student Reader Chapter 4, “The Thyroid and the Pancreas.”

### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**pancreas**

**thyroid**

## Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

### Pages 15–16

Students learned the word *metabolism* in Chapter 2. Remind them that it is the combined chemical and energy processes—anabolism being the building of chemicals and catabolism being the breaking down of chemicals—that occur continuously in the body. The human body gets most of these chemicals and energy from its diet. Students may have the impression that the body needs a certain level of chemicals and energy to maintain homeostasis, but the human body stores and releases chemicals and energy throughout the day to meet its needs.

A person's metabolic rate is the rate at which their body consumes energy. A rate is one quantity measured per unit of another quantity. Write "1,800 calories/day" on the board. Explain that this rate is the amount of energy the average Grade 5 student will use, and need to replace, in a day. (See **Know the Standards.**)

Ask students: How many calories will a body consume in one hour?

» Sample answer: seventy-five calories

Explain that ninety-five calories is about the same amount of energy in a medium-sized apple. Have students calculate the number of calories their body would consume between lunch and dinner. (See **Know the Science.**)

Ask students: Why might someone have snack time after a soccer game?

» Sample answer: to replace the calories used up playing soccer

## Know the Standards

**Math Connection**—Common Core Mathematics Standard CCSS.MATH.CONTENT.5.NBT.B.6 requires students to illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. Though students may write the equations, prompt the students to apply other methods to explain the calculation. (**CCSS.MATH.CONTENT.5.NBT.B.6**)

## Know the Science

**What is a calorie?** As commonly used, the term *calorie* refers to the amount of energy required to raise the temperature of 1,000 grams of water by one degree Celsius. It is a measure of thermal energy, and in this context it is a measure of the chemical energy in food. Grade 5 students need between 1,600 for a sedentary student to 2,200 calories a day for an active student.

**CHALLENGE**—Have students record what they eat for a day and then calculate the number of calories they consumed. Then have students calculate the rate they would have to burn those calories over the course of a day to burn all the calories they consume in that day.

Explain that, much like calories, the different hormones secreted by the body are used up at different rates based on the needs of the body.

## Page 17

As with other disorders, remind students that their bodies are or will be going through many changes in the coming years. Many symptoms of thyroid diseases, such as irritability, trouble sleeping, depression, and weight gain or loss, are also symptomatic of the changes students will be going through. It is always best to have a doctor provide a diagnosis of any possible disorder.

**EXTEND**—Encourage students to research specific disorders of the thyroid, and have them name the disorder, symptoms, and treatment.

Approximately twenty million people in the United States have some form of thyroid condition, and of that twenty million, roughly twelve million go undiagnosed, so many of the cases of thyroid disorders are inconvenient more than fatal. Make sure students understand that most of the disorders are manageable and easy to treat.

## Pages 18–19

The pancreas has a duct running through its center through which pancreatic juice is secreted. *Duct* is a term meaning “passageway.” The human body has many ducts that serve as passageways for fluids, such as tear ducts through which tears flow into the eyes.

To help students understand how little sugar is in the blood sugar calculation, show students a pitcher of water with 2.5 quarts (2.3 liters), and tell students that this represents the total blood volume in a Grade 5 student. Then show them three-fourths of a teaspoon of sugar. Point out that this is roughly 3.15 grams of sugar. This represents the amount of sugar in the blood before a meal. To maintain homeostasis, the body needs between two and 4.5 grams of sugar.

Ask students: What happens to the homeostasis of the body when you eat a candy bar with thirty grams of sugar in it?

» Sample answer: Homeostasis is thrown out of balance, and the body has to release hormones to deal with the excess sugar.

## Page 20

Online Resources



About one in ten Americans has type 2 diabetes. Because this type of diabetes develops over time, there are ways to delay the onset of type 2 diabetes. Have students research the causes of type 2 diabetes and ways people can reduce or prevent its onset.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

### 3. Teach Core Vocabulary.

5 MIN

#### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**pancreas**

**thyroid**

#### Word Work

**pancreas:** Make sure students understand that the pancreas functions as an organ to release digestive juices through a duct as well as functions as a gland to release insulin and glucagon.

**thyroid:** Explain that the word *thyroid* comes from a Greek term for “shield-shaped” or “shaped like a door.”

### 4. Check for understanding.

10 MIN

Activity Page



AP 4.1

#### Formative Assessment

Distribute More Parts of the Endocrine System (AP 4.1). Have students follow the directions to label the diagrams and write their cause-and-effect statements. Review students' work, and see the Activity Pages Answer Key sample answers.

Return to this lesson's Big Question—**What do the thyroid and pancreas do?** Direct students to think about what they read in Chapter 4 to answer this question. Look for evidence in a class discussion that students recognize the following:

- The thyroid many aspects of daily metabolism, such as heart rate and body temperature.
- The pancreas releases insulin and glucagon, which control blood sugar in the body.

#### Formative Assessment

Review students' writing on More Parts of the Endocrine System (AP 4.1) to determine how well they understand the core science concepts of this lesson as well as the direction to write creatively.

LESSON 5

# Human Adolescence

**Big Question:** What are puberty and adolescence?

**Tie to the Anchoring Phenomenon:** At the completion of this lesson, students will have a better understanding of the period of life known as adolescence. Students will learn to identify early-, middle-, and late-stage changes in both females and males during puberty.

AT A GLANCE

Learning Objectives

- ✓ Identify changes in females during adolescence.
- ✓ Identify changes in males during adolescence.

Instructional Activities

- video and discussion
- reading and discussion
- vocabulary instruction

Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**adolescent                  puberty**

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**adolescence**

## Instructional Resources

Student Reader



Ch. 5

Activity Page



AP 5.1

**Student Reader, Chapter 5**  
“Human Adolescence”

### Activity Page

Growth and Change from  
Childhood to Puberty (AP 5.1)

Make copies for your students  
prior to conducting the lesson.

## Materials and Equipment

**Collect or prepare the following items:**

- poster paper (1 per class)
- markers (1 set per class)
- internet access and the means to project images/video for whole-class viewing

## THE CORE LESSON 45 MIN

### 1. Focus student attention with video.

10 MIN

Online Resources



Have students watch a video that explains the mechanisms of hair growth and the chemistry of acne. Point out that growing more body hair once they enter puberty is just an indicator of the change humans go through as they enter puberty. (See **Know the Science 1.**)

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

Then share the Big Question for this lesson with your class—**What are puberty and adolescence?** Display this question where students can refer to it throughout the chapter.

Draw on poster paper a K-W-L chart to record students’ current understanding of the Big Question and pinpoint misconceptions. Have students suggest what they already know about how the endocrine system works and how the endocrine system is related to puberty. If students need prompting to get started, ask the following:

- How do adult bodies look different from children’s bodies?
- What causes the body to change?
- What changes in puberty are permanent, and which are not?

## Know the Science

**1. Why is hair important during puberty?** Students may express concern about physical hygiene related to the natural process of new hair formation, such as acne, body odor, and excessive hair growth. During puberty, the endocrine system starts secreting growth hormones, which prompts growth in the body. One structure that starts growing in earnest is body hair. At the base of each hair follicle is a sebaceous gland, which releases oils that lubricate the hair as it grows from the base of the follicle. Since the hair is growing thicker, the sebaceous gland is releasing more oils to lubricate the thicker hair. Because the oils can trap dirt at the opening of the hair follicle, a blockage may form.

## 2. Read and discuss “Human Adolescence.”

20 MIN

Student Reader



Ch. 5

Read together, or have students read independently, the Student Reader Chapter 5, “Human Adolescence.” The selection provides details about sex specific developments in females and males during puberty.

### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**adolescent**

**puberty**

### Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

Page 21

Review the two video choices for appropriateness for the class. Both videos are intended as a starting point for discussion. The video “That’s Puberty” is done in cartoon form using a short song, covers the basics, and may be better suited for less mature classes. The video “4 Signs You’re Going Through Puberty” is longer, covers more late-stage puberty changes in detail, and presents material that may be better suited for more mature classes.

Show students a video that highlights some of the mechanisms and effects they will encounter during puberty.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

Online Resources



**[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)**

Ask students: What triggers the start of puberty in the human body?

- » Sample answer: The hypothalamus secretes growth hormones to the pituitary gland. The pituitary gland releases hormones to the ovaries in females and testes in males, which signal both those glands to release sex hormones, which start the changes seen in puberty.

Have students create cause-and-effect chains starting with “Cause: hypothalamus secretes hormones to the pituitary → Effect: pituitary releases hormones.” Have students complete the chain to the sex organ of each sex.

Remind students that the start and duration of puberty is unique for each person but that the general idea, that the body is being prepared to develop into an adult, applies to everyone.



## Pages 22–25

Have students continue to build their cause-and-effect chains beyond the pituitary releasing hormones to the sex organs and leading to the development of secondary sex characteristics covered in this and the next two lessons.

Each person will inherit physical characteristics from their parents, such as eye color, hair color, and height. However, a lot of growth also comes down to the effect their environment has on them. Diet, injuries, and malfunctions in the glands can affect how much their body grows. Each person will grow to the level of the genetic programming in their DNA, dependent on environmental effects. (See **Know the Science 2.**)

**SUPPORT**—Invite students to support their cause-and-effect chains with further research using milestones each sex will encounter during puberty.

**EXTEND**—Have students investigate the evolutionary theories for secondary sex characteristics, such as wider hips in females and broad shoulders in males.

**CHALLENGE**—By the end of puberty, the body has completed most of its development. However, many people continue to experience growth past puberty. Challenge students to investigate aspects of human growth that continue past puberty.

### Online Resources



Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

## Page 26

If time allows, make three two-column charts on poster board with headings of “Advantages” and “Disadvantages” for “Being a Child,” “Being an Adolescent,” and “Being an Adult.” Have students brainstorm characteristics for each stage of life. As students go through the rest of the unit, invite them to add more characteristics.

## Know the Science

**2. How does the body start and stop growing?** From a reproductive view, once our bodies have reached the point at which they can reproduce, the purpose for growth is complete. Adding to the uncertainty of the process is that some organs, such as the intestinal lining, kidneys, and liver, have cells that continue to divide and grow past puberty while other organs, such as the brain and lungs, do not have cells that can continue to divide and grow past puberty.

### 3. Teach Core Vocabulary.

5 MIN

#### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**adolescent**

**puberty**

#### Word Work

**adolescent:** A person is considered an adolescent from about age ten when puberty starts. However, the age at which a person stops being an adolescent is not so easily defined. Some people consider eighteen, the age at which a person gains legal rights as an adult, to be the endpoint of being an adolescent. However, some body structures, such as the brain and teeth, continue to grow into a person's early twenties.

**puberty:** The term *puberty* refers to physical changes in the body that lead to becoming an adult. *Adolescence* refers to the physical changes as well as the emotional, mental, and social changes the adolescent goes through.

### 4. Check for understanding.

10 MIN

Activity Page



AP 5.1

Distribute to students Growth and Change from Childhood to Puberty (AP 5.1). Tell students that they may want to reference Growth and Change from Infancy to Childhood (AP 1.1) from Lesson 1.

**SUPPORT**—Students may have a lot of misconceptions about puberty, ranging from simple misunderstandings to things they heard from someone else. To provide a forum to help clarify understanding and dispel misconceptions, consider having a way for students to ask anonymous questions. You or a school health care provider can then present the question to the class with the answer.

Return to discuss the Big Question—**What are puberty and adolescence?** Next, return to the K-W-L chart you made in Step 1. As a class, complete the Learn column. Then compare what students learned to what students knew before the lesson.

#### Formative Assessment

Review students' work on Growth and Change from Childhood to Puberty (AP 5.1), and give feedback as needed to have students correct any misunderstandings. See the Activity Pages Answer Key.

## LESSON 6

# The Reproductive System

**Big Question:** What are the parts of the human reproductive system, and how do they function?

**Tie to the Anchoring Phenomenon:** At the completion of this lesson, students will have a better understanding of the parts and functions of the female and male reproductive systems.

## AT A GLANCE

### Learning Objectives

- ✓ Identify structures and functions of the female reproductive system.
- ✓ Recognize the role and function of the menstrual cycle.
- ✓ Identify structures and functions of the male reproductive system.

### Instructional Activities (2 Days)

- reading and discussion
- whole-class demonstration

## Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

**adult**

**female**

**male**

**reproductive system**

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

**fallopian tubes**

**menstruation**

**ovaries**

**penis**

**scrotum**

**semen**

**testes**

**urethra**

**uterus**

**vagina**

## Instructional Resources

### Student Reader



Ch. 6

### Student Reader, Chapter 6 “The Reproductive System”

**NOTE:** The Chapter 6 reading will be broken down across two days. On Day 1, students will read about structures and functions of the female reproductive system. On Day 2, students will read about structures and functions of the male reproductive system.

### Activity Page



AP 6.1

### Activity Page

Body Changes for Sexual Reproduction (AP 6.1)

Make copies for your students prior to conducting the lesson.

## Materials and Equipment

### Collect or prepare the following items:

- poster paper (1 per class)
- markers (1 set per class)
- student-sized chair (teacher/student demo)
- internet access and the means to project images/video for whole-class viewing

## THE CORE LESSON TWO DAYS, 45 MIN EACH

### 1. Day 1: Focus student attention on the Big Question.

10 MIN

Share the Big Question with your class—**What are the parts of the human reproductive system, and how do they function?** Display this question where students can refer to it throughout this lesson. Elicit students’ ideas on what the answer might be.

Remind students of how the period of puberty is changing and will change their bodies during puberty. Ask: What is the result of a person going through puberty? If students are unsure how to answer, remind them that some parts of their body are developing so they can reproduce.

### Activity Page



AP 6.1

Give each student a copy of Body Changes for Sexual Reproduction (AP 6.1). Encourage students to use Chapter 5 as a reference to the body changes. Let students know that their responses on the Activity Page will be reviewed on the second day after they have completed the chapter reading.

Explain that in this lesson, students will learn the parts of the human reproductive system and how they function, with the goal of having the biological capacity to reproduce.

## 2. Read and discuss “The Reproductive System.”

25 MIN

Student Reader



Ch. 6

Read together, or have students read independently, the Student Reader Chapter 6, “The Reproductive System.” The selection covers details of the parts and functions of the female and male reproductive systems.

### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**adult**

**female**

**male**

**reproductive system**

### Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

**Page 27**

After reading, ask: What are some things adults do that children and teens cannot do?

**SUPPORT**—To help students better understand the difference in what people can do at certain ages, have them classify their responses in groupings such as the following: biological, such as reproducing; emotional, such as being able to handle complex problems; and social, such as groups of friends.

Remind students that, unlike other body systems they have learned about like the circulatory system, the sexual reproductive system has parts and functions unique to each sex. Additionally, for humans and many other organisms to reproduce, there must be a sex cell from each gender. (See **Know the Science 1.**)

## Know the Science

**1. What are sexual and asexual reproduction?** Sexual reproduction occurs when sex cells, egg and sperm, meet and form a zygote, a fertilized egg. The result of sexual reproduction leads to a recombining of genetic material from both parents and leads to both shared characteristics and genetic diversity.

Asexual reproduction is reproduction that does not involve the fusion of two different sex cells or a change in the number of chromosomes. Examples are simple cell division such as happens in a bacterium or budding such as occurs in yeast or in some plants. In asexual reproduction, genetic material comes from only one parent; it does not lead to genetic diversity.

**Pages 28–29**

After the reading, ask: What does it mean, biologically, to say someone is female?

Biologically, a female is an individual that at some stage of life has the capacity to produce egg cells. Point out that females are born with all the eggs their bodies will ever release. At birth, there are about one million eggs in the ovaries. By puberty, there are about 300,000 eggs. Over the course of adulthood before menopause, 300 to 400 eggs will be released. (See **Know the Science 2.**)

**Pages 30–31**

Have students develop sets of cause-and-effect statements for each step of the menstruation cycle and post them in a common class area if possible. Have the sets arranged as a cycle. NOTE: The Student Reader arranges the menstrual cycle in a linear fashion, so students should not use the same layout to show the cycle.

The topic of menstruation can be challenging to teach to students. Consider asking the school health professional, a nurse, or a doctor to present or assist. Remind students that more than half the human population goes through menstruation every month, so while it can be alarming when females start experiencing it, it is a common human experience.

### 3. Teach Core Vocabulary.

**10 MIN**

#### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**adult****female****male****reproductive system**

#### Word Work

**adult:** Make sure students understand that an adult is someone who is biologically capable of reproduction but that there are many other conditions, such as legal or social, that determine when someone is considered an adult socially and legally.

## Know the Science

**2. What is gender identity?** Gender identity is one's understanding of themselves in regard to female and male. Except for some rare cases, each person is equipped with a reproductive system for one gender. Gender identity also has a social component of how someone sees themselves within their social circle. Gender identity also has a psychological component of what gender a person feels like they belong to. Most people clearly identify with the gender of their reproductive system. But there are many people whose gender understanding does not align with their reproductive system. So the answer to the question of "What is gender?" depends on how one defines *gender*.

**female:** Have students make a short list of physical characteristics of being female.

**male:** Have students make a short list of physical characteristics of being male.

**reproductive system:** Have students list the ways the female and male reproductive systems are alike and different.

## 1. Day 2: Focus student attention.

15 MIN

Online Resources



Show students a video of the chair challenge, a physical activity that highlights what appears to be a physical functional difference in the body depending on sex. The directions for the chair challenge are presented up to the 1:25 mark. After that, the video explains the math and science behind the chair challenge. (See **Know the Science 3.**)

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

If time allows, consider having students try the chair challenge. Because students' bodies are still developing, results can vary widely. Explain to students that there are differences between sexes but that some, such as this demonstration, are not as important as other differences.

## 2. Read and discuss “The Reproductive System.”

20 MIN

Pages 32–34

Student Reader



Have students brainstorm what they think of when you say someone is biologically and socially male. Make a list of students' ideas, and then help students organize their ideas by classifying the ideas into biological determinants such as their reproductive system and social constructs such as gender roles.

Point out that males are not born with sperm but that their body starts producing sperm at the onset of puberty. It takes about three months for the body to produce viable sperm. The human body produces between 200 and 300 million sperm a day, with only about 100 million being viable sperm.

## Know the Science

**3. What is the secret to lifting the chair?** The primary reason that males cannot pick up the chair and females can is because males tend to have bigger feet than females and this puts them farther from the wall, taking away most of their mechanical advantage. When a female steps just a little farther away, they will have trouble lifting the chair. When a male steps in just a little closer, they will be able to lift the chair, though with some difficulty. This is because the center of mass on females is lower and their broader hips provide better leverage whereas males have a higher center of mass and narrower hips, which provide less ideal leverage.

### 3. Check for understanding.

10 MIN

Activity Page



AP 6.1

Have students return to Body Changes for Sexual Reproduction (AP 6.1) and review the answers they wrote at the start of the lesson. Allow students to change their answers as their understanding may have changed. Review students' work, and see the Activity Pages Answer Key for sample answers.

Restate the Big Question—**What are the parts of the human reproductive system, and how do they function?** Direct students to think about what they read in Chapter 6 before answering the question. Look for the following concepts:

- Females release an egg, which upon fertilization implants into the uterine wall, where it grows into an embryo and then into a baby.
- Females have structures that are designed to be in a protected environment in which the baby develops.
- Males release sperm. One sperm cell combines with an egg to become a zygote.



LESSON 7

# Sexual Reproduction

**Big Question:** What is sexual reproduction?

**Tie to the Anchoring Phenomenon:** At the completion of this lesson, students will have a better understanding of fertilization and the development of a zygote to a fetus. Students will learn about the development of the fetus during the different trimesters.

AT A GLANCE

Learning Objectives

- ✓ Recognize the role of fertilization, both internal and external, in the development of a zygote.
- ✓ Identify the three trimesters of pregnancy.

Instructional Activities (2 Days)

- video and discussion
- reading and discussion
- vocabulary instruction

Core Vocabulary

**Core Vocabulary:** Core Vocabulary terms are those that students should learn to use accurately in discussion and in written responses. During instruction, expose students repeatedly to these terms. However, these terms are not intended for isolated drill or memorization.

- birthembryo
- fertilizationfetus
- newbornpregnancy

**Language of Instruction:** The Language of Instruction consists of additional terms, not considered a part of Core Vocabulary, that you should use when talking about any concepts in this exercise. Students will benefit from your modeling the use of these words without the expectation that students will use or explain the words themselves. A Glossary at the end of this Teacher Guide lists definitions for both Core Vocabulary and Language of Instruction.

- eggexternal fertilization
- gestationintercourse
- internal fertilizationspermzygote

## Instructional Resources

### Student Reader



Ch. 7

### Student Reader, Chapter 7 “Sexual Reproduction”

**NOTE:** The Chapter 7 reading will be broken down across two days. On Day 1, students will read about internal and external fertilization. On Day 2, students will read about human pregnancy.

### Activity Pages



AP 7.1  
AP 7.2

### Activity Pages

Internal or External Fertilization? (AP 7.1)  
Growth and Change from Puberty to Adulthood (AP 7.2)

Make copies for your students prior to conducting the lesson.

## Materials and Equipment

### Collect or prepare the following items:

- poster paper (1 per class)
- markers (1 set per class)
- internet access and the means to project images/video for whole-class viewing

## THE CORE LESSON TWO DAYS, 45 MIN EACH

### 1. Day 1: Focus student attention on the Big Question.

10 MIN

### Online Resources



**NOTE:** The emphasis of this lesson is on the biological component of sex in terms of sexual reproduction for the continuance of the species and is not intended or designed to be a lesson on sexuality.

Share the Big Question with your class—**What is sexual reproduction?** Display this question where students can refer to it throughout the chapter. Explain that *reproduction* refers to making a copy. Have students raise their hand if they are an exact copy of their parents. Next, have students raise their hand if they have physical characteristics of one but maybe not both of their parents.

Show students a video of a zygote differentiating into more and more cells. Explain that the zygote is a single cell made from the fusion of a female and a male sex cell, an egg and a sperm cell. As the two cells join, genetic material is mixed between the two cells. This leads to an organism with features from the donor of each sex cell.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

## 2. Read and discuss “Sexual Reproduction.”

20 MIN

Student Reader



Ch. 7

Read together, or have students read independently, the Student Reader Chapter 7, “Sexual Reproduction.” The first four pages of the selection, the reading for today, describe fertilization, both internal and external, and development of a zygote into a baby. The second four pages of the selection, which will be read on Day 2, cover human pregnancy.

### Preview Core Vocabulary

Before students read, write these terms on the board or chart paper. Encourage students to pay special attention to these terms as they read.

**birth**

**embryo**

**fertilization**

**fetus**

**newborn**

**pregnancy**

### Guided Reading Supports

When reading aloud together as a class, always prompt students to follow along. Pause for discussion. Include suggested questions and prompts:

**Page 35**

For a sperm and an egg to combine, the sperm needs to enter the egg. Once an egg is fertilized, cell division starts. In some cases, early on the cell can divide into two or three zygotes, which is one way twins and triplets form. Offspring from cell division like this are called *identical*. In other cases, more than one released egg combines with a sperm, and each of these zygotes becomes a baby. Offspring from zygotes that form this way are called *fraternal*. (See **Know the Science**.)

Explain to students that an egg, once a sperm has entered, releases a calcium ion, which signals the outer layer of the egg to release chemicals that prevent the fusion of additional sperm with the egg. Science does not have a definitive answer for why millions of sperm are needed to fertilize a single egg. Theories for the need to release so many sperm include the need for a very small cell to find a different very small cell in a large environment and the fact that the environment in the uterus performs many different functions, all of which the sperm have to overcome on their way to fertilizing an egg.

## Know the Science

**How many sperm are needed to fertilize an egg?** One sperm is needed to fertilize an egg. In many cases where more than one sperm enters an egg, the genetic materials inside the zygote have too much of one sex’s DNA, the genetic information in the sperm, and as the cells inside the zygote divide, more and more nonviable cells are created, eventually resulting in a zygote that is rejected and removed during menstruation. In some cases, the genetic material from only one of the sperm is used by the zygote. Fertilization by more than one sperm is required in some types of birds, however.

## Pages 36–37

Point out that the period in which the parent internally carries the zygote, the earliest stage of development, and then the fetus, the later stage of development, is known as *gestation*. Gestation begins when the embryo implants into the uterine wall.

An embryo that develops through internal fertilization will share some of its body functions with the parent and requires those functions, such as waste disposal, to survive. An embryo that develops through external fertilization contains all the resources it needs to develop inside.

Ask students: In terms of what the embryo and fetus need, how are internal and external fertilization different?

- » Sample answer: In internal fertilization, the embryo and fetus share some body functions with the parent and depend on them to develop. In external fertilization, the embryo has everything it needs to survive.

Ask students: In terms of what the embryo needs, how are internal and external fertilization alike?

- » Sample answer: In the cases of egg-laying animals, both their eggs and the embryos of animals that use external fertilization have everything they need internally to develop.

## Page 38

Explain that each zygote has the correct genetic material to reproduce an organism for the species to which it belongs and that the body parts it will develop will be specific to that organism.

## 3. Research reproductive strategies

15 MIN

### Activity Page



AP 7.1

Give each student a copy of Internal or External Fertilization? (AP 7.1). Have students determine which animal they will research, or have a list of animals ready with a variety of land- and water-based animals that have a variety of reproductive strategies.

## 1. Day 2: Focus student attention on the Big Question.

10 MIN

### Online Resources



Share the Big Question with your class—**What is sexual reproduction?** Display this question where students can refer to it throughout the chapter. Show students a video of the three different methods of mammalian gestation and birth. Lead a discussion of the types of reproduction, internal or external, and development, internal or external, for each group in the video.

Use this link to download the CKSci Online Resources Guide for this unit, where a specific link to this resource may be found:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

## 2. Read and discuss “Sexual Reproduction.”

20 MIN

Pages 39–41

Student Reader



Ch. 7

The trimesters into which human pregnancy is divided represent checkpoints in the development from zygote to birth. It is a traditional way to understand pregnancy. To assist student understanding, set up a poster board or section at the front of the room for each trimester. Have each student or group of students post an understanding of what happens in each trimester in terms of the parts developed and what the function of each part will be after the baby is born.

**SUPPORT**—To help clarify student understanding of fetal development, have them consider that the body systems of a human need to be functional for a baby to survive outside the womb. Have students consider different body systems, such as the muscular system, what other systems are related to its functioning, such as the nervous system, and when each system develops. Then have students identify on the poster board in which trimester each system is functional and work backward through its development.

Page 42

Point out that to survive, many newborn and young mammals require milk from their mother to survive while their body adapts to eating solid food. Milk from the mother contains nutrients and other substances that will help the newborn grow and be more fit to survive in its environment. Other newborn animals, such as birds, require the parent to help feed them while they develop outside the egg or womb. Human newborns require mother’s milk or a chemical substitute for at least the first six months of life.

**CHALLENGE**—Beyond needing mother’s milk, different baby and infant animals have different developmental needs. Have students research the developmental milestones of different animals and identify how the milestones meet the needs of the animals and when the milestones are reached.

## 3. Teach Core Vocabulary.

10 MIN

### Prepare Core Vocabulary Cards

Direct student attention to the Core Vocabulary words (displayed on the board earlier in the lesson). Have students write each term in the upper left corner of an index card and underline it (one term per card).

**birth**

**embryo**

**fertilization**

**fetus**

**newborn**

**pregnancy**

### Word Work

**birth:** Explain to students that *birth* refers to the time when a fetus emerges from the womb and that each species of animal has a period in which the fetus will be fully developed, called a gestation period, but that a fetus can also be born before being fully developed.

**embryo:** Remind students that an embryo is the stage between being a zygote and being a fetus.

**fertilization:** Point out that the fertilization covered in this reading refers to in vivo (live) fertilization but that humans have used in vitro (outside the living organism) fertilization to promote fertilization.

**fetus:** *Fetus* comes from the Latin *fetus*, meaning “offspring.”

**newborn:** *Newborn* is synonymous with baby and infant.

**pregnancy:** The root words of *pregnancy*, *præ-* and *gnasci*, come from the Latin for “before” and “be born.” Thus, *pregnancy* refers to something before birth.

## 4. Check for understanding.

5 MIN

Return to the Big Question—**What is sexual reproduction?** Direct students to think about what they read in Chapter 7, and look for understanding of the following in the discussion:

- Fertilization is the joining of a female and a male sex cell, resulting in a zygote.
- Fertilization can occur internally or externally.
- Cell division occurs in a zygote, resulting in a fetus.
- Human pregnancy can be thought of as having three trimesters, each with its own set of milestones the developing fetus achieves.

Activity Page



AP 7.2

Give each student a copy of Growth and Change from Puberty to Adulthood (AP 7.2). Ask students to complete the chart. Have students use Growth and Change from Infancy to Childhood (AP 1.1) and Growth and Change from Childhood to Puberty (AP 5.1) as references to complete how a human grows and develops.

### Formative Assessment

Review students’ data collection and responses to questions on Internal or External Fertilization? (AP 7.1) and Growth and Change from Puberty to Adulthood (AP 7.2).

# Teacher Resources

**Activity Pages**

- Growth and Change from Infancy to Childhood (AP 1.1) **50**
- Structures of the Endocrine System (AP 2.1) **51**
- Parts of the Endocrine System (AP 3.1) **52**
- More Parts of the Endocrine System (AP 4.1) **53**
- Growth and Change from Childhood to Puberty (AP 5.1) **54**
- Body Changes for Sexual Reproduction (AP 6.1) **55**
- Internal or External Fertilization? (AP 7.1) **56**
- Growth and Change from Puberty to Adulthood (AP 7.2) **57**

**Activity Pages Answer Key: *Human Hormones and Reproduction* **58****

Name \_\_\_\_\_

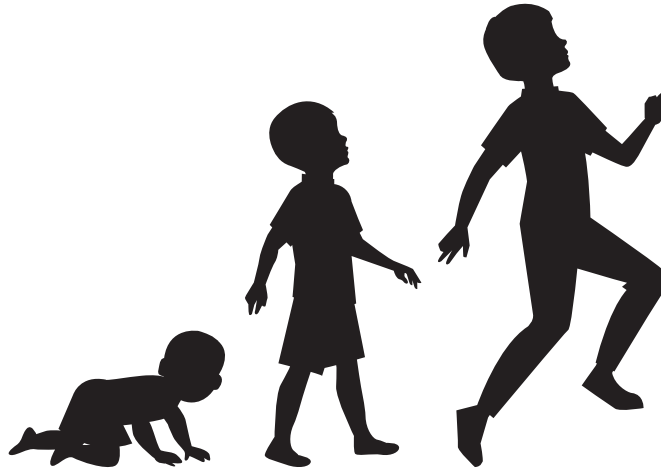
Date \_\_\_\_\_

Activity Page 1.1

Use with Lesson 1.

## Growth and Change from Infancy to Childhood

Write answers to each question.



1. How does a baby change from when it is a newborn?

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2. How does a baby change as it becomes a young child?

---

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3. How does a young child change as it gets older?

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Name \_\_\_\_\_

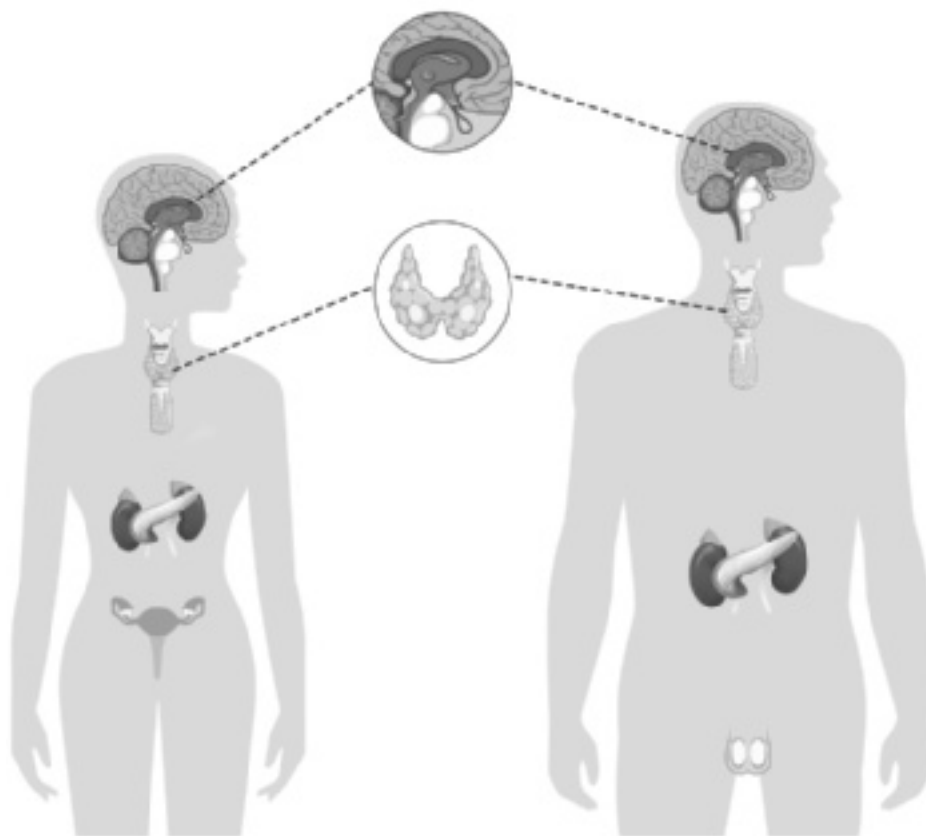
Date \_\_\_\_\_

Activity Page 2.1

Use with Lesson 2.

## Structures of the Endocrine System

Label the main structures of the endocrine system. Then, complete the table.



Part	Function
hypothalamus	
pituitary gland	
pineal gland	
thyroid gland	
parathyroid	
thymus	
adrenal gland	
pancreas	
ovaries	
testes	

## Parts of the Endocrine System

Identify the structure of the endocrine system shown and its role in the endocrine system.

1.



Structure: \_\_\_\_\_

Location: \_\_\_\_\_

Role: \_\_\_\_\_

\_\_\_\_\_

2.



Structure: \_\_\_\_\_

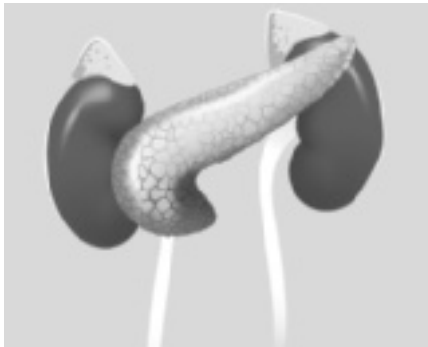
Location: \_\_\_\_\_

Role: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3.



Structure: \_\_\_\_\_

Location: \_\_\_\_\_

Role: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Write a short cause-and-effect paragraph describing a negative or positive feedback loop that includes some of the structures you read about.

\_\_\_\_\_

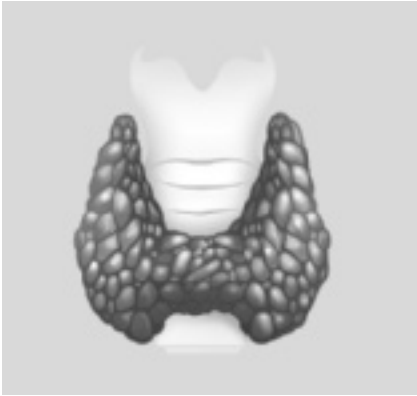
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## More Parts of the Endocrine System

Identify the structure of the endocrine system shown and its role in the endocrine system.

1.



Structure: \_\_\_\_\_

Location: \_\_\_\_\_

Role: \_\_\_\_\_

\_\_\_\_\_

2.



Structure: \_\_\_\_\_

Location: \_\_\_\_\_

Role: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Write a short cause-and-effect paragraph describing a feedback loop, negative or positive, that includes some of the structures you read about.

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Name \_\_\_\_\_

Date \_\_\_\_\_

Activity Page 5.1

Use with Lesson 5.

## Growth and Change from Childhood to Puberty

Write answers to each question.



1. What changes will females and males share?

---

---

2. What changes will be unique to females?

---

---

3. What changes will be unique to males?

---

---

4. What is the end result of puberty?

---

Name \_\_\_\_\_

Date \_\_\_\_\_

## Activity Page 6.1

Use with Lesson 6.

**Body Changes for Sexual Reproduction**

The human body changes during puberty. Identify if the change is necessary to reproduce or if it is a secondary change to becoming an adult. Give a brief explanation of your reasoning.

	Necessary or Related	Reasoning
body size		
breasts		
hair		
ovaries		
penis		
sperm		
testes		
vagina		
voice		

Name \_\_\_\_\_

Date \_\_\_\_\_

## Activity Page 7.1

Use with Lesson 7.

**Internal or External Fertilization?****Complete each table.**

1. Identify if each animal reproduces using internal or external fertilization. Then identify if the development of each animal is internal or external.

	<b>Fertilization</b>	<b>Development</b>
eagle		
horse		
human		
salmon		

2. Research the reproduction of an animal species. Complete the table.

Animal	
Internal or External Fertilization	
Internal or External Development	
Environment	
Number of Newborns in Litter	
Time from Fertilization to Newborn	
Time to Survive on Their Own	

3. What is one advantage of your species, method of reproduction?

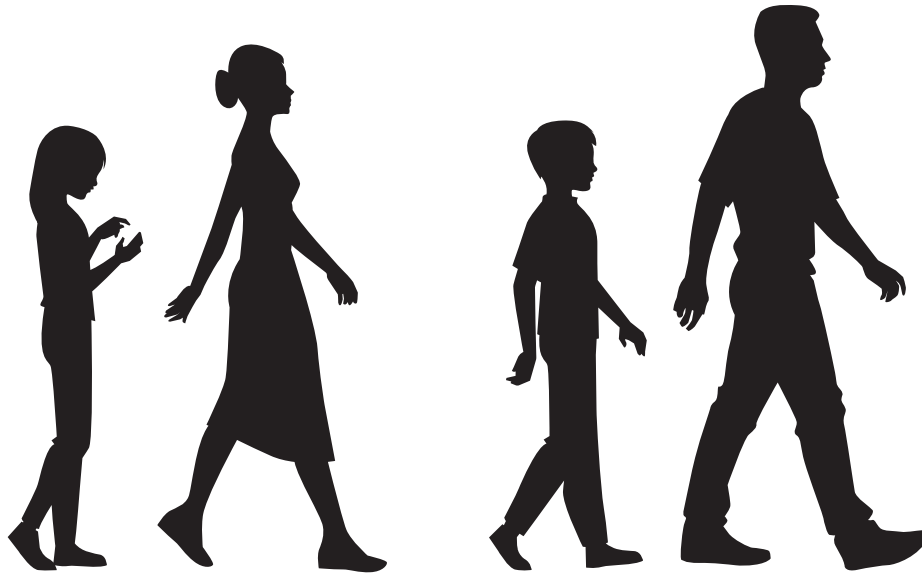
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4. What is one disadvantage of your species' method of reproduction?

---

## Growth and Change from Puberty to Adulthood

Write answers to each question.



1. What changes will females and males share?

---

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2. In terms of glands, what changes will happen?

---

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3. What changes will be unique to females?

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4. What changes will be unique to males?

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---

## Activity Pages Answer Key: Human Hormones and Reproduction

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This answer key offers guidance to help you assess your students' learning progress. Here you will find descriptions of the expectations and correct answers for each Activity Page of this unit.

### Growth and Change from Infancy to Childhood (AP 1.1) (page 50)

1. The baby grows and gets stronger. The baby grows hair and teeth. The baby develops enough to sit up and crawl.
2. The baby starts to walk. The child grows taller. The child can't walk well. They are clumsy. They can start to talk.
3. The child grows taller. The child is less clumsy and can run. The child grows taller.

### Structures of the Endocrine System (AP 2.1) (page 51)

Sample answers for table:

hypothalamus: connects endocrine system to the nervous system; main function is to tell the pituitary gland to start or stop making hormones

pituitary gland: the master gland that tells other glands what to do; produces growth hormone

pineal gland: produces a hormone to help with sleep

thyroid gland: produces thyroid hormone, which controls the human metabolism

parathyroid: plays a role in bone health

thymus: produces white blood cells, which fight infections

adrenal gland: produces adrenaline and hormones that affect metabolism

pancreas: produces hormones that regulate blood sugar; produces enzymes that break food down in the stomach

ovaries: found in females only; produce female hormones

testes: found in males only; produce male hormones

### Parts of the Endocrine System (AP 3.1) (page 52)

1. Structure: hypothalamus; Location: under the brain; Role: connects the nervous system to the endocrine system
2. Structure: pituitary gland; Location: below the hypothalamus under the brain; Role: master gland; directs the release of hormones from other glands in the endocrine system; releases hormones that cause human growth
3. Structure: adrenal glands; Location: at the top of each kidney; Role: responsible for the fight or flight reaction; regulate many aspects of metabolism
4. When the jack-in-the-box popped up, my body sent a signal to the hypothalamus. The hypothalamus sent a signal to the pituitary gland. The pituitary gland sent a signal to my adrenal glands. The adrenal glands released adrenaline with the effect that my heart beat faster.

### More Parts of the Endocrine System (AP 4.1) (page 53)

1. Structure: thyroid; Location: on either side of the throat; Role: produces hormones that control metabolism
2. Structure: pancreas; Location: in abdomen behind the stomach; Role: produces insulin and glucagon, which control blood sugar; also produces digestive enzymes
3. When the jack-in-the-box popped up, my body sent a signal to the hypothalamus. The hypothalamus sent a signal to the pituitary gland. The pituitary gland sent a signal to my adrenal glands. The adrenal glands released adrenaline with the effect that my heart beat faster.



## **Growth and Change from Childhood to Puberty (AP 5.1)** **(page 54)**

1. Females and males will grow taller and develop more hair, and at the end of puberty they will be able to reproduce.
2. Females will have their ovaries develop and start releasing eggs, their hips will get wider, they will develop breasts, and at the end of puberty they will be able to give birth.
3. Males will have their testes develop and be able to release sperm, their shoulders will get broader, their chest will get larger, their voice will get deeper, and at the end of puberty they will be able to reproduce.
4. The end result of puberty is to develop the human body so it can reproduce.

## **Body Changes for Sexual Reproduction (AP 6.1)** **(page 55)**

Sample answers for table:

body size: both; Females need to be larger to carry a baby, but males do not need to be larger to reproduce.

breasts: both; Females need breasts to provide milk for their babies, but males do not.

hair: related; Answers will vary.

ovaries: necessary; In females, developed ovaries are needed to release eggs.

penis: necessary; Adult size increases the likelihood of sperm reaching the egg.

sperm: necessary; Males need to release sperm to fertilize the egg.

testes: necessary; Males need developed testes to release sperm.

vagina: necessary; Females need to develop a vagina as the birth canal for the baby to exit the mother's body.

voice: related; Having a nice voice can attract someone.

## **Internal or External Fertilization? (AP 7.1)** **(page 56)**

1. eagle: internal fertilization; external development  
horse: internal fertilization; internal development  
human: internal fertilization; internal development  
salmon: external fertilization; external development
2. Accept all plausible research.
3. Sample answer: The baby whale will be fully developed and ready to live in the ocean.
4. Sample answer: Producing only one baby means the whales need to make sure the baby grows up into an adult.

## **Growth and Change from Puberty to Adulthood (AP 7.2)** **(page 57)**

1. Both females and males will grow taller, develop more hair, and be able to reproduce.
2. The hypothalamus will stop directing the pituitary to secrete growth hormone, slowing down the growth process.
3. Females will menstruate every month and be able to carry a baby for nine months.
4. Males will be able to release sperm and be able to reproduce.

## Glossary

**Purple words and phrases** are Core Vocabulary for the unit. **Bold-faced words and phrases** are Language of Instruction, additional vocabulary terms related to the unit that you should model for students during instruction. Vocabulary words are not intended for use in isolated drill or memorization.

### A

**adolescence, n.** the period between childhood and adulthood

**adolescent, n.** a young person in the development stage between childhood and adulthood

**adrenal gland, n.** the gland that produces adrenaline and other hormones related to heart rate, blood pressure, and metabolism

**adrenaline, n.** a hormone released by the adrenal glands

**adult, n.** a fully developed and mature human

### B

**birth, n.** the emergence of a fetus from its mother

### C

**child, n.** a young human being who has not been through puberty

**control, v.** to exercise direct influence over something

### D

**diabetes, n.** a condition in which the body does not make enough insulin or the body cannot use the insulin it does make

**duct, n.** a body passageway through which a hormone is secreted

### E

**egg, n.** female reproductive cell, also known as an ovum

**embryo, n.** an organism in the earliest stages of growth and development before birth

**endocrine system, n.** the glands and body structures which create and control the metabolic activity of a body

**external fertilization, n.** method of fertilization in which the egg is fertilized outside the female body

### F

**fallopian tubes, n.** pair of tubes in the female body that lead from the ovaries to the uterus

**feedback, n.** information about an outcome returned to the source that produced the outcome

**feedback loop, n.** a system in which outputs of a system are looped back into the system as inputs

**female, n.** the sex that typically has the ability to produce eggs or bear young

**fertilization, n.** the process in which sex cells from a female and a male member of a species combine to produce a cell called a zygote

**fetus, n.** a developing organism that has reached its basic structural form

### G

**gestation, n.** the period of development when the embryo or fetus is attached inside the body of the parent

**gland, n.** a body organ that makes substances used by the body

**growth, n.** the life process of becoming bigger and stronger

### H

**homeostasis, n.** the balanced functional state of the body's systems to maintain life

**hormone, n.** substances made in the body that produce effects in other cells or tissues in the body

**hyper-, pref.** high or above normal

**hypo-, pref.** low or below normal

**hypothalamus, n.** region of the brain that produces and releases hormones that regulate many body functions

### I

**infant, n.** a very young human being between being a newborn and one year old

**insulin, n.** a hormone that regulates blood sugar

**intercourse, n.** sexual contact between individuals

**internal fertilization, n.** method of fertilization in which the egg is fertilized inside the female body

---

## M

**male, n.** the sex that has the capacity to produce the small cells capable of fertilizing female egg cells

**maturation, n.** the development of personal, physical, and behavioral characteristics during the growth process

**mature, adj.** fully developed (v. to develop and become full-grown)

**menstruation, n.** a cycle the female reproductive system goes through roughly every twenty-eight days in which the uterus is prepared to carry a zygote, egg(s) are released, and then the uterus continues to prepare to carry a zygote(s) or sheds its lining and unfertilized egg(s)

**metabolism, n.** the combined chemical and energy processes that occur continuously in a living body

---

## N

**newborn, n.** a recently birthed baby

---

## O

**ovaries, n.** a pair of female reproductive organs that release eggs on a monthly basis

---

## P

**pancreas, n.** organ that produces insulin and other hormones and fluids related to metabolism and digestion

**penis, n.** male organ that provides a pathway for removal of urine from the body and the delivery of sex cells for fertilization

**pituitary gland, n.** master gland that produces hormones that control other glands

**pregnancy, n.** the period during which a zygote develops into an embryo and then into a newborn

**process, n.** ongoing biological activity carried out for a particular purpose

**puberty, n.** the onset of changes to the human body that result in the ability to reproduce

---

## R

**rate, n.** an amount of something measured as a unit against something else

**reaction, n.** a response to a stimulus

**regulation, n.** the process of being controlled

**reproductive system, n.** the organs and structures that function to produce offspring

---

## S

**scrotum, n.** pouch of skin that contains the testes

**secrete, v.** to gradually release a substance

**semen, n.** fluid that contains the male reproductive cells

**sperm, n.** male reproductive cells

---

## T

**testes, n.** a pair of male reproductive organs in which sperm are developed and stored

**thyroid, n.** a gland located in the front of the neck that produces hormones to control growth and metabolism

---

## U

**urethra, n.** the opening where urine leaves the body. In males, it is also the pathway for sperm from the testes.

**uterus, n.** female reproductive organ in which eggs are fertilized and in which zygotes develop into fetuses

---

## V

**vagina, n.** canal that connects the uterus to the outside of the body

---

## Z

**zygote, n.** a fertilized egg cell

## Classroom Safety for Activities and Demonstrations

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In the Core Knowledge Science program (CKSci), activities and demonstrations are a vital part of the curriculum and provide students with active engagement related to the lesson content. The activities and demonstrations in this unit have been selected and designed to engage students in a safe manner. The activities and demonstrations make use of materials and equipment that are typically deemed classroom safe and readily available.

Safety should be a priority when engaged in science activities. With that in mind, observe the following safety procedures when the class is engaged in activities and demonstrations:

- Be aware of students who have food allergies, and adjust related activities or make materials substitutions as necessary. Check the ingredients of all food to make sure known allergies are not listed. Students with food allergies can still be affected even if they do not ingest the food item. Some common food allergies are peanuts, tree nuts (e.g., almonds, walnuts, hazelnuts, etc.), and cow's milk (rice milk is a good nut-free alternative).
- Report and treat any injuries immediately.
- Check equipment prior to usage, and make sure everything is clean and ready for use.
- Clean up spills or broken equipment immediately using the appropriate tools.
- Monitor student behavior to ensure they are following proper classroom and activity procedures.
- Do not touch your eyes, ears, face, or mouth while engaging in an activity or demonstration.
- Review each step of the lesson to determine if there are any safety measures or materials necessary in advance.
- Wear personal protective equipment (e.g., safety goggles, aprons, etc.) as appropriate.
- Check for allergies to latex and other materials that students may have, and take appropriate measures.
- Secure loose clothing, hair, or jewelry.
- Establish storage and disposal procedures for chemicals as per their Safety Data Sheet (SDS), including household substances such as vinegar and baking soda.

Copy and distribute the Student Safety Contract, found on the next page. Have a read-along, and have students agree to the expectations for students when engaged in science activities prior to the start of the first unit.

### Online Resources



For additional support for safety in the science classroom, follow the links in the Online Resources Guide for this unit:

**[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)**

## Student Safety Contract

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When doing science activities, I will do the following:

- Report spills, breakages, or injuries to the teacher right away.
- Listen to the teacher for special instructions and safety directions. If I have questions, I will ask the teacher.
- Avoid eating or drinking anything during the activity unless told to by my teacher.
- Review the steps of the activity before I begin. If I have questions, I will ask the teacher.
- Wear safety goggles when working with liquids or things that can fly into my eyes.
- Be careful around electric appliances and unplug them, just by pulling on the plug, when a teacher is supervising.
- Keep my hands dry when using tools and devices that use electricity.
- Be careful to use safety equipment like gloves or tongs when handling materials that may be hot.
- Know when a hot plate is on or off and let it cool before touching it.
- Roll or push up long sleeves, keep my hair tied back, and secure any jewelry I am wearing.
- Return unused materials to the teacher.
- Clean up my area after the activity and wash my hands.
- Treat all living things and the environment with respect.

I have read and agree to the safety rules in this contract.

\_\_\_\_\_ / \_\_\_\_ / \_\_\_\_

Student signature and date

\_\_\_\_\_  
Print name

Dear Parent or Guardian,

During science class, we want to create and maintain a safe classroom. With this in mind, we are making sure students are aware of the expectations for their behavior while engaged in science activities. We are asking you to review the safety rules with your student and sign this contract. If you have any questions, please feel free to contact me.

\_\_\_\_\_ / \_\_\_\_ / \_\_\_\_

Parent or guardian signature and date

## Strategies for Acquiring Materials

The materials used in the Core Knowledge Science program (CKSci) are readily available and can be acquired through both retail and online stores. Some of the materials will be reusable and are meant to be used repeatedly. This includes equipment such as scales, beakers, and safety goggles but also items such as plastic cups that can be safely used again. Often these materials are durable, can be cleaned, and will last for more than one activity or even one school year. Other materials are classified as consumable and are not able to be used more than once, such as glue, baking soda, and aluminum foil.

### Online Resources



The Material Supply List for this unit's activities can be found online. Follow the links in the Online Resources Guide for this unit:

[www.coreknowledge.org/cksci-online-resources](http://www.coreknowledge.org/cksci-online-resources)

## Ways to Engage with Your Community

The total cost of materials can add up for an entire unit, even when the materials required for activities and demonstrations have been selected to be individually affordable. And the time needed to acquire the materials adds up too. Reaching out to your community to help support STEM education is a great way to engage parents, guardians, and others with the teaching of science, as well as to reduce the cost and time of collecting the materials. With that in mind, the materials list can be distributed or used as a reference for the materials teachers will need to acquire to teach the unit.

### Consider some of the following as methods for acquiring the science materials:

- **School Supply Drive**—If your school has a supply drive at any point in the year, consider distributing materials lists as wish lists for the science department.
- **Open Houses**—Have materials lists available during open houses. Consider having teams of volunteers perform an activity to show attendees how the materials will be used throughout the year.
- **Parent-Teacher Organizations**—Reach out to the local PTO for assistance with acquiring materials.
- **Science Fair Drive**—Consider adding a table to your science fair as part of a science materials drive for future units.
- **College or University Service Project**—Ask service organizations affiliated with your local higher education institutions to sponsor your program by providing materials.
- **Local Businesses**—Some businesses have discounts for teachers to purchase school supplies. Others may want to advertise as sponsors for your school/programs. Usually you will be asked for verifiable proof that you are a teacher and/or for examples of how their sponsorship will benefit students.

Remember: If your school is public, it will be tax exempt, so make sure to have a Tax Identification Number (TIN) when purchasing materials. If your school is private, you may need proof of 501(c)(3) status to gain tax exemption. Check with your school for any required documentation.

## **Advance Preparation for Activities and Demonstrations**

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Being properly prepared for classroom activities and demonstrations is the first step to having a successful and enriching science program. Advance preparation is critical to effectively support student learning and understanding of the content in a lesson.

### **Before doing demonstrations and activities with the class, do the following:**

- Familiarize yourself with the activity by performing the activity yourself or with a team, and identify any issues or talking points that could be brought up.
- Gather the necessary materials for class usage. Consider if students will gather their materials at stations or if you will preassemble the materials to be distributed to the students and/or groups.
- Identify safety issues, such as food allergies, that could occur during an activity or demonstration, and plan and prepare how to address them.
- Review the Teacher's Guide before teaching, and identify opportunities for instructional support during activities and demonstrations. Consider other Support and/or Challenge opportunities that may arise as you work to keep students engaged with the content.
- Prepare a plan for postactivity collection and disposal of materials/equipment.

### **While engaged in the activity or demonstration, do the following:**

- Address any emergencies immediately.
- Check that students are observing proper science safety practices as well as wearing any necessary safety gear, such as goggles, aprons, or gloves.
- When possible, circulate around the room, and provide support for the activity. Return to the Teacher Guide as students work, to utilize any Support and Challenge opportunities that will make the learning experience most meaningful for your students.

### **After the activity or demonstration, do the following:**

- Use your plan for students to set aside or dispose of their materials as necessary.
- Have students wash their hands after any activity in which they could come in contact with any potentially harmful substances.

When engaging students in activities and demonstrations, model good science practices, such as wearing proper safety equipment, never eating during an investigation, etc. Good science practices at a young age will lead to students observing good science practices themselves and being better prepared as they move into upper-level science classes.

## What to Do When Activities Don't Give Expected Results

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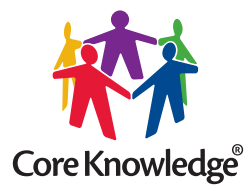
Science activities and experiments do not always go according to plan. Microwave ovens, super glue, and X-rays are just some of the discoveries made when people were practicing science and something did not go according to plan. In your classroom, however, you should be prepared for what to do when activities don't give the expected results or when an activity doesn't work.

**When going over an activity with an unexpected result, consider these points in discussion with your students:**

- Was there an error in following the steps in order? You or the student may have skipped a step. To help control for this, have students review the steps to an investigation in advance and make a check mark next to each step as they complete it.
- Did students design their own investigation? Perhaps their steps are out of sequence, or they missed a step when performing the activity. Review and provide feedback on students' investigation plan to ensure the work is done in proper sequence and that it supports the lesson segment's guiding question.
- When measurements were taken, were they done correctly? It is possible a number was written down incorrectly; a measurement was made in error, such as a wrong unit of measure or quantity; or the starting or ending point of a measurement was not accurate.
- Did the equipment or materials contribute to the situation? For example, chemicals that have lost their potency or a scale that is not measuring accurately can contribute to the success or failure of an activity.

One of the greatest gifts a student can learn when engaged in science is to develop a curiosity for *why something happened*. Students may find it challenging or frustrating to work through a problem during an activity, but guiding them through the problem to figure out *why* something happened will help them to develop a better sense of how to do science.





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# Core Knowledge Curriculum Series™

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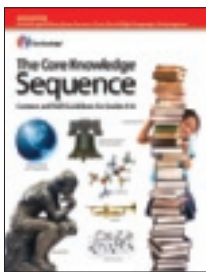
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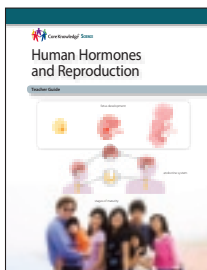
## Human Hormones and Reproduction

Core Knowledge Science 5



### What is the Core Knowledge Sequence?

The *Core Knowledge Sequence* is a detailed guide to specific content and skills to be taught in Grades K–8 in language arts, history, geography, mathematics, science, and the fine arts. In the domains of science, including Earth and space, physical, and life sciences, the *Core Knowledge Sequence* outlines topics that build systematically grade by grade to support student learning progressions coherently and comprehensively over time.



### For which grade levels is this book intended?

In general, the content and presentation are appropriate for students in the middle elementary grades. For teachers and schools following the *Core Knowledge Sequence*, this book is intended for Grade 5 and is part of a series of **Core Knowledge SCIENCE** units of study.

For a complete listing of resources in the  
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