Learning Objective: The goal of this two to four day exemplar is to give teachers multiple pathways to careful reading of a typical middle school science textbook with their students. All of these suggestions, used alone or in any combination the teacher chooses, will provide students the opportunity to use the reading and writing habits they need to employ on a regular basis to absorb important content – in this case, about the human digestive system. By reading and rereading the passage closely, and focusing their reading through either a series of questions and discussion about the text or the structured journal approach outlined here, students will come away with a working knowledge of the digestive system, its parts, and how they function together.

Initially, teaching this way will take much more time than swiftly reviewing textbook content and key ideas with students through an oral exchange. Content area teachers, tasked with covering a course full of objectives might legitimately feel they cannot afford this time, but the learning students will achieve when they can access the textbook content on their own and with confidence will be far more durable and deep. If content area teachers regularly insist on students reading the text for full understanding as this exemplar models, in the long run, teachers will be able to teach much more rich and sophisticated content than they currently can. They can do so because they know the students have mastered the basics in the course textbook.

Reading Task: This close reading approach, whether done by answering questions and performing activities that are based on the text or by writing a structured journal (where the students capture what they think is most important, where they are responsible for tracking what they do not understand, and where they work to make connections to other science they have learned), forces students to use the text as a source of information. It may make sense to notify students that the text is densely packed with ideas, and they are not expected to understand it fully on a first reading—that they can expect to struggle and reread. Some students may be frustrated, but all students need practice in doing their best to stay with something they do not initially understand and to learn to use the tools provided by a textbook.

Depending on the difficulties of a given subsection, what points the teacher wants to emphasize, and the teacher’s knowledge of the fluency abilities of students, there might be more or less rereading or oral reading. What is important is to allow all students to interact with challenging text on their own as frequently and independently as possible. The teacher should point out that text is bolded where the textbook authors bolded it in the original for emphasizing key ideas.

Vocabulary Task: Many of the meanings of words in the exemplar text can be discovered by students from careful reading of the context in which they appear. In particular, content words for this topic are carefully defined and pronunciation support offered by the textbook authors when they make their first appearance. Teachers can use discussions to model and reinforce how to learn vocabulary from contextual clues, and students must be held accountable for engaging in this practice. Where it is judged this is not possible, underlined words are defined briefly for students to the right of the text in a separate column. At times, this is all the support these defined words need. At other times,
particularly with abstract words, teachers will need to spend more time explaining and discussing them. Given how crucial vocabulary knowledge is for academic and career success, it is essential that these high value words be discussed and lingered over during the instructional sequence even if they are not directly connected to the topic of the lesson.

**Discussion Task:** Students will discuss each section in depth with their teacher and their classmates, after having performed activities that help develop an understanding of the digestive system. The goal of the discussion is for the teacher to ensure that students are confident about how the digestive system works and have a grasp of the most important elements. The reason for the independent work coming in advance of the discussions is to foster student confidence when encountering complex text and to reinforce the skills they have acquired regarding how to build and extend their understanding of a text. A general principle is to always reread the passage that provides evidence for the question under discussion. This gives students another encounter with the text, helping them develop fluency and reinforcing their use of text evidence.

**Writing Task:** Students will be held accountable for the content of these sections either through their work in developing a structured journal or through their answers to the questions posed, or best of all – through both. While students should be held accountable for expressing themselves clearly and providing the textual evidence for their answer, there is no formal writing assignment associated with this exemplar. Teachers might afford students the opportunity to revise their journals or question responses after participating in classroom discussion or even rewrite their explanation after receiving teacher feedback, allowing them to refashion both their understanding of the text and their expression of that understanding.

**Text Selection:** This exemplar text, taken from a widely used middle school science series, was chosen because of its widespread use and its practical content. It is intended to stand as an example of how to engage students more deeply than is customary in textbook reading and to hold them accountable when doing so.

**Outline of Lesson Plan:** This lesson offers a “mix and match” approach to the textbook selection. It is intended to demonstrate several different methods that teachers can in turn modify to their own classroom materials and purposes. Because it is so flexibly designed, the amount of time spent on the activities will vary widely. Below is our recommended sequence, which would take 2-4 days:

**Examining the Text Structure:** (comes first in any sequence)

Because teaching students to observe and use text structure when reading textbooks is so critical a goal, the two sections have been reproduced directly from the textbook. This is located in Appendix A. We have inserted black “balloons” to point out features of text structure for instructional purposes. They are written directly to students to provide support for noticing text structure and how it can be helpful to understanding. This support falls away in section four of this exemplar so students can practice the steps without the balloon reminders. Students should always begin their textbook reading by looking over the text structure of the assigned chunk.

*System for examining text structure:*

1. Read the title of the section
2. Read the text preview: key concepts and key terms
3. Read the bolded subsection headers and the bolded sentences within that subsection.
4. Look carefully at pictures and read accompanying captions and labels
5. Notice all the sidebar activities and how distracting they can be. The teacher should be particularly active in pointing out what students do not need to attend to. Students have no way to sort this out for themselves.

**Structured Journaling: Helping students be responsible for their initial learning**

Structured journaling is the unique pedagogy offered by this close reading exemplar. Because of that, there is lots of support and explanation offered in these materials. It should be done early in the process: We recommend doing it immediately after the examining of text structure. The teacher can decide how much or how little support students will need, but we can assure you, students need lots of initial support in learning how to do structured journaling effectively. We can also assure you that time is well spent in the resultant independent capacity for learning it can lead to for students.

Early in this exemplar the textbook is reproduced without illustrations or sidebars in a two- column format, with the text under discussion occupying the left column and academic vocabulary defined in the slim center right-hand column across from the underlined word. The text is bolded where the textbook authors bolded it in the original for emphasizing key ideas. This will be used for the first reading of the text: where the students do structured journaling.

Again, structured journaling needs to be taught carefully to students with lots of teacher support at the beginning. There is lots of support for the teacher in this exemplar. **Appendix B** is a complete explanation of how to do structured journaling and includes directions to students and teachers. It also offers a research-based rationale for why this approach is effective pedagogy. **Appendix C** offers a sample, structured journal for this exemplar text.

**Text-based questions and tasks:**

Textbook sections appear again in the left column. The new right hand column holds questions for students and commentary for the teacher. These questions are designed to be answered independently by students or in small groups, so the commentary is limited. These can be printed off and given to students directly as homework or classwork if desired. They can also be used as the basis of class discussion of the material, since they would guide a discussion to most of the key content these sections hold.

**Standards Covered:** The following Common Core State Standards are the focus of this assignment: RI.7.1, RI.7.2, RI.7.4, RI.7.5, RI.7.7, RI.7 W.7.2, W.7.10, SL.7.1A, SL.7.1D, L.7.4A, L.7.6.
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The Text: “The Digestive Process Begins” and “Final Digestion and Absorption”

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<tr>
<th>Exemplar Text</th>
<th>Vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section Three - “The Digestive Process Begins”</strong></td>
<td>Note: the key terms and ideas are bolded, defined and a pronunciation guide provided (when necessary) by the textbook authors within the text.</td>
</tr>
<tr>
<td><strong>Key Concepts</strong></td>
<td>Words defined in this space are academic (“Tier Two”) words of high value that cannot be determined from context. Those words are underlined in the text each time they appear.</td>
</tr>
<tr>
<td>What digestive processes occur in the small intestine, and how are other digestive organs involved?</td>
<td>Guessed based on evidence</td>
</tr>
<tr>
<td>What role does the large intestine play in digestion?</td>
<td>Studied carefully</td>
</tr>
<tr>
<td><strong>Key Terms</strong></td>
<td>Absorbed- sucked into</td>
</tr>
<tr>
<td>digestion</td>
<td>Organ- body part that has a function</td>
</tr>
<tr>
<td>absorption</td>
<td></td>
</tr>
<tr>
<td>saliva</td>
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<tr>
<td>enzyme</td>
<td></td>
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<td>epiglottis</td>
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<td>esophagus</td>
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<tr>
<td>mucus</td>
<td></td>
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<tr>
<td>peristalsis</td>
<td></td>
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<tr>
<td>stomach</td>
<td></td>
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<tr>
<td><strong>Reading Preview</strong></td>
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<tr>
<td>In 1822, a man named Alexis St. Martin was wounded in the stomach. Dr. William Beaumont saved St. Martin’s life. The wound, however, left an opening in St. Martin’s stomach that never healed completely. Beaumont realized that by looking through the opening in St. Martin's abdomen, he could observe what was happening inside the stomach. Beaumont observed that food changed chemically inside the stomach. He hypothesized that chemical reactions in the stomach broke down foods into smaller particles. Beaumont removed liquid from St. Martin's stomach and analyzed it. The stomach liquid contained an acid that played a role in the breakdown of foods into simpler substances.</td>
<td></td>
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<tr>
<td><strong>Functions of the Digestive System</strong></td>
<td></td>
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<tr>
<td>Beaumont’s observations helped scientists understand the role of the stomach in the digestive system. The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body. Figure 14 shows the organs of the digestive system, which is about 9 meters long from beginning to end.</td>
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</tr>
</tbody>
</table>
Digestion
The process by which your body breaks down food into small nutrient molecules is called digestion. There are two kinds of digestion—mechanical and chemical. In mechanical digestion, foods are physically broken down into smaller pieces. Mechanical digestion occurs when you bite into a sandwich and chew it into small pieces.

In chemical digestion, chemicals produced by the body break foods into their smaller chemical building blocks. For example, the starch in bread is broken down into individual sugar molecules.

Absorption and Elimination
After your food is digested, the molecules are ready to be transported throughout your body. Absorption (ab SAWRP shun) is the process by which nutrient molecules pass through the wall of your digestive system into your blood. Materials that are not absorbed, such as fiber, are eliminated from the body as wastes.

The Mouth
Have you ever walked past a bakery or restaurant and noticed your mouth watering? Smelling or even just thinking about food when you’re hungry is enough to start your mouth watering. This response isn’t accidental. When your mouth waters, your body is preparing for the delicious meal it expects. Both mechanical and chemical digestion begin in the mouth. The fluid released when your mouth waters is saliva (suh LYYUh). Saliva plays an important role in both kinds of digestion.

Mechanical Digestion in the Mouth
Your teeth carry out the first stage of mechanical digestion. Your center teeth, or incisors (in SY zurz), cut the food into bite-sized pieces. On either side of the incisors there are sharp, pointy teeth called canines (KAY nyny). These teeth tear and slash the food into smaller pieces. Behind the canines are the premolars and molars, which crush and grind the food. As the teeth do their work, saliva moistens the pieces of food into one slippery mass.

Chemical Digestion in the Mouth
As mechanical digestion begins, so does chemical digestion. If you take a bite of a cracker and suck on it, the cracker begins to taste sweet. It tastes sweet because a chemical in the saliva has broken down the starch molecules in the cracker into sugar molecules.

The chemical in saliva that digests starch is an enzyme. Enzymes are proteins that speed up chemical reactions in the body. Your body produces many different enzymes. Each enzyme has a specific chemical shape. Its shape enables it to take part in only one kind of chemical
reaction. An example of enzyme action is shown in Figure 16.

The Esophagus
If you’ve ever choked on food, your food may have "gone down the wrong way." That’s because there are two openings at the back of your mouth. One opening leads to your windpipe, which carries air into your lungs. As you swallow, a flap of tissue called the **epiglottis** (ep uh GLAHHT is) seals off your windpipe preventing the food from entering. The food goes into the **esophagus** (ih SAHF uh gus), a muscular tube that connects the mouth to the stomach. The esophagus is lined with mucus, a thick, slippery substance produced by the body. Mucus makes food easier to swallow and move along.

Food remains in the esophagus for only about 10 seconds. **After food enters the esophagus, contractions of smooth muscles push the food toward the stomach.** These involuntary waves of muscle contraction are called **peristalsis** (pehr ih STAWL sis). Peristalsis also occurs in the stomach and farther down the digestive system. These muscular waves keep food moving in one direction.

Section 4: “Final Digestion and Absorption”

**Key Concepts**
What digestive processes occur in the small intestine, and how are other digestive organs involved?
What role does the large intestine play in digestion?

**Key Terms**
small intestine
liver
bile
gallbladder
pancreas
villus
large intestine
rectum
anus

**Reading Preview**
Have you ever been part of a huge crowd attending a concert or sports event? **Barriers and
passageways often guide people in the right direction. Ticket takers make sure that people enter in an orderly fashion.

In some ways, the stomach can be thought of as the "ticket taker" of the digestive system. Once the food has been changed into a thick liquid, the stomach releases a little of the liquid at a time into the next part of the digestive system. This slow, smooth passage of food through the digestive system ensures that digestion and absorption can take place efficiently.

**The Small Intestine**
After the thick liquid leaves the stomach, it enters the small intestine. The small intestine is the part of the digestive system where most chemical digestion takes place. You may wonder how the small intestine got its name. After all, at about 6 meters--longer than some full-sized cars--it makes up two thirds of the length of the digestive system. The small intestine was named for its small diameter. It is from 2 to 3 centimeters wide, about half the diameter of the large intestine.

When food reaches the small intestine, it has already been mechanically digested into a thick liquid. But chemical digestion has just begun. Starches and proteins have been partially broken down, but fats haven’t been digested at all. *Almost all chemical digestion and absorption of nutrients takes place in the small intestine.* As the liquid moves into the small intestine it mixes with enzymes and secretions that are produced by the small intestine, the liver, and the pancreas. The liver and the pancreas deliver their *substances* to the small intestine through small tubes.

**The Liver**
As you can see in Figure 18, the liver is located in the upper right portion of the abdomen. It is the largest organ inside the body. The liver is like an extremely busy chemical factory and plays a role in many body processes. For example, it breaks down medicines, and it helps eliminate nitrogen from the body. *The role of the liver in the digestive system is to produce bile.*

Bile is a substance that breaks up fat particles. Bile flows from the liver into the gallbladder, the organ that stores bile. After you eat, bile passes through a tube from the gallbladder into the small intestine.

Bile is not an enzyme. It does not chemically digest goods. It does, however, physically break...
up large fat particles into smaller fat droplets. You can compare the action of bile on fats with the action of soap on a greasy frying pan. Soap physically breaks up the grease into small droplets that can mix with the soapy water and be washed away. Bile mixes with the fats in food to form small fat droplets. The droplets can then be chemically broken down by enzymes produced in the pancreas.

The Pancreas

The pancreas is a triangular organ that lies between the stomach and the first part of the small intestine. Like the liver, the pancreas plays a role in many body processes. As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, protein, and fats.

Digestive enzymes do not break down all food substances. Recall that the fiber in food isn’t broken down. Instead, fiber thickens the liquid material in the intestine. This thickening makes it easier for peristalsis to push the material forward.

Absorption in the Small Intestines

After chemical digestion takes place, the small nutrient molecules are ready to be absorbed by the body. The structure of the small intestine makes it well suited for absorption. The inner surface, or lining, of the small intestine looks bumpy. Millions of tiny finger-shaped structures called villi (VIL eye) (singular villus) cover the surface. The villi absorb nutrient molecules. Notice in Figure 19 that tiny blood vessels run through the center of each villus. Nutrient molecules pass from cells on the surface of a villus into blood vessels. The blood carries the nutrients throughout the body for use by body cells.

Villi greatly increase the surface area of the small intestine. If all the villi were laid out flat, the total surface area of the small intestine would be about as large as a tennis court. This increased surface enables digested food to be absorbed much faster than if the walls of the small intestine were smooth.

The Large Intestine

By the time material reaches the end of the small intestine, most nutrients have been absorbed. The remaining material moves from the small intestine into the large intestine. The large intestine is the last section of the digestive system. It is about 1.5 meters long—about as long as the average bathtub. It runs up the right hand side of the abdomen, across the upper abdomen, and then down the left-hand side. The large intestine contains bacteria that feed on the material passing through. These bacteria normally do not cause disease. In fact, they are helpful because they make certain vitamins, including vitamin K.
The material entering the large intestine contains water and undigested food. **As the material moves through the large intestine, water is absorbed into the bloodstream.** The remaining material is readied for elimination from the body.

The large intestine ends in a short tube called the **rectum.** Here, waste material is **compressed** into a solid form. This waste material is eliminated from the body through the **anus,** a muscular opening at the end of the rectum.

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Day One: Instructional Exemplar for Section Three “The Digestive Process Begins”

Text Structure and Initial Reading of Section Three “The Digestive Process Begins”
1. The teacher goes through Section Three pointing out the text structures that make the dense information more accessible. The students follow in their texts (Appendix D) and participate in identifying and discussing text structures and what purpose they play in explicating the text.
2. Students then read Section Three to themselves or in stronger reader-weaker reader pairs or with the teacher reading aloud and students following (which choice depends on the composition of the students in a particular class and how deep in the school year the class is). They should read section by section and write a structured journal entry for each section.

For homework or for Day Two Activities:
3. Students go back through the section and answer a small set of guiding questions and tasks about the text (Appendix D) and in the chart that follows or complete the structured journaling begun during the class period. We recommend both be done, but the best combination can be determined by the teacher (see Appendix B for an explanation of structured journaling and Appendix C for a sample student response for this sections three and four)
4. After the independent work, students discuss the section with the teacher who elaborates on the work the students did and on the information provided in the text.
<table>
<thead>
<tr>
<th>Text under Discussion</th>
<th>Instructional Commentary/Guiding Questions For Students</th>
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</table>
| For text structure, use the reproduced text provided in Appendix A | 1. Introduce Section Three “The Digestive Process Begins” and go through the text structure (use Appendix A for textbook replica) before asking students to read the section independently.  
System for examining text structure:  
1. Read the title of the section  
2. Read the text preview: key concepts and key terms  
3. Read the bolded subsection headers and the bolded sentences within that subsection.  
4. Look carefully at pictures and read accompanying captions and labels  
Notice all the sidebar activities and how distracting they can be. The teacher should be particularly active in pointing out what students do not need to attend to. Students have no way to sort this out for themselves.  
2. Students read Section Three to themselves and write structured journal entries for each major subsection (indicated by larger font) or follow along as the teacher models and guides structured journaling (for this, the text provided on will work best).  
Note on what version of the text to use when: Students should have access to both the text at the beginning of this exemplar and the reproduction of the textbook pages (Appendix A). The teacher should select which version to use by evaluating whether the students need vocabulary support more or text structure support in a given instance. This can best be determined through experimenting with using both forms at different times or by following this exemplar as written and seeing the results for your students. In general, for structured journaling and text-based questions, less busy text works best, especially when students are getting used to this process. For discussions, the original text is best so the pictures and captions can be used freely. |

For structured journaling, use the text provided on pages 5-8
Text under Discussion

Reading Preview:

In 1822, a man named Alexis St. Martin was wounded in the stomach. Dr. William Beaumont saved St. Martin's life. The wound, however, left an opening in St. Martin's stomach that never healed completely. Beaumont realized that by looking through the opening in St. Martin's abdomen, he could observe what was happening inside the stomach. Beaumont observed that food changed chemically inside the stomach. He hypothesized that chemical reactions in the stomach broke down foods into smaller particles. Beaumont removed liquid from St. Martin's stomach and analyzed it. The stomach liquid contained an acid that played a role in the breakdown of foods into simpler substances.

Functions of the Digestive System

Beaumont's observations helped scientists understand the role of the stomach in the digestive system. The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body. Figure 14 shows the organs of the digestive system, which is about 9 meters long from beginning to end.

Digestion

The process by which your body breaks down food into small nutrient molecules is called digestion. There are two kinds of digestion – mechanical and chemical. In mechanical digestion, foods are physically broken down into smaller pieces. Mechanical digestion occurs when you bite into a sandwich and chew it into small pieces.

In chemical digestion, chemicals produced by the body break foods into their smaller chemical building blocks. For example, the starch in bread is broken down into individual sugar molecules.

Instructional Commentary/Guiding Questions for Students

Stand-alone questions and tasks for use with the text after the text structure review and the first full read:

Functions of the Digestive System:

Translate the bolded portions of the paragraph

Digestion:

The section explaining mechanical and chemical digestion is particularly poorly written. This can be turned to an advantage by using the structured journal to check for student understanding.

Why does food have to be broken down into smaller parts?

Explain the process of absorption in your own words.
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<td></td>
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<tr>
<td>After your food is digested, the molecules are ready to be transported throughout your body. <strong>Absorption</strong> (ab SAWRP shun) is the process by which nutrient molecules pass through the wall of your digestive system into your blood. Materials that are not absorbed, such as fiber, are eliminated from the body as wastes.</td>
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<tr>
<td><strong>The Mouth</strong></td>
<td></td>
</tr>
<tr>
<td>Have you ever walked past a bakery or restaurant and noticed your mouth watering? Smelling or even just thinking about food when you're hungry is enough to start your mouth watering. This response isn't accidental. When your mouth waters, your body is preparing for the delicious meal it expects. <strong>Both mechanical and chemical digestion begin in the mouth.</strong> The fluid released when your mouth waters is saliva (suh LYY VUh). Saliva plays an important role in both kinds of digestion.</td>
<td><strong>The Mouth:</strong> Describe completely the events that occur when food enters the mouth. Explain the diagram on the top of page 63 (excerpt from Appendix A needed here).</td>
</tr>
<tr>
<td><strong>Mechanical Digestion in the Mouth</strong></td>
<td></td>
</tr>
<tr>
<td>Your teeth carry out the first stage of mechanical digestion. Your center teeth, or incisors (in SY zurz), cut the food into bite-sized pieces. On either side of the incisors there are sharp, pointy teeth called canines (KAY nynz). These teeth tear and slash the food into smaller pieces. Behind the canines are the premolars and molars, which crush and grind the food. As the teeth do their work, saliva moistens the pieces of food into one slippery mass.</td>
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<td><strong>Chemical Digestion in the Mouth</strong> As mechanical digestion begins, so does chemical digestion. If you take a bite of a cracker and suck on it, the cracker begins to taste sweet. It tastes sweet because a chemical in the saliva has broken down the starch molecules in the cracker into sugar molecules.</td>
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The chemical in saliva that digests starch is an enzyme. **Enzymes** are proteins that speed up chemical reactions in the body. Your body produces many different enzymes. Each enzyme has a **specific** chemical shape. Its shape enables it to take part in only one kind of chemical reaction. An example of enzyme action is shown in Figure 16.

**The Esophagus** If you’ve ever choked on food, your food may have "gone down the wrong way." That's because there are two openings at the back of your mouth. One opening leads to your windpipe, which carries air into your lungs. As you swallow, a flap of tissue called the **epiglottis** (ep uh GLAHT is) seals off your windpipe preventing the food from entering. The food goes into the **esophagus** (ih SAH F uh gus), a muscular tube that connects the mouth to the stomach. The esophagus is lined with mucus, a thick, slippery substance produced by the body. Mucus makes food easier to swallow and move along. Food remains in the esophagus for only about 10 seconds. **After food enters the esophagus, contractions of smooth muscles push the food toward the stomach.** These involuntary waves of muscle contraction are called **peristalsis** (pehr ih STAWL sis). Peristalsis also occurs in the stomach and farther down the digestive system. These muscular waves keep food moving in one direction.

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<td></td>
</tr>
</tbody>
</table>
Day Three: Instructional Exemplar for Section Four “Final Digestion and Absorption”

Initial Reading of Section Four “Final Digestion and Absorption”
1. The teacher goes through Section Four pointing out the text structures that make the dense information more accessible. The students follow in their texts and participate in identifying and discussing text structures and what purpose they play in explicating the text.
2. Students then read section four to themselves or in stronger reader-weaker reader pairs or with the teacher reading aloud and students following (which choice depends on the composition of the students in a particular class and how deep in the school year the class is). They should read section by section and write a structured journal entry for each section. It would be good if the teacher passed more responsibility to the students for doing the structured journal for section four and then provided feedback on how well the students did (teachers can see Appendix C for benchmark student responses).

For homework or for Day Four Activities:
3. Students go back through the section and either finish or revise their structured journals or answer a small set of guiding questions and tasks about the text (Appendix D and in the chart following), or do both in a combination determined by the teacher
4. After the independent work, students discuss the section with the teacher who elaborates on the work the students did and on the information provided in the text.
<table>
<thead>
<tr>
<th>Text under Discussion</th>
<th>Instructional Commentary/Guiding Questions For Students</th>
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</thead>
<tbody>
<tr>
<td>For text structure, use the reproduced text provided in Appendix A</td>
<td>1. Introduce Section Four “Final Digestion and Absorption” and go through the text structure (use Appendix A for textbook replica) before asking students to read the section independently.</td>
</tr>
<tr>
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<td>System for examining text structure:</td>
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<td>5. Read the title of the section</td>
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<td>6. Read the text preview: key concepts and key terms</td>
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<td>7. Read the bolded subsection headers and the bolded</td>
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<td>sentences within that subsection.</td>
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<td>8. Look carefully at pictures and read accompanying</td>
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<td>captions and labels</td>
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<td>Notice all the sidebar activities and how distracting</td>
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<td>they can be. The teacher should be particularly active</td>
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<td>in pointing out what students do not need to attend</td>
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<td>to. Students have no way to sort this out for</td>
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<td>themselves.</td>
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<tr>
<td>For structured journaling, use the text provided on pages 5-8</td>
<td>2. Students read Section Four to themselves and write structured journal entries for each major subsection (indicated by larger font) or follow along as the teacher models and guides structured journaling (for this, the text provided on will work best).</td>
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<td>Note on what version of the text to use when: Students</td>
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<td>should have access to both the text at the beginning</td>
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<td>of this exemplar and the reproduction of the textbook</td>
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<td>pages (Appendix A). The teacher should select which</td>
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<td>version to use by evaluating whether the students need</td>
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<td>vocabulary support more or text structure support in</td>
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<td>a given instance. This can best be determined through</td>
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<td>experimenting with using both forms at different times</td>
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<td>or by following this exemplar as written and seeing</td>
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<td>the results for your students. In general, for</td>
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<td>structured journaling and text-based questions, less</td>
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<td>busy text works best, especially when students are</td>
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<td>getting used to this process. For discussions, the</td>
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<td></td>
<td>original text is best so the pictures and captions can</td>
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<td>be used freely.</td>
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</table>
**Text under Discussion**

**Reading Preview: Section Four**

Have you ever been part of a huge crowd attending a concert or sports event? Barriers and passageways often guide people in the right direction. Ticket takers make sure that people enter in an orderly fashion.

In some ways, the stomach can be thought of as the "ticket taker" of the digestive system. Once the food has been changed into a thick liquid, the stomach releases a little of the liquid at a time into the next part of the digestive system. This slow, smooth passage of food through the digestive system *ensures* that digestion and absorption can take place efficiently.

**The Small Intestine**

After the thick liquid leaves the stomach, it enters the small intestine. The small intestine is the part of the digestive system where most chemical digestion takes place. You may wonder how the small intestine got its name. After all, at about 6 meters—longer than some full-sized cars—it makes up two thirds of the length of the digestive system. The small intestine was named for its small diameter. It is from 2 to 3 centimeters wide, about half the diameter of the large intestine.

When food reaches the small intestine, it has already been mechanically digested into a thick liquid. But chemical digestion has just begun. Starches and proteins have been partially broken down, but fats haven’t been digested at all. Almost all chemical digestion and absorption of nutrients takes place in the small intestine. As the liquid moves into the small intestine it mixes with enzymes and *secretions* that are produced by the small intestine, the liver, and the pancreas. The liver and the pancreas deliver their *substances* to the small intestine through small tubes.

---

**Instructional Commentary/Guiding Questions for Students**

*Stand-alone questions and tasks for use with the text after the text structure review and the first full read:*

**Reading Preview**

According to the text what is the role the stomach plays in digestion?

Explain what might happen if the stomach failed to work properly?

**The Small Intestine:**

Describe what happens to food in the small intestine.

Why is the small intestine called “the small intestine?”

---

Page 68 “Discover Activity” (Use Appendix A version)

Using both the hand example and the section on the small intestine explain how the hand example illustrates the workings of the small intestine.
The Liver

As you can see in Figure 18, the liver is located in the upper right portion of the abdomen. It is the largest organ inside the body. The liver is like an extremely busy chemical factory and plays a role in many body processes. For example, it breaks down medicines, and it helps eliminate nitrogen from the body. **The role of the liver in the digestive system is to produce bile.**

**Bile** is a substance that breaks up fat particles. Bile flows from the liver into the **gallbladder**, the organ that stores bile. After you eat, bile passes through a tube from the gallbladder into the small intestine.

Bile is not an enzyme. It does not chemically digest goods. It does, however, physically break up large fat particles into smaller fat droplets. You can compare the action of bile on fats with the action of soap on a greasy frying pan. Soap physically breaks up the grease into small droplets that can mix with the soapy water and be washed away. Bile mixes with the fats in food to form small fat droplets. The droplets can then be chemically broken down by enzymes produced in the pancreas.

The Pancreas

The **pancreas** is a triangular organ that lies between the stomach and the first part of the small intestine. Like the liver, the pancreas plays a role in many body processes.  **As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, protein, and fats.**

Digestive enzymes do not break down all food substances. **Recall** that the fiber in food isn’t broken down. Instead, fiber thickens the liquid material in the intestine. This thickening makes it easier for peristalsis to push the material forward.

<table>
<thead>
<tr>
<th>Text under Discussion</th>
<th>Instructional Commentary/Guiding Questions For Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Liver:</strong></td>
<td>Describe what happens in the liver.</td>
</tr>
<tr>
<td></td>
<td>What are the different roles the liver performs?</td>
</tr>
<tr>
<td><strong>The text lists a number of functions of the liver. But students might be tempted to take a shortcut and paraphrase or even copy just the bolded line, since that is one quick-to-spot role.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>The Pancreas:</strong></td>
<td>Explain how the Liver and the Pancreas work together in digestion.</td>
</tr>
<tr>
<td>Text under Discussion</td>
<td>Instructional Commentary/Guiding Questions for Students</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Absorption in the Small Intestines</strong></td>
<td><strong>Absorption in the Small Intestines:</strong></td>
</tr>
<tr>
<td>After chemical ingestion takes place, the small nutrient molecules are ready to be</td>
<td>After carefully rereading this section and the section on the small intestine, including the activity, explain how the</td>
</tr>
<tr>
<td>absorbed by the body. The structure of the small intestine makes it well suited for</td>
<td>structure or shape of the small intestine helps it perform its role in digestion.</td>
</tr>
<tr>
<td>absorption. The inner surface, or lining, of the small intestine looks bumpy.</td>
<td>Based on your answer to the above, what might happen if much of the small intestine was damaged?</td>
</tr>
<tr>
<td>Millions of tiny finger-shaped structures called villi (VIL eye) (singular villus)</td>
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<tr>
<td>cover the surface. The villi absorb nutrient molecules. Notice in Figure 19 that tiny</td>
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<tr>
<td>blood vessels run through the center of each villus. Nutrient molecules pass from</td>
<td></td>
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<tr>
<td>cells on the surface of a villus into blood vessels. The blood carries the nutrients</td>
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<tr>
<td>throughout the body for use by body cells.</td>
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<tr>
<td>Villi greatly increase the surface area of the small intestine. If all the villi were</td>
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<tr>
<td>laid out flat, the total surface area of the small intestine would be about as large</td>
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<tr>
<td>as a tennis court. This increased surface enables digested food to be absorbed much</td>
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<tr>
<td>faster than if the walls of the small intestine were smooth.</td>
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<tr>
<td><strong>The Large Intestine</strong></td>
<td><strong>The Large Intestine:</strong></td>
</tr>
<tr>
<td>By the time material reaches the end of the small intestine, most nutrients have</td>
<td>Explain what happens to food as it enters the large intestine.</td>
</tr>
<tr>
<td>been absorbed. The remaining material moves from the small intestine into the large</td>
<td>Why might the large intestine have a greater diameter than the small intestine?</td>
</tr>
<tr>
<td>intestine. The large intestine is the last section of the digestive system. It is</td>
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<tr>
<td>about 1.5 meters long – about as long as the average bathtub. It runs up the right</td>
<td></td>
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<tr>
<td>hand side of the abdomen, across the upper abdomen, and then down the left-hand side.</td>
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<tr>
<td>The large intestine contains bacteria that feed on the material passing through. These</td>
<td></td>
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<tr>
<td>bacteria normally do not cause disease. In fact, they are helpful because they make</td>
<td></td>
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<tr>
<td>certain vitamins, including vitamin K.</td>
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<tr>
<td>The material entering the large intestine contains water and undigested food. As the</td>
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<tr>
<td>material moves through the large intestine, water is absorbed into the bloodstream.</td>
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<tr>
<td>The remaining material is readied for elimination from the body.</td>
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</tr>
<tr>
<td>Text under Discussion</td>
<td>Instructional Commentary/Guiding Questions For Students</td>
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<tr>
<td>The large intestine ends in a short tube called the <strong>rectum</strong>. Here, waste material is <strong>compressed</strong> into a solid form. This waste material is eliminated from the body through the <strong>anus</strong>, a muscular opening at the end of the rectum.</td>
<td></td>
</tr>
</tbody>
</table>
### Culminating Assignments: Directions for Teachers and Students / Guidance for Teachers

**Option 1:** Create a flow chart of the digestive process that shows a piece of food as it travels from mouth to rectum (from beginning to end). Highlight those points where digestion, absorption, and elimination occur.

An expansion of this project would be to break the class into groups and give each group a different type of food to “digest” in their flow chart. This would reinforce the fact that the human digestive system can deal differently with entirely different types of food (such as fatty meats, highly acidic fruit, or high fiber foods like oatmeal).

**Option 2:** Create a “proposition chart” for any one or more paragraphs to show the density of information that even these seemingly straightforward sections contain. Students take a paragraph the teacher selects for its density of information and the students go through and list each separate proposition, or idea. Most sentences in this text contain more than one proposition. This activity can really bring home to students how much information is packed into a textbook, even one as apparently simple as this one, and teaches them they have to slow down their rate of reading in order to take in the information effectively.

**Option 3:** Any of the activities offered by the textbook authors and contained in the original (Appendix A) version of the text. There are many good ones, and they will be much more meaningful to students after they have gained the basic knowledge of the digestive system these two sections offer.
Grade 7 Informational Mini-Assessment

“The Digestive Process Begins” and “Final Digestion and Absorption” excerpts

This grade 7 mini-assessment is based on two excerpts, “The Digestive Process Begins” and “Final Digestion and Absorption.” These texts are considered to be worthy of students’ time to read and also meet the expectations for text complexity at grade 7. Assessments aligned to the Common Core State Standards (CCSS) will employ quality, complex texts such as these. Because the topic of the texts is scientific, the mini-assessment will measure both Reading Standards for Informational Text as well as Reading Standards in Literacy in Science and Technical Subjects. Questions aligned to the CCSS should be worthy of students’ time to answer and therefore do not focus on minor points of the texts. Questions also may address several standards within the same question because complex texts tend to yield rich assessment questions that call for deep analysis. In this mini-assessment, there are five selected-response questions and two paper/pencil equivalent of technology enhanced items that address the Reading Standards listed below.

We encourage educators to give students the time that they need to read closely. While we know that it is helpful to have students complete the mini-assessment in one class period, we encourage educators to allow additional time as necessary.

The questions align to the following standards:

<table>
<thead>
<tr>
<th>RI.7.1</th>
<th>Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI.7.2</td>
<td>Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text.</td>
</tr>
<tr>
<td>RI.7.3</td>
<td>Analyze the interactions between individuals, events, and ideas in a text (e.g., how ideas influence individuals or events, or how individuals influence ideas or events).</td>
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<tr>
<td>RI.7.8</td>
<td>Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.</td>
</tr>
<tr>
<td>RST.6-8.1</td>
<td>Cite specific textual evidence to support analysis of science and technical texts.</td>
</tr>
<tr>
<td>RST.6-8.2</td>
<td>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.</td>
</tr>
<tr>
<td>RST.6-8.4</td>
<td>Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.</td>
</tr>
<tr>
<td>RST.6-8.5</td>
<td>Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.</td>
</tr>
<tr>
<td>RST.6-8.6</td>
<td>Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.</td>
</tr>
<tr>
<td>RST.6-8.7</td>
<td>Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).</td>
</tr>
</tbody>
</table>
Grade 7 Mini-Assessment – The Digestive Process

Today you will read two passages about how the human digestive system processes food. You will then answer several questions based on the text. I will be happy to answer questions about the directions, but I will not help you with the answers to any questions. You will notice as you answer the questions that some of the questions have two parts. You should answer Part A of the question before you answer Part B, but you may go back and change your answer to Part A if you want to.

Take as long as you need to read and answer the questions. If you do not finish when class ends, come see me to discuss when you may have additional time.

Now read the passages and answer the questions. I encourage you to write notes in the margin as you read the passages.

Grade 7
“The Digestive Process Begins” and “Final Digestion and Absorption”

Excerpt 1: “The Digestive Process Begins”

1 In 1822, a man named Alexis St. Martin was wounded in the stomach. Dr. William Beaumont saved St. Martin's life. The wound, however, left an opening in St. Martin's stomach that never healed completely. Beaumont realized that by looking through the opening in St. Martin's abdomen, he could observe what was happening inside the stomach. Beaumont observed that food changed chemically inside the stomach. He hypothesized that chemical reactions in the stomach broke down foods into smaller particles. Beaumont removed liquid from St. Martin's stomach and analyzed it. The stomach liquid contained an acid that played a role in the breakdown of foods into simpler substances.

Functions of the Digestive System

2 Beaumont's observations helped scientists understand the role of the stomach in the digestive system. The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body. Figure 14 shows the organs of the digestive system, which is about 9 meters long from beginning to end.
Digestion

3 The process by which your body breaks down food into small nutrient molecules is called digestion. There are two kinds of digestion – mechanical and chemical. In mechanical digestion, foods are physically broken down into smaller pieces. Mechanical digestion occurs when you bite into a sandwich and chew it into small pieces. In chemical digestion, chemicals produced by the body break foods into their smaller chemical building blocks. For example, the starch in bread is broken down into individual sugar molecules.

Absorption and Elimination

4 After your food is digested, the molecules are ready to be transported throughout your body. Absorption (ab SAWRP shun) is the process by which nutrient molecules pass through the wall of your digestive system into your blood. Materials that are not absorbed, such as fiber, are eliminated from the body as wastes.
The Mouth

5 Have you ever walked past a bakery or restaurant and noticed your mouth watering? Smelling or even just thinking about food when you're hungry is enough to start your mouth watering. This response isn't accidental. When your mouth waters, your body is preparing for the delicious meal it expects. Both mechanical and chemical digestion begin in the mouth. The fluid released when your mouth waters is saliva (suh-LY-vuh). Saliva plays an important role in both kinds of digestion.

Mechanical Digestion in the Mouth

6 Your teeth carry out the first stage of mechanical digestion. Your center teeth, or incisors (in SY zurz), cut the food into bite-sized pieces. On either side of the incisors there are sharp, pointy teeth called canines (KAY nyz). These teeth tear and slash the food into smaller pieces. Behind the canines are the premolars and molars, which crush and grind the food. As the teeth do their work, saliva moistens the pieces of food into one slippery mass.

Chemical Digestion in the Mouth

7 As mechanical digestion begins, so does chemical digestion. If you take a bite of a cracker and suck on it, the cracker begins to taste sweet. It tastes sweet because a chemical in the saliva has broken down the starch molecules in the cracker into sugar molecules.

8 The chemical in saliva that digests starch is an enzyme. Enzymes are proteins that speed up chemical reactions in the body. Your body produces many different enzymes. Each enzyme has a specific chemical shape. Its shape enables it to take part in only one kind of chemical reaction. An example of enzyme action is shown in Figure 16.
The Esophagus

If you’ve ever choked on food, your food may have "gone down the wrong way." That’s because there are two openings at the back of your mouth. One opening leads to your windpipe, which carries air into your lungs. As you swallow, a flap of tissue called the epiglottis (ep uh GLAHT is) seals off your windpipe preventing the food from entering. The food goes into the esophagus (ih SAHF uh gus), a muscular tube that connects the mouth to the stomach. The esophagus is lined with mucus, a thick, slippery substance produced by the body. Mucus makes food easier to swallow and move along.

Food remains in the esophagus for only about 10 seconds. After food enters the esophagus, contractions of smooth muscles push the food toward the stomach. These involuntary waves of muscle contraction are called peristalsis (pehr ih STAWL sis). Peristalsis also occurs in the stomach and farther down the digestive system. These muscular waves keep food moving in one direction.
Excerpt 2: “Final Digestion and Absorption”

1 Have you ever been part of a huge crowd attending a concert or sports event? Barriers and passageways often guide people in the right direction. Ticket takers make sure that people enter in an orderly fashion.

2 In some ways, the stomach can be thought of as the "ticket taker" of the digestive system. Once the food has been changed into a thick liquid, the stomach releases a little of the liquid at a time into the next part of the digestive system. This slow, smooth passage of food through the digestive system ensures that digestion and absorption can take place efficiently.

The Small Intestine

3 After the thick liquid leaves the stomach, it enters the small intestine. The small intestine is the part of the digestive system where most chemical digestion takes place. You may wonder how the small intestine got its name. After all, at about 6 meters--longer than some full-sized cars--it makes up two thirds of the length of the digestive system. The small intestine was named for its small diameter. It is from 2 to 3 centimeters wide, about half the diameter of the large intestine.

4 When food reaches the small intestine, it has already been mechanically digested into a thick liquid. But chemical digestion has just begun. Starches and proteins have been partially broken down, but fats haven’t been digested at all. Almost all chemical digestion and absorption of nutrients takes place in the small intestine. As the liquid moves into the small intestine it mixes with enzymes and secretions that are produced by the small intestine, the liver, and the pancreas. The liver and the pancreas deliver their substances to the small intestine through small tubes.

The Liver

5 As you can see in Figure 18, the liver is located in the upper right portion of the abdomen. It is the largest organ inside the body. The liver is like an extremely busy chemical factory and plays a role in many body processes. For example, it breaks down medicines, and it helps eliminate nitrogen from the body. The role of the liver in the digestive system is to produce bile.
Bile is a substance that breaks up fat particles. Bile flows from the liver into the gallbladder, the organ that stores bile. After you eat, bile passes through a tube from the gallbladder into the small intestine.

Bile is not an enzyme. It does not chemically digest foods. It does, however, physically break up large fat particles into smaller fat droplets. You can compare the action of bile on fats with the action of soap on a greasy frying pan. Soap physically breaks up the grease into small droplets that can mix with the soapy water and be washed away. Bile mixes with the fats in food to form small fat droplets. The droplets can then be chemically broken down by enzymes produced in the pancreas.

The Pancreas

The pancreas is a triangular organ that lies between the stomach and the first part of the small intestine. Like the liver, the pancreas plays a role in many body processes. As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, protein, and fats.

Digestive enzymes do not break down all food substances. Recall that the fiber in food isn’t broken down. Instead, fiber thickens the liquid material in the intestine. This thickening makes it easier for peristalsis to push the material forward.

Absorption in the Small Intestines

After chemical ingestion takes place, the small nutrient molecules are ready to be absorbed by the body. The structure of the small intestine makes it well suited for absorption. The inner surface, or lining, of the small intestine looks bumpy. Millions of tiny finger-shaped structures called villi (VIL eye) (singular villus) cover the surface. The villi absorb nutrient molecules. Notice in Figure 19 that tiny blood vessels run through the center of each villus. Nutrient molecules pass from cells on the surface of a villus into blood vessels. The blood carries the nutrients throughout the body for use by body cells.
11 Villi greatly increase the surface area of the small intestine. If all the villi were laid out flat, the total surface area of the small intestine would be about as large as a tennis court. This increased surface enables digested food to be absorbed much faster than if the walls of the small intestine were smooth.

**The Large Intestine**

12 By the time material reaches the end of the small intestine, most nutrients have been absorbed. The remaining material moves from the small intestine into the large intestine. The large intestine is the last section of the digestive system. It is about 1.5 meters long – about as long as the average bathtub. It runs up the right hand side of the abdomen, across the upper abdomen, and then down the left-hand side. The large intestine contains bacteria that feed on the material passing through. These bacteria normally do not cause disease. In fact, they are helpful because they make certain vitamins, including vitamin K.

13 The material entering the large intestine contains water and undigested food. As the material moves through the large intestine, water is absorbed into the bloodstream. The remaining material is readied for elimination from the body.

14 The large intestine ends in a short tube called the rectum. Here, waste material is compressed into a solid form. This waste material is eliminated from the body through the anus, a muscular opening at the end of the rectum.

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QUESTIONS:

1. The following item has two parts. Answer Part A and then answer Part B.
   Part A: According to Excerpt 1, what are enzymes?
   A. acids that make food easier to swallow
   B. chemicals found in blood to help transport nutrients
   C. substances made by the body that increase the rate of chemical reactions
   D. proteins that carry nutrient molecules to organs throughout the body

   Part B: The author of Excerpt 1 discusses enzymes in order to help the reader understand—
   A. how our bodies turn food into nutrients.
   B. how the liver performs more than one function.
   C. why the digestive process can take several hours.
   D. why a balanced diet contributes to efficient digestion.

2. The following item has two parts. Answer Part A and then answer Part B.
   Part A: Which statement best describes what happens to fat in the body as described in Excerpt 2?
   A. In the small intestine, fat is broken down by special substances from the liver and pancreas.
   B. In the stomach, fat gets digested so it can be stored in the liver.
   C. In the small intestine, fat thickens waste material before it passes into the large intestine.
   D. In the mouth, fat works with enzymes in saliva to change food into a slippery mass.

   Part B: Based on the answer to Part A, what can the reader conclude about fat?
   A. Fat is responsible for moving food through the body.
   B. Fat is mostly affected by mechanical digestion.
   C. Fat contains important nutrients.
   D. Fat is harder to digest than other types of food.

3. Circle a sentence in Excerpt 2 that provides evidence that the late stages of digestion require several organs to work together at the same time.

4. Which idea discussed in Excerpt 2 is further emphasized by Figure 19?
   A. The small intestine is much longer than the large intestine but it is also more narrow.
   B. The small intestine produces enzymes that help break food down further.
   C. The small intestine allows digested nutrients to easily pass into the bloodstream.
   D. The small intestine compresses food into solid form in order to aid elimination.
5. Study the chart and the List of Body Parts to decide which part performs each of the roles described on the chart. Then complete the chart by writing the names of the correct body part. One line of the chart has been done for you.
You will NOT use all the parts in the List of Body Parts. Also note that one part performs two main roles.

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Main Role in Digestive Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Begins chemical and mechanical digestion</td>
</tr>
<tr>
<td></td>
<td>Starts peristalsis</td>
</tr>
<tr>
<td>Stomach</td>
<td>Slowly releases liquid food</td>
</tr>
<tr>
<td></td>
<td>1. Completes chemical digestion</td>
</tr>
<tr>
<td></td>
<td>2. Absorbs nutrients into blood</td>
</tr>
<tr>
<td></td>
<td>Moves waste material</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List of Body Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epiglottis</td>
</tr>
<tr>
<td>Gallbladder</td>
</tr>
<tr>
<td>Small Intestine</td>
</tr>
<tr>
<td>Rectum</td>
</tr>
<tr>
<td>Esophagus</td>
</tr>
<tr>
<td>Large intestine</td>
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<tr>
<td>Liver</td>
</tr>
<tr>
<td>Mouth</td>
</tr>
<tr>
<td>Pancreas</td>
</tr>
</tbody>
</table>

6. The author has mainly structured the two articles by—
A. listing the body parts involved in the digestive process and describing the appearance of each.
B. explaining the role that each organ plays in the sequential steps of the digestive process.
C. comparing the three digestive functions and the organs that each depends on.
D. describing how the digestive process results from the reactions shown in Figure 16.

7. The author defines digestion in paragraph 3 of “The Digestive Process Begins.” Based on this definition and other information from both articles, in which three organs does digestion mainly occur?
A. esophagus
B. large intestine
C. mouth
D. liver
E. small intestine
F. gallbladder
G. pancreas
H. stomach
Information for Teachers: Quantitative and Qualitative Analyses of the Texts

Regular practice with complex texts is necessary to prepare students for college and career readiness, as outlined in Reading Standard 10. The text for this mini-assessment has been placed at grade 7, and the process used to determine this grade level placement is described below. “Appendix A of the Common Core” and the “Supplement to Appendix A: New Research on Text Complexity” lay out a research-based process for selecting complex texts.

1. Place a text or excerpt within a grade band based on at least one qualitative measure according to the research-based conversion table provided in the Supplement to Appendix A: New Research on Text Complexity (www.corestandards.org/resources).

2. Place a text or excerpt at a grade level based on a qualitative analysis.

<table>
<thead>
<tr>
<th>“The Digestive Process Begins” (circled in orange)</th>
<th>Qualitative Measure #1</th>
<th>Qualitative Measure #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lexile: 1080</td>
<td>Flesch-Kincaid: 8.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>“Final Digestion and Absorption” (circled in blue)</th>
<th>Qualitative Measure #1</th>
<th>Qualitative Measure #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lexile: 1150</td>
<td>Flesch-Kincaid: 8.1</td>
<td></td>
</tr>
</tbody>
</table>

After gathering the quantitative measures, the next step is to place the quantitative scores in the Conversion Table found in the Supplement to Appendix A (www.corestandards.org/resources) and determine the grade band of the text. NOTE: With scientific texts, there are often many scientific terms that drive the readability ratings up. Careful attention should be paid to the complexity of the topic itself. Figure 1 reproduces the conversion table from the Supplement to Appendix A, showing how the initial results from the Lexile and the Flesch-Kincaid measures were converted to grade bands.

Figure 1: Updated Text Complexity Grade Bands and Associated Ranges from Multiple Measures

<table>
<thead>
<tr>
<th>Common Core Band</th>
<th>ATOS</th>
<th>Degrees of Reading Power</th>
<th>Flesch-Kincaid</th>
<th>The Lexile Framework</th>
<th>Reading Maturity</th>
<th>SourceRater</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd - 3rd</td>
<td>2.75</td>
<td>42 - 54</td>
<td>1.98 - 5.34</td>
<td>420 - 820</td>
<td>3.53 - 6.13</td>
<td>0.05 - 2.48</td>
</tr>
<tr>
<td>4th - 5th</td>
<td>4.97</td>
<td>52 - 60</td>
<td>4.51 - 7.73</td>
<td>740 - 1010</td>
<td>5.42 - 7.92</td>
<td>0.84 - 5.75</td>
</tr>
<tr>
<td>6th - 8th</td>
<td>7.00</td>
<td>57 - 67</td>
<td>6.03 - 9.05</td>
<td>950 - 1295</td>
<td>7.04 - 9.57</td>
<td>4.11 - 10.66</td>
</tr>
<tr>
<td>9th - 10th</td>
<td>9.67</td>
<td>62 - 72</td>
<td>8.32 - 12.17</td>
<td>1050 - 1355</td>
<td>8.41 - 10.81</td>
<td>9.02 - 13.93</td>
</tr>
<tr>
<td>11th - CCR</td>
<td>11.20</td>
<td>67 - 74</td>
<td>10.34 - 14.2</td>
<td>1185 - 1305</td>
<td>9.57 - 12.00</td>
<td>12.30 - 14.50</td>
</tr>
</tbody>
</table>

1 For higher-stakes tests, it is recommended that two corresponding text complexity measures be used to place a text in a grade band. When two measures are used, both placing the text in the same band, the results provide additional assurance that the text selected is appropriate for the band.
To find the **grade-level** of the text within the designated grade-band, engage in a systematic analysis of the characteristics of the text. The characteristics that should be analyzed during a qualitative analysis can be found in Appendix A of the CCSS. (www.corestandards.org)

<table>
<thead>
<tr>
<th>Qualitative Analysis</th>
<th>The Digestive Process excerpts</th>
<th>Where to place within the band?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td>Notes and comments on text, support for placement in this band</td>
<td>Too low for grade band</td>
</tr>
<tr>
<td>Structure (both story structure or form of piece)</td>
<td>These excerpts are organized mainly in a straightforward sequential order, moving readers through the digestive process. Paragraphs 1–4 in Excerpt 1 provide a general overview of digestion, while remaining paragraphs in both texts describe the role of each body part in the process. Subheadings also help readers grasp the structure, connecting and highlighting topics (e.g., Functions of the Digestive System, Chemical Digestion in the Mouth, The Pancreas). Also, illustrations directly support comprehension and captions reinforce information in the text and pronunciation guides support tier 3 vocabulary acquisition.</td>
<td></td>
</tr>
<tr>
<td>Language Clarity and Conventions</td>
<td>The language conventions in the text are explicit and readily accessible. The excerpt includes a mix of simple and compound sentences, with a small number of more complex constructions (As you swallow, a flap of tissue called the epiglottis (ep uh GLAHT is) seals off your windpipe preventing the food from entering.). Vocabulary is mostly contemporary and familiar. There are instances of tier 3 words that may be unfamiliar to students (enzyme, villi, absorption); however, there is sufficient context to enable readers to understand the subject-specific vocabulary.</td>
<td></td>
</tr>
<tr>
<td>Knowledge Demands (life, content, cultural/literary)</td>
<td>To understand the text, it would be helpful for students to have a basic understanding of human anatomy. But even without that knowledge, the information needed to answer the questions lies within the four corners of the text.</td>
<td></td>
</tr>
<tr>
<td>Levels of Meaning (chiefly literary)/ Purpose (chiefly informational)</td>
<td>The main purpose of the texts is to explain the digestive process, as indicated in paragraph 2 of Excerpt 1: “The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body.”</td>
<td></td>
</tr>
<tr>
<td>Overall placement: Grade 7</td>
<td>These texts are moderately complex in regard to structure and knowledge demands. The domain-specific vocabulary may be challenging, but the texts are still likely to be accessible to the average 7th grader. This mini-assessment may be most appropriate for advanced 7th graders early in the year, all 7th graders later in the year, or even 8th graders in their first semester.</td>
<td></td>
</tr>
<tr>
<td>Question Number</td>
<td>Correct Answer(s)</td>
<td>Standards</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
| 1 Part A        | C                | RST.6-8.4, RST.6-8.6, RST.6-8.1 | A. According to paragraph 9 of Excerpt 1, mucus, rather than acids, allows food to be swallowed easily.  
B. Enzymes are not found in blood, nor do they act as transporters of nutrients.  
C. This is the correct answer. According to paragraph 8 of Excerpt 1, “Enzymes are proteins that speed up chemical reactions in the body.”  
D. Although enzymes are proteins, they cause chemical reactions rather than transport nutrient molecules. |
| 1 Part B        | A                |           | A. This is the correct answer. The author discusses enzymes to explain the main function of the digestive system, breaking down food into usable molecules.  
B. Although the liver plays a role in multiple processes, it is discussed in Excerpt 2 rather than Excerpt 1.  
C. Although enzymes play a role in the digestive process, the excerpt does not identify how long the digestive process takes.  
D. Although enzymes are involved in digestion, the author focuses on the digestion process rather than the need for a balanced diet. |
| 2 Part A        | A                | RI.7.3, RI.7.1 | A. This is the correct answer. According to paragraph 7 of Excerpt 2, bile breaks up “large fat particles into smaller fat droplets.”  
B. According to paragraph 7 of Excerpt 2, fat is broken up physically by bile, then “chemically broken down by enzymes produced in the pancreas.”  
C. According to paragraph 9 of Excerpt 2, fiber, rather than fat, “thickens the liquid material in the intestine.”  
D. Teeth, not fat, help saliva transform food into “one slippery mass.” |
| 2 Part B        | D                |           | A. Peristalsis and absorption, rather than fat, move food through the body.  
B. According to paragraph 4 of Excerpt 2, fats are digested during chemical digestion, not mechanical digestion.  
C. Although absorption of nutrients and the breakdown of fat particles both occur during chemical digestion, the excerpt does not suggest that fat contains important nutrients.  
D. This is the correct answer. According to paragraph 4 of Excerpt 2, “Starches and proteins have been partially broken down, but fats haven’t been digested at all.” |
<table>
<thead>
<tr>
<th>Question Number</th>
<th>Correct Answer(s)</th>
<th>Standards</th>
<th>Rationales for Answer Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>See possible answers and rationales to the right.</td>
<td>RST.7.2, RI.7.8, RST.6-8.1</td>
<td>“As the liquid moves into the small intestine it mixes with enzymes and secretions that are produced by the small intestine, the liver, and the pancreas.” (para 4) Rationale: The small intestine, liver, and pancreas produce enzymes and secretions that help digest food in the small intestine. “The liver and the pancreas deliver their substances to the small intestine through small tubes.” (para 4) Rationale: The liver and pancreas send enzymes and secretions to the small intestine to aid in digestion. “After you eat, bile passes through a tube from the gallbladder into the small intestine.” (para 6) Rationale: After food is eaten, bile leaves the gallbladder to help break up fat in the small intestine. “As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, protein, and fats.” (para 8) Rationale: Enzymes produced in the pancreas break down starches, protein, and fats in the small intestine.</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>RST.6-8.7, RST.6-8.1</td>
<td>A. Although Figure 19 illustrates the small intestine, it focuses on the structure of the small intestine, not its size compared to the large intestine. B. Although the small intestine does produce enzymes that aid in digestion, Figure 19 illustrates the physical components of the small intestine that allow absorption of nutrient molecules, not the work of enzymes breaking down substances. C. This is the correct answer. Villi that cover the surface of the small intestine greatly increase the surface area of the organ, allowing for easier absorption of digested food. D. Figure 19 focuses on the structure of the small intestine and the villi, rather than the part the small intestine plays in the digestive process.</td>
</tr>
<tr>
<td>Question Number</td>
<td>Correct Answer(s)</td>
<td>Standards</td>
<td>Rationales for Answer Options</td>
</tr>
<tr>
<td>-----------------</td>
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<td>-------------------------------</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>See chart in right column.</td>
<td>RST.6-8.2, RST.6-8.1, RI.7.3</td>
<td><strong>Organ</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Mouth</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Esophagus</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Stomach</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Large intestine</strong></td>
</tr>
</tbody>
</table>
| **6**           | B                  | RST.6-8.5, RST.6-8.1 | A. Although the author identifies body parts involved in the digestive process, the appearance is not necessarily described.  
B. This is the correct answer. The function of each organ is explained through the digestive process sequence.  
C. Although the author begins Excerpt 1 by stating that “the digestive system has three main functions,” the structure of the articles is based on sequence rather than comparison.  
D. Although enzymes play an important role in the digestive process, the two articles discuss the organs and substances involved in the complete process rather than only one part. |
<table>
<thead>
<tr>
<th>Question Number</th>
<th>Correct Answer(s)</th>
<th>Standards</th>
<th>Rationales for Answer Options</th>
</tr>
</thead>
</table>
| 7               | C, E, H           | RI.7.2, RI.7.3 | A. Although the esophagus plays an important role in digestion by connecting the mouth to the stomach, it does not break down food mechanically or physically.  
B. Although the large intestine plays an important role in digestion by housing beneficial bacteria, it does not break down food mechanically or physically.  
C. This is a correct answer. Teeth begin the first step of mechanical digestion, while saliva begins the chemical digestion process.  
D. Although the liver plays an important role in digestion by producing bile, it does not break down food mechanically or physically.  
E. This is a correct answer. According to Excerpt 2, “The small intestine is the part of the digestive system where most chemical digestion takes place.”  
F. Although the gallbladder plays an important role in digestion by storing bile, it does not break down food mechanically or physically.  
G. Although the pancreas plays an important role in digestion by producing enzymes that help break down starches, protein, and fats, it does not break down food mechanically or physically.  
H. This is a correct answer. The stomach slowly releases the liquid food into the next part of the digestive system to help digestion and absorption occur efficiently. |
**Additional Resources for Assessment and CCSS**

**Shift 1 – Complexity:** *Regular practice with complex text and its academic language*
- See Appendix B for examples of informational and literary complex texts: [http://www.corestandards.org/assets/Appendix_B.pdf](http://www.corestandards.org/assets/Appendix_B.pdf)
- See the Text Complexity Collection on [www.achievethecore.org](http://www.achievethecore.org)

**Shift 2 – Evidence:** *Reading, writing, and speaking grounded in evidence from text, both literary and informational*
- See Close Reading Exemplars for ways to engage students in close reading on [http://www.achievethecore.org/steal-these-tools/close-reading-exemplars](http://www.achievethecore.org/steal-these-tools/close-reading-exemplars)
- See the Basal Alignment Project for examples of text-dependent questions: [http://www.achievethecore.org/basal-alignment-project](http://www.achievethecore.org/basal-alignment-project)

**Shift 3 – Knowledge:** *Building knowledge through content-rich nonfiction*
- See Appendix B for examples of informational and literary complex texts: [http://www.corestandards.org/assets/Appendix_B.pdf](http://www.corestandards.org/assets/Appendix_B.pdf)

The Digestive Process Begins

Reading Preview

Key Concepts
- What functions are carried out in the digestive system?
- What roles do the mouth, esophagus, and stomach play in digestion?

Key Terms
- digestion
- absorption
- saliva
- enzyme
- epiglottis
- esophagus
- mucus
- peristalsis
- stomach

Target Reading Skill
Using Prior Knowledge Before you read, look at the section headings and visuals to see what this section is about. Then write what you know about the digestive system in a graphic organizer like the one below. As you read, continue to write in what you learn.

How Can You Speed Up Digestion?
1. Obtain two plastic jars with lids. Fill the jars with equal amounts of water at the same temperature.
2. Place a whole sugar cube into one jar. Place a crushed sugar cube into the other jar.
3. Fasten the lids on the jars. Holding one jar in each hand, shake the two jars gently and for equal amounts of time.
4. Place the jars on a flat surface. Observe whether the whole cube or the crushed cube dissolves faster.

Think It Over
Predicting Use the results of this activity to predict which would take longer to digest: a large piece of food or one that has been cut up into many small pieces. Explain your answer.

In 1822, a man named Alexis St. Martin was wounded in the stomach. Dr. William Beaumont saved St. Martin's life. The wound, however, left an opening in St. Martin's stomach that never healed completely. Beaumont realized that by looking through the opening in St. Martin's abdomen, he could observe what was happening inside the stomach.

Beaumont observed that food changed chemically inside the stomach. He hypothesized that chemical reactions in the stomach broke down foods into smaller particles. Beaumont removed liquid from St. Martin's stomach and analyzed it. The stomach liquid contained an acid that played a role in the breakdown of foods into simpler substances.

Functions of the Digestive System
Beaumont's observations helped scientists understand the role of the stomach in the digestive system. The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body. Figure 14 shows the organs of the digestive system, which is about 9 meters long from beginning to end.
**Digestion** The process by which your body breaks down food into small nutrient molecules is called digestion. There are two kinds of digestion—mechanical and chemical. In mechanical digestion, foods are physically broken down into smaller pieces. Mechanical digestion occurs when you bite into a sandwich and chew it into small pieces.

In chemical digestion, chemicals produced by the body break foods into their smaller chemical building blocks. For example, the starch in bread is broken down into individual sugar molecules.

**Absorption and Elimination** After your food is digested, the molecules are ready to be transported throughout your body. Absorption (ab SAWRP shun) is the process by which nutrient molecules pass through the wall of your digestive system into your blood. Materials that are not absorbed, such as fiber, are eliminated from the body as wastes.
The Mouth

Have you ever walked past a bakery or restaurant and noticed your mouth watering? Smelling or even just thinking about food when you're hungry is enough to start your mouth watering. This response isn't accidental. When your mouth waters, your body is preparing for the delicious meal it expects. Both mechanical and chemical digestion begin in the mouth. The fluid released when your mouth waters is saliva (suh LV uh). Saliva plays an important role in both kinds of digestion.

Mechanical Digestion in the Mouth Your teeth carry out the first stage of mechanical digestion. Your center teeth, or incisors (in sy zurz), cut the food into bite-sized pieces. On either side of the incisors there are sharp, pointy teeth called canines (kay nyonz). These teeth tear and slash the food into smaller pieces. Behind the canines are the premolars and molars, which crush and grind the food. As the teeth do their work, saliva moistens the pieces of food into one slippery mass.

Chemical Digestion in the Mouth As mechanical digestion begins, so does chemical digestion. If you take a bite of a cracker and suck on it, the cracker begins to taste sweet. It tastes sweet because a chemical in the saliva has broken down the starch molecules in the cracker into sugar molecules.

Figure 15
Digestion in the Mouth
Mechanical digestion begins in the mouth, where the teeth cut and tear food into smaller pieces. Salivary glands release enzymes that begin chemical digestion. Observing Which teeth are best suited for biting into a juicy apple?
The chemical in saliva that digests starch is an enzyme. **Enzymes** are proteins that speed up chemical reactions in the body. Your body produces many different enzymes. Each enzyme has a specific chemical shape. Its shape enables it to take part in only one kind of chemical reaction. An example of enzyme action is shown in Figure 16.

**The Esophagus**

If you've ever choked on food, your food may have "gone down the wrong way." That's because there are two openings at the back of your mouth. One opening leads to your windpipe, which carries air into your lungs. As you swallow, a flap of tissue called the **epiglottis** (ep uh GLAHT is) seals off your windpipe, preventing the food from entering. The food goes into the **esophagus** (ih SAHF uhs guh), a muscular tube that connects the mouth to the stomach. The esophagus is lined with **mucus**, a thick, slippery substance produced by the body. Mucus makes food easier to swallow and move along.

Food remains in the esophagus for only about 10 seconds. **After food enters the esophagus, contractions of smooth muscles push the food toward the stomach.** These involuntary waves of muscle contraction are called **peristalsis** (pehr ih STAWL sis). Peristalsis also occurs in the stomach and farther down the digestive system. These muscular waves keep food moving in one direction.

**Lab zone Try This Activity**

**Modeling Peristalsis**

1. Obtain a clear, flexible plastic straw.
2. Hold the straw vertically and insert a small bead into the top of the straw. The bead should fit snugly into the straw. **CAUTION: Do not put the straw in your mouth or blow into the straw.**
3. Pinch the straw above the bead so the bead begins to move down the length of the tubing.
4. Repeat Step 3 until the bead exits the straw.

**Making Models** How does this action compare with peristalsis? What do the bead and the straw represent?

---

**Figure 16**

**How Enzymes Work**

The shape of an enzyme molecule is specific to the shape of the food molecule it breaks down. Here, an enzyme breaks down a starch into sugars.

1. The shape of the enzyme fits the starch molecule.
2. A chemical reaction occurs between the enzyme and starch molecule.
3. The starch molecule has been broken down into sugar molecules.

---

**Reading Checkpoint** How is food prevented from entering the windpipe?
Protein Digestion
A scientist performed an experiment to determine the amount of time needed to digest protein. He placed small pieces of hard-boiled egg white (a protein) in a test tube containing hydrochloric acid, water, and the enzyme pepsin. He measured the rate at which the egg white was digested over a 24-hour period. His data are recorded in the graph.

1. **Reading Graphs** What do the values on the y-axis represent?
2. **Interpreting Data** After about how many hours would you estimate that half of the protein was digested?

3. **Interpreting Data** How much digestion occurred in 16 hours?
4. **Drawing Conclusions** During which 4-hour period did the most digestion take place?

---

**The Stomach**

When food leaves the esophagus, it enters the stomach, a J-shaped, muscular pouch located in the abdomen. As you eat, your stomach expands to hold all of the food that you swallow. Most mechanical digestion and some chemical digestion occur in the stomach.

**Mechanical Digestion in the Stomach** The process of mechanical digestion occurs as three strong layers of smooth muscle contract to produce a churning motion. This action mixes the food with fluids in somewhat the same way that clothes and soapy water are mixed in a washing machine.

**Chemical Digestion in the Stomach** Chemical digestion occurs as the churning food makes contact with digestive juice, a fluid produced by cells in the lining of the stomach. Digestive juice contains the enzyme pepsin. Pepsin chemically digests the proteins in your food, breaking them down into short chains of amino acids.

Digestive juice also contains hydrochloric acid, a very strong acid. Without this strong acid, your stomach could not function properly. First, pepsin works best in an acid environment. Second, the acid kills many bacteria that you swallow with your food.

Why doesn't stomach acid burn a hole in your stomach? The reason is that cells in the stomach lining also produce mucus, which coats and protects the stomach lining. Also, the cells that line the stomach are quickly replaced as they are damaged or worn out.
Food remains in the stomach until all of the solid material has been broken down into liquid form. A few hours after you finish eating, the stomach completes mechanical digestion of the food. By that time, most of the proteins have been chemically digested into shorter chains of amino acids. The food, now a thick liquid, is released into the next part of the digestive system. That is where final chemical digestion and absorption will take place.

**What is pepsin?**

**Section 3 Assessment**

**Target Reading Skill Using Prior Knowledge** Review your graphic organizer and revise it based on what you just learned in the section.

**Reviewing Key Concepts**

1. a. **Listing** What are the functions of the digestive system?
   b. **Comparing and Contrasting** Distinguish between mechanical and chemical digestion.
   c. **Inferring** Why must mechanical digestion start before chemical digestion?

2. a. **Reviewing** What key chemicals do the mouth and stomach contain?
   b. **Describing** How do pepsin and hydrochloric acid work together to digest food in the stomach?
   c. **Predicting** What could happen if your stomach didn’t produce enough mucus? Explain.

**At-Home Activity**

**First Aid for Choking** Explain to your family what happens when people choke on food. With your family, find out how to recognize when a person is choking and what to do to help the person. Learn about the Heimlich maneuver and how it is used to help someone who is choking.

*This is a great place to come back to study if you’re going to have a test on this material, but don’t get stuck here on your first or second reading of the material!*

**Lab Zone**

Chapter 2 D 65
As the Stomach Churns

Problem
What conditions are needed for the digestion of proteins in the stomach?

Skills Focus
interacting data, controlling variables, drawing conclusions

Materials
• test-tube rack
• pepsin
• water
• 4 strips of blue litmus paper
• cubes of boiled egg white
• 10-mL plastic graduated cylinder
• 4 test tubes with stoppers
• marking pencil
• diluted hydrochloric acid
• plastic stirrers

Procedure
1. In this lab, you will investigate how acidic conditions affect protein digestion. Read over the entire lab to see what materials you will be testing. Write a prediction stating which conditions you think will speed up protein digestion. Then, copy the data table into your notebook.

2. Label four test tubes A, B, C, and D, and place them in a test-tube rack.

3. In this lab, the protein you will test is boiled egg white, which has been cut into cubes about 1 cm on each side. Add 3 cubes to each test tube. Note and record the size and overall appearance of the cubes in each test tube. CAUTION: Do not put any egg white into your mouth.

4. Use a graduated cylinder to add 10 mL of the enzyme pepsin to test tube A. Observe the egg white cubes to determine whether an immediate reaction takes place. Record your observations under Day 1 in your data table. If no changes occur, write “no immediate reaction.”

5. Use a clean graduated cylinder to add 5 mL of pepsin to test tube B. Then rinse out the graduated cylinder and add 5 mL of water to test tube B. Observe whether or not an immediate reaction takes place.

6. Use a clean graduated cylinder to add 10 mL of hydrochloric acid to test tube C. Observe whether or not an immediate reaction takes place. CAUTION: Hydrochloric acid can burn skin and clothing. Avoid direct contact with it. Wash any splashes or spills with plenty of water, and notify your teacher.

<table>
<thead>
<tr>
<th>Test Tube</th>
<th>Egg White Appearance</th>
<th>Litmus Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data Table

<table>
<thead>
<tr>
<th>Test Tube</th>
<th>Egg White Appearance</th>
<th>Litmus Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. Use a clean graduated cylinder to add 5 mL of pepsin to test tube D. Then, rinse the graduated cylinder and add 5 mL of hydrochloric acid to test tube D. Observe whether or not an immediate reaction takes place. Record your observations.

8. Obtain four strips of blue litmus paper. (Blue litmus paper turns pink in the presence of an acid.) Dip a clean plastic stirrer into the solution in each test tube, and then touch the stirrer to a piece of litmus paper. Observe what happens to the litmus paper. Record your observations.

9. Insert stoppers in the four test tubes and store the test tube rack as directed by your teacher.

10. The next day, examine the contents of each test tube. Note any changes in the size and overall appearance of the egg white cubes. Then, test each solution with litmus paper. Record your observations in your data table.

**Analyze and Conclude**

1. **Interpreting Data** Which materials were the best at digesting the egg white? What observations enabled you to determine this?

2. **Inferring** Is the chemical digestion of protein in food a fast or a slow reaction? Explain.

3. **Controlling Variables** Why was it important that the cubes of egg white all be about the same size?

4. **Drawing Conclusions** What did this lab show about the ability of pepsin to digest protein?

5. **Communicating** Write a paragraph in which you describe the purpose of test tube A and test tube C as they relate to the steps you followed in the procedure.

**Design an Experiment**

Design a way to test whether protein digestion is affected by the size of the food pieces. Write down your hypothesis and the procedure you will follow. Obtain your teacher's permission before carrying out your investigation.
Final Digestion and Absorption

Reading Preview

Key Concepts
• What digestive processes occur in the small intestine, and how are other digestive organs involved?
• What role does the large intestine play in digestion?

Key Terms
• small intestine  • liver  • bile
• gallbladder  • pancreas
• villus  • large intestine
• rectum  • anus

Target Reading Skill
Identifying Main Ideas  As you read the section titled The Small Intestine, write the main idea in a graphic organizer like the one below. Then, write three supporting details that further explain the main idea.

Main Idea
Chemical digestion takes place in the . . .

Details:

Labzone  Discover Activity

Which Surface Is Larger?
1. Work with a partner to carry out this investigation.
2. Begin by placing your hand palm-side down on a table. Keep your thumb and fingers tightly together. Lay string along the outline of your hand. Have your partner help you determine how long a string you need to outline your hand.
3. Use a metric ruler to measure the length of that string.

Think it Over
Predicting  How long would you expect your hand outline to be if you spread out your thumb and fingers? Use string to test your prediction. Compare the two string lengths.

Have you ever been part of a huge crowd attending a concert or sports event? Barriers and passageways often guide people in the right direction. Ticket takers make sure that people enter in an orderly fashion.

In some ways, the stomach can be thought of as the “ticket taker” of the digestive system. Once the food has been changed into a thick liquid, the stomach releases a little of the liquid at a time into the next part of the digestive system. This slow, smooth passage of food through the digestive system ensures that digestion and absorption can take place efficiently.

The Small Intestine
After the thick liquid leaves the stomach, it enters the small intestine. The small intestine is the part of the digestive system where most chemical digestion takes place. You may wonder how the small intestine got its name. After all, at about 6 meters—longer than some full-sized cars—it makes up two thirds of the length of the digestive system. The small intestine was named for its small diameter. It is from 2 to 3 centimeters wide, about half the diameter of the large intestine.
When food reaches the small intestine, it has already been mechanically digested into a thick liquid. But chemical digestion has just begun. Starches and proteins have been partially broken down, but fats haven’t been digested at all. **Almost all chemical digestion and absorption of nutrients takes place in the small intestine.** As the liquid moves into the small intestine, it mixes with enzymes and secretions that are produced by the small intestine, the liver, and the pancreas. The liver and the pancreas deliver their substances to the small intestine through small tubes.

**The Liver**  As you can see in Figure 18, the liver is located in the upper right portion of the abdomen. It is the largest organ inside the body. The liver is like an extremely busy chemical factory and plays a role in many body processes. For example, it breaks down medicines, and it helps eliminate nitrogen from the body. **The role of the liver in the digestive system is to produce bile.**

Bile is a substance that breaks up fat particles. Bile flows from the liver into the gallbladder, the organ that stores bile. After you eat, bile passes through a tube from the gallbladder into the small intestine.

Bile is not an enzyme. It does not chemically digest foods. It does, however, physically break up large fat particles into smaller fat droplets. You can compare the action of bile on fats with the action of soap on a greasy frying pan. Soap physically breaks up the grease into small droplets that can mix with the soapy water and be washed away. Bile mixes with the fats in food to form small fat droplets. The droplets can then be chemically broken down by enzymes produced in the pancreas.

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**Break Up!**

You can model the breakup of fat particles in the small intestine.

1. Fill two plastic jars half full of water. Add a few drops of oil to each jar.
2. Add about 1/4 spoonful of baking soda to one jar.
3. Stir the contents of both jars. Record your observations.

**Observing** In which jar did the oil begin to break up? What substance does the baking soda represent?

**Figure 18**  

**The Liver and Pancreas**  
Substances produced by the liver and pancreas aid in digestion.  

**Predicting** How would digestion be affected if the tube leading from the gallbladder to the small intestine became blocked?
The Pancreas  The pancreas is a triangular organ that lies between the stomach and the first part of the small intestine. Like the liver, the pancreas plays a role in many body processes. As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, proteins, and fats.

Digestive enzymes do not break down all food substances. Recall that the fiber in food isn’t broken down. Instead, fiber thickens the liquid material in the intestine. This thickening makes it easier for peristalsis to push the material forward.

Absorption in the Small Intestine  After chemical digestion takes place, the small nutrient molecules are ready to be absorbed by the body. The structure of the small intestine makes it well suited for absorption. The inner surface, or lining, of the small intestine looks bumpy. Millions of tiny finger-shaped structures called villi (V.I. eye) (singular villus) cover the surface. The villi absorb nutrient molecules. Notice in Figure 19 that tiny blood vessels run through the center of each villus. Nutrient molecules pass from cells on the surface of a villus into blood vessels. The blood carries the nutrients throughout the body for use by body cells.

Villi greatly increase the surface area of the small intestine. If all the villi were laid out flat, the total surface area of the small intestine would be about as large as a tennis court. This increased surface enables digested food to be absorbed much faster than if the walls of the small intestine were smooth.
The Large Intestine

By the time material reaches the end of the small intestine, most nutrients have been absorbed. The remaining material moves from the small intestine into the large intestine. The large intestine is the last section of the digestive system. It is about 1.5 meters long—about as long as the average bathtub. It runs up the right-hand side of the abdomen, across the upper abdomen, and then down the left-hand side. The large intestine contains bacteria that feed on the material passing through. These bacteria normally do not cause disease. In fact, they are helpful because they make certain vitamins, including vitamin K.

The material entering the large intestine contains water and undigested food. As the material moves through the large intestine, water is absorbed into the bloodstream. The remaining material is readyed for elimination from the body.

The large intestine ends in a short tube called the rectum. Here, waste material is compressed into a solid form. This waste material is eliminated from the body through the anus, a muscular opening at the end of the rectum.

What role do bacteria play in the large intestine?

Section 4 Assessment

Target Reading Skill
Identifying Main Ideas Use your graphic organizer to help you answer Question 1 below.

Reviewing Key Concepts
1. a. Reviewing What two digestive processes occur in the small intestine?
   b. Explaining Explain how bile produced by the liver and enzymes produced in the pancreas function in the small intestine.
   c. Relating Cause and Effect Some people are allergic to a protein in wheat. When these people eat foods made with wheat, a reaction destroys the villi in the small intestine. What problems would you expect these people to experience?
2. a. Identifying Which key nutrient is absorbed in the large intestine?

b. Describing What happens as food moves through the large intestine?

c. Applying Concepts Diarrhea is a condition in which waste material that is eliminated contains too much water. How might diarrhea upset homeostasis in the body? How could a person reduce the effects of diarrhea on the body?

Writing in Science

Sequence of Events Describe the journey of a bacon, lettuce, and tomato sandwich through a person's digestive system, starting in the mouth and ending with absorption. Include where digestion of fats, carbohydrates, and proteins take place. Use words like first, next, and finally in your writing.
1 Food and Energy

Key Concepts
- Foods provide the body with raw materials and energy.
- Carbohydrates provide energy as well as the raw materials to make cell parts.
- In addition to providing energy, fats form part of the cell membrane. Fatty tissue also protects and supports internal organs and insulates the body.
- Proteins are needed for tissue growth and repair. They also play an important part in chemical reactions within cells.
- Vitamins and minerals are needed in small amounts to carry out chemical processes.
- Water is the most important nutrient because the body's vital processes take place in water.

Key Terms
- nutrient
- calorie
- carbohydrate
- glucose
- fat
- protein
- amino acid
- vitamin
- mineral

2 Healthy Eating

Key Concepts
- The Food Guide Pyramid classifies foods into six groups. It also indicates how many servings from each group should be eaten every day.
- Food labels allow you to evaluate a single food as well as to compare the nutritional value of two different foods.

Key Terms
- Food Guide Pyramid
- Percent Daily Value
- Dietary Reference Intakes (DRIs)

3 The Digestive Process Begins

Key Concepts
- The digestive system breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated.
- Both mechanical and chemical digestion begin in the mouth.
- In the esophagus, contractions of smooth muscles push the food toward the stomach.
- Most mechanical digestion and some chemical digestion occur in the stomach.

Key Terms
- digestion
- absorption
- saliva
- enzyme
- epiglottis
- esophagus
- mucus
- peristalsis
- stomach

4 Final Digestion and Absorption

Key Concepts
- Almost all chemical digestion and absorption of nutrients takes place in the small intestine.
- The liver produces bile, which breaks up fats.
- The pancreas produces enzymes that help break down starches, proteins, and fats.
- In the large intestine, water is absorbed into the bloodstream. The remaining material is readied for elimination.

Key Terms
- small intestine
- liver
- bile
- gallbladder
- pancreas
- villus
- large intestine
- rectum
- anus
Appendix B: The Structured Journal Explained

Structured Journal:

[Written for teachers to read to students] What is it?

Essentially, structured journaling is an attempt to encourage readers (you) to activate the thinking processes most essential for reading. Invariably, reading complex text well (i.e. understanding what you read) means reading more carefully and slowly. This effortful process, combined with tracking confusions and insights in the structured journal, is hard work. You may be slow to appreciate the value of this hard work, even when you can see it makes you a far better reader. The goal of structured journaling is to make these practices into reading habits. The structured journal, like any good scaffold, has been a complete success when you can read closely, demand meaning from what you read, and trust yourself to see the important parts of what you read without having to do a structured journal.

How do you do structured journaling?

While you can react and comment on any aspect of the text, tracking these variables is a most powerful way to connect to the text, prepare for discussion, and bring clarity.

- Keep track of what you don’t completely understand. These might be references, words or ideas that you just can’t ponder your way to an understanding of. Make sure you note where you encountered them in the text.

- What do you think are the most important ideas and/or parts, and why? Make sure you note where these are developed in the text.

For informational text: make connections to other readings, other versions, or work from our class.

- What “I wonder” questions or other reflections do you have? It can be anything from wondering why the author is making the decisions s/he is to something in the text that made you stop and think. This is where the reading brain becomes invested in the major ideas and implications of what it has read.

[Notes to the instructor]: It is important to “chunk” text when you are using the structured journal. When first teaching the structured journal, introduce these different tracking categories described above one at a time to increase facility and comfort level. It will prove MOST helpful once your students learn what you expect. This can happen most efficiently through sharing examples of strong and weak journal entries and by insisting that paltry efforts be redone.

For this and any textbook, the sections are provided for you by the authors. We suggest using the subsections provided in red in Section Three and Section Four that are the subject of this exemplar. There is a sample of structured journal in bulleted form (Appendix C) that offers what you might expect competent structured journaling to look like.
This method of tracking reading so closely is a potent way for students to cultivate deep comprehension. The strength of the structured journal is that students are being held accountable for producing a deep response to the text on their own, without the scaffold of a question (which points to what the questioner thinks the reader should pay attention to). As a teacher, you are accountable for evaluating the depth of each student’s response without the scaffold of a question. Essentially, structured journaling in this way scaffolds independent close reading and builds stamina in the reader. By asking for this kind of independent judgment before questions are raised and addressed, students have to rely on their own thinking and reading. This brings students into the text and readies them for deep text dependent questions. When students start to see their own observations and understanding and thoughts about a text mirrored in the questions that come after, they are validated in their own reading ability. Both activities serve to strengthen the other and both contribute to developing stronger readers.

More on structured journaling, its cognitive research base, how to evaluate student efforts, and miscellaneous points:

The structured journal can be used as a first read after an introduction and section preview or at any point thereafter. This is completely up to the teacher. Many of the details, concepts and ideas covered in the exemplars should come up in working with the structured journal. Again, the difference is that with the journal more responsibility is thrust upon the students. The journal then is a practical straight-forward way of shifting more responsibility to the students.

The journal is based on well-established findings in the psychology of reading and learning. Paraphrasing has long been known to support learning. Questions in the textbook can also be answered by paraphrasing. The textbook, however, often tells the student what is important and directs them where to go. The journal requires the student to read the entire section with an eye for determining the important points and then paraphrasing. Reflection, often referred to as elaboration, has also been shown to enhance content learning. Finally, one of the most documented findings in the psychology of reading concerns comprehension monitoring as a characteristic of proficient readers. The journal moves students in this direction by asking them to note what they don’t understand or are uncertain about.

Connections can be problematic in that students often make trivial ones that do not enhance comprehension. As you can see, we avoided this category here, though students who have been reading the whole textbook should have many connections to make. Stopping trivial connections is best dealt with directly by requiring students to explain how the connection helps their understanding. Connections in a content class should be based on previous readings or classroom work (though with something like digestion you might get some legitimate personal connections).

Some general points to consider:

- A clarifying question comes from not understanding what the text is saying. A reflection or “I wonder question” is a question the text does not address. Students will be confused about these distinctions at first. It may help to say that clarifying questions help clear things up, and are the types of questions a teacher would ask to see if you understand. A reflection goes beyond the text and is often concerned with what is most important about what you read. Our experience is that with time and practice, the distinction becomes clear. In the meantime, keep in mind it is the thinking behind raising questions that is more important than student mastery of the distinction, though mastery will come with practice.

- Students will discover that often a reflection or even a clarifying question will be answered as they continue reading. The reflection or question makes it much more likely they will take notice of the information when they get to it.
• Reflections will often produce questions that are excellent for class discussion. Many science and social studies teachers collect the good ones and integrate them into lessons or discussions at appropriate points.

• There will be times students do not have a clarifying question. At times this is legitimate, at others not. You will soon able to make the distinction.

• The journal can be collected and graded, used as a first reading, combined with the kinds of close reading questions that follow, used as an assessment, or in any other way you think makes sense. Grading is different than traditional assignments for the same reason that the journal is different for students: more responsibility is placed on the teacher for determining what represents good journaling for a given text selection. Most teachers will have a good sense of what they want from students in the “Important Parts” section. Reflections and connections require the teacher to distinguish between those that are more insightful and germane than others. The Clarifying Questions category is perhaps the most difficult to judge. Frequently the weakest students have the most difficulty with this, either because there is so much they don’t understand, or they can’t determine what they don’t understand.

• Note that the “Important Parts” category is used instead of asking students to write a summary. There is no reason, however, that a teacher can’t choose to require a summary of each of the sections. It would just involve more time, since writing a summary is more time-intensive than a list or bullet points. There is no reason students can’t do structured journaling in full sentences rather than bullet points, or be given the choice of which they prefer.

• It is important that students paraphrase or write the important parts in their own words as much as possible.
Appendix C: Sample student structured journal (in bulleted form) for Sections 3 “The Digestive Process Begins” and 4 “Final Absorption and Digestion”

Guidance to teachers is in italics, while model student responses are in straight font – by section.

Section 3: “The Digestive Process Begins”

INTRODUCTION

IMPORTANT POINTS

• Doctor was able to look inside stomach of wounded man to see how it works
• Found that food “changed chemically” inside the stomach
• Removed liquid from the stomach and found that the liquid contained an acid that helped breakdown food into simpler “substances”

If students include the names of the doctor or the patient you should ask, “Why is this important”?

CLARIFYING QUESTIONS

• How did the doctor know that the acid played a role in the breakdown of the food?

REFLECTIONS

• I wonder why the man didn’t die.
• Did anyone else ever do this before?

CONNECTIONS

• Connections should be to learning that came earlier in the text e.g. the role of acids in digestion or the nature of acids

The introduction is small and in many ways Introductions do not lend themselves to structured journaling. Teachers could choose to read it aloud with students following during the text based front loading (the text structure work) or students could read it independently followed by a brief discussion which may raise some of these questions. Even though this is a thin introduction, students should know that it is an introduction.
FUNCTIONS OF THE DIGESTIVE SYSTEM

IMPORTANT PARTS:

- The digestive system has three functions. It breaks food down into smaller parts so the body can use them. Then these parts go into the blood and throughout the body
- Digestion is what breaks food down into smaller parts
- After food is digested it goes to the different parts of the body
- Food which is not digested or absorbed is gotten rid of

REFLECTIONS:

- Why is the digestive system so long?
- How does the food go from the digestive system into the blood?
- Why are some materials not absorbed?

CLARIFYING QUESTIONS:

- The difference between chemical digestion and mechanical digestion is not clearly explained here. Mechanical digestion is explained by an example rather than any type of definition.

THE MOUTH

IMPORTANT PARTS:

- Mechanical and chemical digestion begin in the mouth
- Saliva in the mouth is part of both types of digestion
- The teeth begin digestion by making food into smaller pieces
- Saliva makes the food slippery and also turns starches into sugars by using enzymes

REFLECTIONS:

- Why do both types of digestion happen in the mouth
- What would happen if there was no chemical digestion in the mouth
- Why does the mouth start to water even before it has food in it
CLARIFYING QUESTIONS:

- I don’t understand why the mouth waters when it thinks about or smells food

THE ESOPHAGUS

IMPORTANT PARTS

- There are two openings at the back of the mouth one for bringing food to the stomach the other air to the lungs
- Food goes into the esophagus, air into the windpipe. When you swallow the epiglottis seals off the windpipe so food won’t go into it
- Contractions called peristalsis push the food down the esophagus. They also keep the food moving after the esophagus and through other parts of the digestive system

REFLECTIONS:

- Why is the esophagus called a muscular tube
- Why does food stay in the esophagus for only 10 seconds
- Where does the epiglottis go when you are not swallowing

CLARIFYING QUESTIONS:

This is a brief simple passage and may not have any.

Section 4: “Final Absorption and Digestion”

INTRODUCTION

IMPORTANT IDEA:

- The stomach is in charge of sending the food to the next part of the digestive system. It does this a little at a time so that it is done completely

THE SMALL INTESTINE

IMPORTANT PARTS:

- After food leaves the stomach it goes to the small intestine. Most chemical digestion takes place here
• It is very long but is called small because it is small in diameter (thin)
• Chemical digestion begins in the small intestine. Most chemical digestion is here
• Enzymes sent from the liver and the pancreas help with digestion in the small intestine
• The liver does a lot of work in the body. It breaks down medicines and helps eliminate nitrogen
• The pancreas makes enzymes that go to the small intestine and help breakdown starches proteins and fats.
• Not everything is broken down some food is helps the intestine work but is not broken down
• The small intestine is where everything goes into the blood and then all over the body

REFLECTIONS:

• Why are enzymes needed to help digestion?
• Why does the small intestine have to be so long? How can it be so long inside our bodies?
• Where does nitrogen come from and how does it get into the body?
• Why does the bile made by the liver need to be stored in the gallbladder? Why can’t it go right into the small intestine?

*This last question would be a great reflection or “I wonder”. While we are not sure of the answer, we know much the need for evolutionary adaptations has shifted body parts in order to use or modify existing parts to meet emerging needs. This may be what happened here. It is a good example of how a simple reflection can produce a profound discussion.

CLARIFYING QUESTION:

• Do the enzymes from the pancreas go into the small intestine? How do they get there?
• The book says the liver’s job in digestion is to make bile. But it also says it helps with medicine and nitrogen. Isn’t this part of digestion?

_Most teachers will explain surface volume and the work of the small intestine, but students reading it on their own for the first time would likely have questions about the structure and how it helps with the work of the small intestine. This would lead to questions such as:_

• How could the small intestine be as large as a tennis court?

THE LARGE INTESTINE

IMPORTANT PARTS:

• The large intestine is the last section of the digestive system
• It has bacteria in it but they are not bad and help with digestion
• When water goes into the large intestine it then goes to the rest of the body
• The large intestine is also where food gets ready to be eliminated from the body. It goes out of the body through the anus.
REFLECTIONS:

• Where do the bacteria in the large intestine come from? What would happen if there were no bacteria there?
• What happens to the bacteria when the food is eliminated? Do they leave too? Where do they stay?
• It says the bacteria do not normally cause disease, but when do they cause disease? What kind of disease?

CLARIFYING QUESTIONS:

• I don’t understand how the large intestine runs up and down the abdomen

*Please refer back to Appendix B for guidance on evaluating and evaluating the structured journal and the early responses you might get from your students.*