Chapter 1:

# Picture Perfect

## INSTRUCTOR'S GUIDE

*As with all the cases in this book, please read the preface if you have not already done so. In the preface you will find suggestions for using Investigative Case Based Learning (ICBL) in different instructional situations such as starting a new lecture topic, assessing what students already know, setting a context for lab activities, and so on. The preface also describes ways to use cases in a variety of classroom settings and suggests multiple ways to assess learning with cases.*

*Picture Perfect* accompanies Unit One: The Chemistry of Life in *Campbell Biology,* 10th edition. The case emphasizes material covered in Chapter 5: The Structure and Function of Large Biological Molecules. Students begin the investigative case by reading a narrative about a museum conservator preserving a 19th-century cotton dress stained with starch. There are three strands (or themes) in the case:

- The use of scientific thinking in preservation work
- The structure and function of polysaccharides, with an emphasis on starch and cellulose
- The introduction of amylase as an enzyme that catalyzes the hydrolysis of starch

Students should complete the Case Analysis immediately following the reading of the case. We strongly suggest that students work in groups to complete the Case Analysis. Actively listening to and challenging the ideas of others can help learners become aware of their own misconceptions, yet also value their own and others' prior knowledge.

Five investigations accompany *Picture Perfect*. Three are "core" investigations relating directly to the facts of the case, and two are additional investigations that extend the case to other applications. Table IG1.1 describes what students will gain from each investigation. See the Case Book website for an additional investigation on plants used as food starch globally.

## Table IG1.1 Picture Perfect Case Overview.

| Investigation | Learning Goals | Inquiry Skills Used |
|---|---|---|
| | **Core Investigations** | |
| I. Critical Reading | Students read parts of Chapter 5 covering an introduction to macromolecules, carbohydrates, and proteins. They also read selected sections in Chapter 8 about enzyme function. Emphasis is on carbohydrate chemistry and enzymes specific to starch. | • identifying information relevant to a question<br>• making observations and constructing an evidence-based argument<br>• relating structure to function |
| II. Analyze and Design an Experiment<br>A. Analyzing an Experiment | Using data generated by simulation software in the *Chapter 41, Investigation: What Role Does Amylase Play in Digestion?* found on the lab media section of the Study Area of MasteringBiology, students analyze the experimental setup and interpret outcomes. The use of iodine to test for starch and Benedict's solution to test for simple sugars is featured. | • analyzing experimental setups and data<br>• explaining outcomes of experiments |
| B. Designing an Experiment | Students use the same experimental methods employed in II.A. to test a variable of their choice. They design experimental and control treatments and predict results. Students could use the website software to run their experiment (optional). | • writing questions<br>• writing hypotheses<br>• identifying variables<br>• designing treatments<br>• predicting results |
| III. Off the Wall: Starch Degradation Investigation | Students study a realistic situation in which an individual needs to test methods of removing wallpaper paste. | • interpreting visual data<br>• making decisions<br>• applying concepts of experimental design and starch chemistry |
| | **Additional Investigations** | |
| IV. Structure and Function of Starch<br>A. Kinds of Starch | Students examine micrographs of starch granules from different plants. They infer the kind of starch Rob removed from the dress in the case. | • making observations<br>• using evidence to solve problems |
| B. Using Starches in Food | Students learn the stages in starch gelatinization and apply their knowledge to common errors in preparing gravy and mashed potatoes. | • reading graphs<br>• applying structure-function thinking to common problems |
| C. How Structural Properties of Native and Modified Starches Affect Their Function | Students learn how amylose affects the properties of native and modified starches, and how these differences are used in manufacturing starch-based products. | Students apply the concepts of starch structure and function to determine the best types of starch to use in the production of different foods. |

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|---|---|---|
| V. Open-Ended Investigations | Students transfer their knowledge of starch to a new example. | • locating and managing information<br>• identifying how their knowledge applies |

Table IG1.2 contains several resources related to *Campbell Biology*, 10th edition, that will help your students further their understanding of this case. Note that chapter readings and activities are listed in order of importance.

## Table IG1.2 Campbell-Related Resources.

| Resource | Chapter/Activity | Topics Covered/Activity Titles |
|---|---|---|
| Critical Reading from *Campbell Biology,* 10th edition | Chapter 5: Structure and Function of Large Biological Molecules | Formation and breakdown of macromolecules; carbohydrates and proteins (Concepts 5.1–5.4) |
| | Chapter 8: An Introduction to Metabolism | Substrate specificity of enzymes; effects of local conditions on enzyme activity (Concept 8.4) |
| Related readings from *Campbell Biology,* 10e | Chapter 2: The Chemical Context of Life | Hydrogen bonds; molecular shape and function (Concept 2.3) |
| | Chapter 4: Carbon and the Molecular Diversity of Life | Carbon skeleton variation and molecular diversity (Concept 4.2) |
| MasteringBiology Study Area | Chapter 5 **Activities** | Models of Glucose |
| | Chapter 8 **Activity** | How Enzymes Work |
| | Chapter 2 **Activity** | Hydrogen Bonds |
| | Chapter 41 **Investigation** | What Role Does Amylase Play in Starch Digestion? |
| | Chapter 2 **Investigation** | How Are Space Rocks Analyzed for Signs of Life? |
| | Chapter 3 **Activity** | The Polarity of Water |
| Morgan/Carter *Investigating Biology,* 8e | Lab Topic 4 | Enzymes: A helpful introduction to enzyme function. In Exercise 4.3, students test the influence of concentration, pH, and temperature on amylase activity. |

## Case Narrative

*Students were asked to underline terms or phrases in the introductory narrative that they think are important to understanding the case. Suggested terms and phrases that students might have chosen are in bold type.*

As she drove back to the museum, Bryn considered the box and the tiny dress it contained. It had been worn by a child in a **19th-century portrait** of a local family already owned by the museum. Discovered in a trunk **in an unheated barn** by descendants, the dress was in **surprisingly good condition**.

Once she arrived, Bryn went to the curators' workroom to give the dress to Rob, the museum's **textile conservator.** Seeing Rob working intently, she quietly knocked on the half-open door. He put down his tools and looked up.

"Rob," she said excitedly. "Here it is! The dress I told you about from the painting! The donor was about to have it cleaned, but I'm so glad he called here first."

"You're not kidding. **It's easy to ruin old fabrics,**" Rob said as he accepted the box with the tissue-wrapped dress. After **putting on gloves,** he unwrapped the old dress carefully and **laid it flat** on a **clean table** to examine it. He saw that the cotton dress was **slightly yellowed** and there was a **small, stiff stain** near the neckline. He wondered if that spot might prove troublesome. "This is terrific, Bryn. I'll do my magic, and with luck these discolorations and spots should disappear."

Bryn laughed, knowing that Rob's work had nothing to do with **magic or luck.** As she left the workroom, Rob grabbed an *Object Description and Restoration* form and began to **fill it out in pencil.** Next he gently brushed the dress. Using a metal probe, he **scraped the stain** at the neckline and placed the **sample on a microscope slide.** Rob examined the slide with the microscope, noticing **several granules** mixed in with a few longer fibers. He was not surprised to see **long cellulose fibers, which he knew to be cotton.** The granules, though, which were smooth and oval-shaped with a diameter of about 75 µm (micrometers), came from the stain itself. He added a drop of a weak, yellowish **iodine solution** to the slide. The **granules turned dark blue.** Under *Treatment Plan* he wrote "Neckline stain: **use amylase cleaning solution**"—an **enzymatic solution specific for removing starch.**