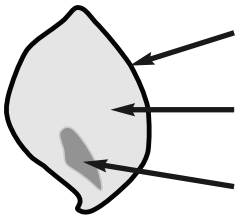
Chapter 9
Grains



Bran: Vitamins, minerals, fiber and some protein

Endosperm: Carbohydrates and some vitamins, minerals and protein

Germ: Vitamins, minerals and fat

Wheat, rice, corn, oats, barley and rye are all grains (plants that belong to a family of grasses). Grains are used to make foods like bread, breakfast cereal, rice and pasta. These products can be made from whole grains or processed grains. Whole grains have three parts called the bran, endosperm and germ. The endosperm contains carbohydrates. The bran and germ are full of vitamins, minerals and fiber. Sadly, the bran and germ are removed from processed grains. Processed grains are left with mostly endosperm. Most Americans need to eat more whole grains.

Enjoy learning about brainy grains!

Hands-On Lessons:

Answer Keys:

Virtual Lessons:

(See Virtual FoodMASTER CD)

Pudding
Growing Granules
Groovy Gluten
Protein Power

Selecting Cereal

Summary

Students will read five cereal Nutrition Facts labels, complete a nutrition facts table and make reasonable conclusions about the nutritional value of each cereal. In addition, students will perform a taste test to further compare the cereals.

Objectives

1. Students will be able to locate calories, grams of fiber and grams of sugar on food labels.
2. Students will be able to classify cereals as whole grains or not whole grains.
3. Students will use correct unit labels.
4. Students will be able to record data in a table.
5. Students will order cereals from most to least based on nutrition facts.
6. Students will be able to explain why one cereal is healthier than another.

Academic Content Standards

MATH

Numbers and Operations Standard

Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

Expectation:

- Understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals.

Data Analysis and Probability Standard

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Expectation:

- Collect data using observations, surveys, and experiments.
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Connections Standard

Expectation:

- Recognize and apply mathematics in contexts outside of mathematics.

SCIENCE

Physical Science: Content Standard B

Properties of objects and materials.

Expectation:

- Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials.

Science and Technology: Content Standard E

Abilities of technological design.

Expectation:

- Evaluate a product or design.

Science in Personal and Social Perspectives: Content Standard F

Personal health.

Expectation:

- Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat.

SCIENTIFIC INQUIRY:
Label Logic

Materials

For the teacher: 1 box Wheat Chex®, 1 box Cheerios®, 1 box Frosted Shredded Wheat®, 1 box Frosted Flakes®, 1 box Froot Loops®.

*Generic equivalents or brand name products may be used.

For each student: 1 plate.

Procedure

1. Read *Selecting Cereal* and complete the Doodle Bugs.
2. Review label reading.
   - Show the class where to find calories, fiber and sugar on the Nutrition Facts label. Note, fiber and sugar are both types of carbohydrates, so they are found underneath "total carbohydrates" on the food label. Be sure to point out the units of measurement and remind students to record these units.
   - Explain that the ingredients are listed from most to least. Remind students that whole grains will have the word "whole" before the grain (whole wheat, whole oats, etc.)
3. Divide the class into five groups.
4. Give each group a box of cereal. Ask the students to read the food label as a group and complete the correct line of the *Cereal Nutrition Facts* table.
5. Rotate the boxes between groups, until all students have completed the *Cereal Nutrition* Facts table.
6. When the students have completed questions one to three, pass out plates and cereal samples.
7. Students will try a sample of each cereal and then complete questions four and five.

Teacher Tips:

- Look for sales on cereal or buy equivalent generic brands.
- Allow groups of students to study the Nutrition Facts labels on the cereal boxes or make copies of labels provided in this manual for each student or pair of students.
- Fun fact to share: There are two types of sugars. Natural sugars come from fruits and milk products. Added sugars come from brown sugar, granulated sugar and powder sugar. Foods with natural sugars are generally good sources of other vitamins, minerals and fiber. Cereals with dried fruits often appear to be high in sugar, but some of the sugar is natural sugar from the fruit.
- Extension: Have students compare Frosted Flakes® and Raisin Bran®. Both are high in sugar; however, the Raisin Bran® has natural sugars from the raisins and the Frosted Flakes® is high in added sugars.
- Extension: Use leftover cereals to make trail mix. Students can practice measurement skills by measuring cereal, dried fruit, nuts and chocolate chips.

SCIENTIFIC INQUIRY:
Label Logic (continued)

Wheat Chex

Nutrition Facts
Serving Size: 3/4 cup
Servings Per Container: 8

Amount Per Servings
Calories 160 Calories from Fat 10

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	340 mg	14%
Potassium	180 mg	5%
Total Carbohydrate	38 g	13%
Dietary Fiber	5 g	21%
Soluble Fiber	1 g	
Sugars	5 g	
Other Carbohydrate	28 g	
Protein	5 g	

Vitamin A	10%	Calcium	10%
Vitamin C	10%	Iron	80%

*Percent Daily Values are based on a 2,000 calorie diet

Cheerios

Nutrition Facts
Serving Size: 1 cup
Servings Per Container: 14

Amount Per Servings
Calories 100 Calories from Fat 15

		% Daily Value
Total Fat	2 g	3%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	190 mg	8%
Potassium	170 mg	5%
Total Carbohydrate	20 g	7%
Dietary Fiber	3 g	11%
Soluble Fiber	1 g	
Sugars	1 g	
Other Carbohydrate	16 g	
Protein	3 g	

Vitamin A	10%	Calcium	10%
Vitamin C	10%	Iron	45%

*Percent Daily Values are based on a 2,000 calorie diet

Frosted Wheat

Nutrition Facts
Serving Size: 1 cup
Servings Per Container: 10

Amount Per Servings
Calories 190 Calories from Fat 10

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	10 mg	0%
Potassium	180 mg	5%
Total Carbohydrate	45 g	15%
Dietary Fiber	6 g	24%
Soluble Fiber	1 g	
Sugars	11 g	
Other Carbohydrate	28 g	
Protein	5 g	

Vitamin A	10%	Calcium	0%
Vitamin C	25%	Iron	25%

*Percent Daily Values are based on a 2,000 calorie diet

Frosted Flakes

Nutrition Facts
Serving Size: 3/4 cup
Servings Per Container: 16

Amount Per Servings
Calories 110 Calories from Fat 0

		% Daily Value
Total Fat	0 g	0%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	140 mg	6%
Potassium	20 mg	1%
Total Carbohydrate	27 g	9%
Dietary Fiber	1 g	3%
Sugars	11 g	
Other Carbohydrate	15 g	
Protein	1 g	

Vitamin A	10%	Calcium	0%
Vitamin C	10%	Iron	25%

*Percent Daily Values are based on a 2,000 calorie diet

Froot Loops

Nutrition Facts
Serving Size: 1 cup
Servings Per Container: 19

Amount Per Servings
Calories 120 Calories from Fat 10

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0.5 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	140 mg	6%
Potassium	30 mg	1%
Total Carbohydrate	26 g	9%
Dietary Fiber	1 g	3%
Sugars	13 g	
Other Carbohydrate	12 g	
Protein	1 g	

Vitamin A	10%	Calcium	0%
Vitamin C	25%	Iron	25%

*Percent Daily Values are based on a 2,000 calorie diet

Ingredient Lists (First Five)

Wheat Chex
Whole grain wheat, sugar, salt, barley malt extract & trisodium phosphate

Cheerios
Whole rolled oats, modified corn-starch, sugar, oat bran & salt

Frosted Shredded Wheat
Whole grain wheat, sugar, high fructose corn syrup & gelatin

Frosted Flakes
Milled corn, sugar, malt flavoring, high fructose corn syrup & salt

Froot Loops
Sugar, corn flour, wheat flour, oat flour & partially hydrogenated vegetable oil

Rice Review

Summary

Students will cook brown rice and compare cooked and uncooked rice. In addition, students will further explore the parts of a whole grain and read a rice graph.

Objectives

1. Students will learn how to prepare instant brown rice.
2. Students will accurately measure the volume and weight of rice.
3. Students will record data in a table.
4. Students will be able to name and label the three parts of a whole grain.
5. Students will read a graph and draw reasonable conclusions.

Academic Content Standards

MATH

Measurement Standard

Apply appropriate techniques, tools, and formulas to determine measurements.

Expectation:

- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles.

Data Analysis and Probability Standard

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Expectation:

- Collect data using observations, surveys, and experiments.
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs.

SCIENCE

Science as Inquiry: Content Standard A

Develop abilities necessary to do scientific inquiry.

Expectation:

- Plan and conduct a simple investigation.
- Use data to construct reasonable explanations.

Physical Science: Content Standard B

Properties of objects and materials.

Expectation:

- Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to react with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers.

Science and Technology: Content Standard E

Abilities of technological design.

Expectation:

- Evaluate a product or design.

SCIENTIFIC INQUIRY:

Nice Rice

Materials

For the teacher: Double burner hot plate, 1 liquid measuring cup, 1 pot with lid, 1 set dry measuring cups, plastic bowl, food scale, timer or clock, 1 serving spoon, 1 package instant whole grain brown rice (including directions)*.

*Don't use boil-in-a-bag rice or a rice mix.

For each student: 1 plate, 1 fork, 1 piece uncooked brown rice.

Procedure

1. Students will read the directions and measurement table on the rice package label. Then they will complete the *Rice Cooking Facts* table.
2. Place the pot on a double burner. Have students measure and pour one and three-fourths cups of water into the pot. Bring water to a boil.
3. Next, allow students to measure two cups of rice. Place an empty plastic bowl on the food scale. Zero the scale and allow students to measure the weight of the rice.
4. While the water heats, read *Rice Review* and complete the Doodle Bugs.
5. When the water boils, an adult should add the measured rice and follow package directions to prepare the rice. Students will set a timer for cooking time and standing time.
6. Students may then work on *While You Wait: Main Grain.*
7. After the rice is done, let it cool slightly. Show students the pan and ask "**What happened to the water?**" Students will then measure the weight of the cooked rice. To weigh the rice, place the plastic bowl on the scale, zero the scale and then add the rice.
8. Give each student a plate, a fork, a piece of uncooked rice and a sample of cooked brown rice. Ask students to compare the pieces of rice, complete the *Rice Facts* tables, taste the rice and answer any remaining questions.

Teacher Tips:

- Be very careful when using the hot plates. Discuss the dangers of touching the hot plate, hot pans and hot water before beginning the lesson.
- You may read the brown rice package label as a class or handout copies of the brown rice package label. Copies may be made directly from the rice package or from the package label information provided in this manual.
- Be sure to buy instant or minute brown rice, which takes 10 minutes to prepare. Regular brown rice will take about 45 minutes to cook.
- Extension: Measure the volume of the cooked rice. Compare the pre-cooked and post-cooked volumes.
- Extension: Read One Grain of Rice: A Mathematical Folktale by Demi.

WHILE YOU WAIT:
Main Grain

Materials
For each student: Colored pencils.

Procedure
1. Instruct students to color the parts of the rice grain and draw a processed grain. Students may turn back to the Chapter Introduction for a review of the three parts.
2. Students will then read the graph and answer the questions.

Teacher Tips:
- Reviewing whole grains:
  - Bran is an outer covering. It provides protection to the seed and provides us with fiber, vitamins and minerals.
  - The endosperm is starchy and provides energy for the seed and us.
  - The germ is meant to nourish the seed and provides vitamins, minerals and fat.
- Note: The graph is in millions of tons. You can discuss that six zero's need to be added to each number.
- Extension: Explore tons.

Brown Rice

Nutrition Facts
Serving Size: 1/2 cup
Servings Per Container: 10

Amount Per Servings
Calories 155 Calories from Fat 9

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	10 mg	0%
Total Carbohydrate	33 g	11%
Dietary Fiber	2 g	8%
Sugar	0 g	0%
Protein	3 g	
Vitamin A		0%
Calcium		1%
Vitamin C		0%
Iron		4%

*Percent Daily Values are based on a 2,000 calorie diet

Cooking Directions
1. Boil water.
2. Add rice.
3. Return water to a boil. Then turn heat down to low.
3. Cover with a lid and cook for 5 minutes.
4. Remove from heat. Stir. Cover with lid and let stand for 5 minutes or until fluffy.

Measurement Table

Servings	2	4	6	8
Rice (cups)	1	2	3	4
Water (cups)	1	1 3/4	2 1/2	3

Pasta Perfection

Summary

The class will cook and compare regular and whole wheat pasta. Students will read pasta Nutrition Facts labels, complete a table and apply real world math skills to answer questions regarding pasta.

Objectives

1. Students will learn how to prepare pasta.
2. Students will be able to name two types of pasta.
3. Students will be able to explain differences between regular and whole wheat pasta.
4. Students will be able to locate serving size, servings per container, calories and grams of fiber.
5. Students will be able to record data in a table and make reasonable conclusions.
6. Students will use math to solve real life problems. For example, students will use division to calculate the cost of pasta per serving.

Academic Content Standards

MATH

Number and Operations Standard

Compute fluently and make reasonable estimates.

Expectation:

- Develop fluency in adding, subtracting, multiplying, and dividing whole numbers.

Data Analysis and Probability Standard

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

Expectation:

- Collect data using observations, surveys, and experiments.
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Problem Solving Standard

Expectation:

- Solve problems that arise in mathematics and other contexts.

Connections Standard

Expectation:

- Recognize and apply mathematics in contexts outside of mathematics.

SCIENCE

Science in Personal and Social Perspectives: Content Standard F

Personal health.

Expectation:

- Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat.

SCIENTIFIC INQUIRY:
Cooking Pasta

Materials

For the teacher: Liquid measuring cup, 1 set measuring spoons, double burner hot plate, 2 large pots, 2 timers, 2 stirring spoon, colander or strainer, hot pad holders, tongs, 1 medium pot, 1 serving spoon, salt, water, 16-ounce box regular pasta*, 16-ounce box whole wheat pasta*, 26-ounce jar pasta sauce.

*Note: you can use rotelle, farfalle or spaghetti.

For each student: 1 plate, 1 fork.

Procedure

1. Begin by placing your large pots on the double burner hot plate. Add water and bring to a boil.
2. Read *Pasta Perfection* and complete the Doodle Bugs.
3. When water boils, an adult should carefully add regular spaghetti to one pot and whole-wheat spaghetti to the second pot. Allow students to set timers for the spaghetti according to package directions.
4. Students may complete *While You Wait: Brainy Grains* while the pasta is cooking.
5. If desired, heat pasta sauce in the medium pot.
6. When the pasta is done, an adult should use a strainer/colander to drain water from each pot. Be sure to pour away from yourself.
7. An adult will then serve a small portion of each type of pasta to each student. As the pasta is being served, asked **"Has anyone tried whole wheat pasta before? Can anyone remember the three parts of a whole grain? The one part of a processed grain?"** Be sure to ask students how well they like the whole-wheat pasta.
8. After tasting the pastas, students will complete the *Regular and Whole Wheat Facts* table.

Teacher Tips:

- Be very careful when using the hot plates. Discuss the dangers of touching the hot plate, hot pans, and hot water before beginning the lesson.
- Inviting an extra adult to help cook, stir and serve the pasta will help this lab run smoothly.
- Check to make sure both large pots fit on the double burner. You may need to use a double burner and a single burner.
- Smaller classes may only need to prepare half of a package of pasta; whereas, larger classes will need to prepare the whole package.
- If your pasta sauce is in a can, remember that only the teacher should use a can opener.
- Extension: Read Cloudy with a Chance of Meatballs by Judi Barrett.

WHILE YOU WAIT:

Brainy Grains

Materials

For each student: 1 regular pasta food label, 1 whole wheat pasta food label.

Procedure

1. Complete the two practice problems as a class.
2. Review where to find the serving size, number of servings per container, calories and fiber on the Nutrition Facts label. Be sure to point out the units of measurement and remind students to record these units.
3. Ask students to use the pasta food labels to complete the *Pasta Facts* table.
4. Instruct students to answer questions one to five. Your students will discover that the whole wheat pasta is more expensive. You can point out that eating healthy sometimes is more expensive. Ask your students "Do you think paying a little more to enjoy healthier food is worth it?"
5. Students who get done early may try solving the challenge question.

Teacher Tips:

- You can make copies of actual labels or the pasta labels provided in this manual.
- You can use actual prices for pastas or prices listed on provided labels. When doing calculations, the prices on provided labels may come out more evenly then using actual prices.

Regular Spaghetti
$0.98

Nutrition Facts

Serving Size: 1/2 cup
Servings Per Container: 7

Amount Per Servings
Calories 210 Calories from Fat 10

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	0 mg	0%
Total Carbohydrate	42 g	15%
Fiber	2 g	8%
Sugar	2 g	
Protein	8 g	
Vitamin A		0%
Calcium		0%
Vitamin C		0%
Iron		10%

*Percent Daily Values are based on a 2,000 calorie diet

Whole Wheat Spaghetti
$1.96

Nutrition Facts

Serving Size: 1/2 cup
Servings Per Container: 7

Amount Per Servings
Calories 180 Calories from Fat 10

		% Daily Value
Total Fat	1 g	2%
Saturated Fat	0 g	0%
Trans Fat	0 g	0%
Cholesterol	0 mg	0%
Sodium	0 mg	0%
Total Carbohydrate	36 g	13%
Fiber	6 g	26%
Sugar	2 g	
Protein	8 g	
Vitamin A		0%
Calcium		2%
Vitamin C		0%
Iron		10%

*Percent Daily Values are based on a 2,000 calorie diet

Spaghetti Cooking Directions

1. Boil 4 quarts of water.
2. Add 1 package of spaghetti.
3. Cook for 12 minutes, stirring at times.
4. Remove from heat and carefully drain water.

Answer Keys

Selecting Cereal

Doodle Bugs

Circle: **Bran, endosperm, germ**
Box: **Look for cereals with more fiber, less sugar and whole grain ingredients.**
Select one: **Whole wheat**

SCIENTIFIC INQUIRY:

Label Logic

Note: Answers based on Nutrition Facts labels will vary depending upon the brands used.

Chex®: **160 calories; 5 grams fiber; 5 grams sugar; yes**
Cheerios®: **100 calories; 3 grams fiber; 1 gram sugar; yes**
Frosted Shredded Wheat®: **190 calories; 6 grams fiber; 11 grams sugar; yes**
Frosted Flakes®: **110 calories; 1 gram fiber; 11 grams sugar; no**
Froot Loops®: **120 calories; 1 gram fiber; 13 grams sugar; no**
Circle: **Cheerios®**
Star: **Frosted Shredded Wheat®**

1. **Frosted Shredded Wheat®, Chex®, Cheerios®, Frosted Flakes® and Froot Loops®**
2. **Froot Loops®, Frosted Flakes® and Frosted Shredded Wheat®, Chex®, Cheerios®**
3. **Answers may vary: Examples:** I think Wheat Chex® is the healthiest because it only has 5 grams of sugar and it has 5 grams of fiber (low in sugar and high in fiber). It also has whole grain ingredients. **Or** I think Cheerios® is the healthiest because it is the lowest in sugar, it contains whole grains, and it has a moderate amount of fiber.
4. **Answers will vary. Example:** I like Frosted Shredded Wheat® because it is sweet.
5. **Answers will vary. Example:** I think it is moderately healthy. It has whole grains and lots of fiber, but it also has a lot of sugar.

Rice Review

Doodle Bugs

Circle: **Rice, wheat bread, beans, corn, yams**
Box: **Bran, endosperm, germ**
Underline: **Nutrients and fiber are taken away when the bran and germ are removed.**

SCIENTIFIC INQUIRY:

Nice Rice

Brown rice: **2 cups rice; 1 3/4 cups water; 5 minutes; 5 minutes**
Uncooked Brown Rice: **172 grams; light brown, small, oblong, dry, hard and crunchy; small piece of rice**
Cooked Brown Rice: **425 grams; light brown, bigger, oblong, moist, soft and fluffy; larger piece of rice**

What happened to the water when you cooked the rice? **It disappeared because it was absorbed into the rice.**
Do you think one piece of uncooked or cooked rice weights more? **Cooked Rice**
Why do you think it weights more? **Cooked rice weighs more because it soaked up water. The water made the rice bigger and added to the weight of the rice.**
Tasting time: **Answers will vary.**

Answer Keys (continued)

WHILE YOU WAIT:

Main Grain

1. Bran brown - **Outer layer**; Endosperm orange - **Large inner area**; Germ yellow - **Small inner area**
2. **Only the endosperm should be drawn.**
3. **China** a. **128 million tons**
   b. **Yes, I think it is a staple food because people in china eat a lot of rice!**
4. **United States of America** a. **4 million tons**
   b. **No, because many Americans don't eat a lot of rice.**

Pasta Perfection

Doodle Bugs

Circle: **Spaghetti, Macaroni, Rotelle, Farfalle, Ravioli**
Fill-in the blank: **Answers will vary. Example: Farfalle because it looks like a bow tie.**
Box: **Flour and water**
Underline: **Whole wheat pasta is healthier because it has more fiber, vitamins and minerals.**

SCIENTIFIC INQUIRY:

Cooking Pasta

Regular pasta cooking time: **12 minutes**
Whole wheat past cooking time: **12 minutes**
Regular pasta: **Yellow, long, thin circular strand; Great, mild flavor**
Whole wheat pasta: **Tan, long, very skinny, circular, strand; Good, tastes more nutty and chewy**

WHILE YOU WAIT:

Brainy Grains

1. **$0.20**
2. **$0.30**

Regular pasta: **$0.98; 1/2 cup; 7 servings; 210 Calories; 2 grams fiber**
Whole wheat pasta: **$1.96; 1/2 cup; 7 servings; 180 Calories; 6 grams fiber**

1. **$0.14**
2. **$0.28**
3. **$0.14**
4. **20 noodles**

5a. **12.5 servings** b. **4 servings**
Challenge: Whole wheat: **6 1/4 cups** Regular Pasta: **2 cups**

Proficiency Questions (Workbook)

1. **c** 2. **a** 3. **c** 4. **d** 5. **b** 6. **a**

Proficiency Questions (Virtual CD)

1. **c** 2. **a** 3. **c** 4. **d**