

# Protein

### At a Glance

#### Recommended Dietary Intake:

55 g for adults = 220 calories  
Daily Calories in diet: 15-25%

#### Calories per Gram of Food: 4

3 oz piece of salmon = 19 g of protein = 76 calories; 10 g of fat = 90 cal; 0g carbohydrate; total calories = 166.

#### Types of Protein:

- 20 Amino Acids
  - 12 Human body makes
  - 8 “Essential” from food

**Function:** Proteins are involved in antibodies, blood clotting, energy, fluid balance, growth and repair of tissue, hormones, transportation of oxygen and minerals.

**Food Sources:** Meat, seafood, dairy, eggs, legumes, beans, tofu, nuts, seeds.

#### Typical Serving Size:

1 cup of black beans: 16 g protein, 40 g carbohydrate, 1 gm fat = 227 calories. 3 oz of meat (size of a deck of cards): 21 g protein, 16 g fat, 0 carbohydrate = 250 calories.

**Health Concerns:** Eating too little protein causes the body to break down tissue for amino acids while too much protein puts stress on the kidneys and gets stored as fat.

### Protein in the Body and Food

Protein is a macronutrient that provides the body with form (structures like muscle and tissue), function (enzymes, antibodies, hormones) and energy. The building blocks of protein are 20 amino acids that are combined in varying ways to give each protein its particular shape and function. When we ingest protein, stomach acids “denature” the protein freeing the amino acids, so the body can recycle them as needed. Eight of the amino acids, called “essential” amino acids must come from food because they can’t be synthesized by the body.

Protein in our diet comes from both animal and plant sources. Animal protein contains all the 20 amino acids needed by our bodies. It can also contain a significant quantity of fat and can be expensive. Plant protein also contains all the amino acids, but not all in one type of food. When a plant is deficient in one of the amino acids, another plant can make up the difference if eaten in combination, like beans and rice, to form a “complete” protein. The advantage of plant based protein is that it is naturally low in fat and inexpensive. In order for vegetarians to eat all the essential amino acids, they must eat a variety of complementary plants.



### Selecting a Diet of High Quality Protein

Be aware of several basic ideas when selecting food. Many animal sources of protein also have nutrients that should be limited like saturated fat, total fat, and cholesterol. Beef has more fat than chicken and pork. Processed meats like deli meat and sausage can be very high in fat, sodium and preservatives. The higher the fat content the higher the calorie content. Limit full fat dairy products. Seafood contains the health promoting omega-3 fatty acid. As a general rule, a 3 ounce serving of lean meat (the size of a deck of cards) is all the protein you need in a day.

Plant sources of protein include naturally low fat grains and legumes, but cooking technique and added ingredients can easily turn it into a high fat meal. Nuts and seeds while naturally higher in fat, have heart healthy fats, but should be eaten in moderation to avoid excess calories. Eating a variety of these foods provides all the amino acids your body needs.

## Protein

### Selecting Healthy Food Using Food Labels

**Goal:** Learn how to use the Nutrition Facts Label to select foods that are good sources of protein.

**Exercise:** The Food and Drug Administration requires a Nutrition Facts panel on all packaged food products. This exercise demonstrates how to read and interpret the label in order to compare different foods. Have the students compare the two nutrition fact labels below to determine the healthiest source of protein. Notice that the caloric content of the food is similar, as is the amount of protein. If you were only looking at protein on the label, you may think both were fine options. However, notice that the hot dog has much more fat, saturated fat, cholesterol, and sodium, and has no fiber. You must look at the entire label before evaluating which food is the better choice.

#### Black Beans

Nutrition Facts			
Serving Size 1 cup 172g (172 g)			
Amount Per Serving			
Calories 227		Calories from Fat 8	
		% Daily Value*	
Total Fat	1g		1%
Saturated Fat	0g		1%
Trans Fat			
Cholesterol	0mg		0%
Sodium	2mg		0%
Total Carbohydrate	41g		14%
Dietary Fiber	15g		60%
Sugars			
<b>Protein</b>	<b>15g</b>		
Vitamin A	0%	Vitamin C	0%
Calcium	5%	Iron	20%

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

		Calories	2,000	2,500
Total Fat	Less than	65g	80g	
Sat Fat	Less than	20g	25g	
Cholesterol	Less than	300mg	300mg	
Sodium	Less than	2,400mg	2,400mg	
Total Carbohydrate		300g	375g	
Fiber		25g	30g	

Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4

#### Hot Dog

Nutrition Facts			
Serving Size 100 grams (100 grams)			
Amount Per Serving			
Calories 290		Calories from Fat 231	
		% Daily Value*	
Total Fat	26g		40%
Saturated Fat	11g		53%
Trans Fat			
Cholesterol	67mg		22%
Sodium	994mg		41%
Total Carbohydrate	2g		1%
Dietary Fiber	0g		0%
Sugars	2g		
<b>Protein</b>	<b>13g</b>		
Vitamin A	0%	Vitamin C	33%
Calcium	1%	Iron	10%

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

		Calories	2,000	2,500
Total Fat	Less than	65g	80g	
Sat Fat	Less than	20g	25g	
Cholesterol	Less than	300mg	300mg	
Sodium	Less than	2,400mg	2,400mg	
Total Carbohydrate		300g	375g	
Fiber		25g	30g	

Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4



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### History and Protein

- Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts. (CCSS.ELA-Literacy.RH.6-8.7)
- Distinguish among fact, opinion, and reasoned judgment in a text. (CCSS.ELA-Literacy.RH.6-8.8)
- Analyze the relationship between a primary and secondary source on the same topic. (CCSS.ELA-Literacy.RH.6-8.9)

#### DID YOU KNOW?

#### LESSONS IDEAS

#### SUPPORTING INFORMATION AND CURRICULUM

#### **Growing food...**

We raise and slaughter 10 billion animals each year in the United States alone.

Global grain production that is fed to cattle could feed 8.7 billion people. Instead we feed it to cows.

How has raising animals been important throughout human history?  
What crops are primarily grown now to feed these animals (corn and soy)?

How has legislation influenced food production and food consumption?

**Crops, United States Department of Agriculture, Economic Research Service**

[www.ers.usda.gov/topics/crops.aspx](http://www.ers.usda.gov/topics/crops.aspx)

**Animal Products, United States Department of Agriculture, Economic Research Service**

[www.ers.usda.gov/topics/animal-products.aspx](http://www.ers.usda.gov/topics/animal-products.aspx)

#### **Eating food...**

American's eat about 110 grams of protein a day, 75 of which come from animal sources. The USDA recommends just 55 grams per day, and the majority from non-animal or lean animal sources.

Compare the way children ate in other countries to the way children eat now. What are the differences and what caused them.

Describe what sources of protein developing nations rely on (black beans in Latin America, rice and chickpeas in India, peanuts in Western Africa, seal blubber in Inuit cultures).

How much protein do you eat as compare to your ancestors?

**Profiling Food Consumption in America, USDA**

[www.usda.gov/factbook/chapter2.pdf](http://www.usda.gov/factbook/chapter2.pdf)

**A Century of Data on Food Availability (Consumption), Economic Research Service, USDA**

<http://webarchives.cdlib.org/sw1s17tt5t/http://ers.usda.gov/Features/Centennial/>

**Global and regional food consumption patterns/trends, WHO**

[www.who.int/nutrition/topics/3\\_foodconsumption/en/index.html](http://www.who.int/nutrition/topics/3_foodconsumption/en/index.html)

**Team Nutrition, USDA, Serving Up MyPlate: A Yummy Curriculum**

[http://teamn nutrition.usda.gov/Resources/sump\\_level3.pdf](http://teamn nutrition.usda.gov/Resources/sump_level3.pdf)

## Protein

### Science and Protein

- 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). (CCSS.ELA-Literacy.RST.6-8.7 )
- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (CCSS.ELA-Literacy.RST.6-8.8)
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (CCSS.ELA-Literacy.RST.6-8.9 )

#### DID YOU KNOW?

##### ***Growing food...***

In ecology, with each movement up a food chain only 10% of the original energy is maintained – the other 90% goes to the functioning of the organism. For example, from grass eaten by rabbit, only 10% of the energy in the grass becomes energy in the rabbit’s flesh. From rabbit eaten by fox, only 10% of the rabbit becomes energy, so 1% of the original grass energy is passed on.

##### ***Eating food...***

The human body has the ability to construct thousands of proteins as needed to perform vital functions from 20 amino acids. Eight of the amino acids are considered “essential,” meaning the body cannot make them and must obtain them from both plant and animal foods.

#### LESSONS IDEAS

Discuss food chains and how they are important in ecology. Go over the concept of energy maintenance as one moves along a food chain. Why is only 10% of the energy retained? Where does the other 90% go? Have students create a food web diagram for an ecosystem (eg Chesapeake Bay). Then have students make a food web for human beings. What do we eat? Only meat? Only plants? Both?

Understanding the complex text on a Nutrition Facts label will increase practical knowledge to make healthy food choices. Using the sample food labels, have students compare two foods and identify healthy snacks.

Discuss the composition of protein molecules and why they are unique. Discuss what an enzyme is and why protein is important.

#### INFORMATION AND CURRICULUM

##### ***Chesapeake Bay Field Office: Food Web Activity***

[www.fws.gov/chesapeakebay/Shad%20activities/ShadFoodWeb.html](http://www.fws.gov/chesapeakebay/Shad%20activities/ShadFoodWeb.html)

##### ***Energy Transfer Worksheet***

[http://science-class.net/Graphic\\_Organizers/GO\\_energy\\_transfer.pdf](http://science-class.net/Graphic_Organizers/GO_energy_transfer.pdf)

##### ***More Food Web Activities/Resources***

[http://science-class.net/Ecology/energy\\_transfer.htm](http://science-class.net/Ecology/energy_transfer.htm)

##### ***Basics of Protein, CDC***

[www.cdc.gov/nutrition/everyone/basics/protein.html](http://www.cdc.gov/nutrition/everyone/basics/protein.html)

##### ***Team Nutrition, USDA, Nutrition Voyager, Trek 2, Backpack full of Snacks***

[teamnutrition.usda.gov/Resources/nutvoyage8\\_trek2.pdf](http://teamnutrition.usda.gov/Resources/nutvoyage8_trek2.pdf)

##### ***MyPlate Protein Lesson, Ole Miss***

<http://nfsmi-web01.nfsmi.olemiss.edu/documentlibraryfiles/PDF/20110831094457.pdf>

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### Math and Protein

- Represent and analyze quantitative relationships between dependent and independent variables. (CCSSM.6.EE)
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations. (CCSSM.7.RP)
- Investigate patterns of association in bivariate data. (CCSSM.8.SP)

#### DID YOU KNOW?

##### *Growing food...*

Global meat production is at record high with 58 billion animals raised worldwide each year  
Many students don't know where food is grown.

##### *Eating food...*

One serving of beef has 200 calories, 13 grams of fat, 5 grams saturated fat, and 19 grams of protein while one serving of black beans has no fat, 200 calories, 15 grams of protein and 15 grams of fiber

On average Americans consume 300 calories daily from the protein in animal foods, which account for about ¼ of the total daily caloric intake of the average American. Another 40% of calories come just from added fat and sugar in products!

#### LESSONS IDEAS

Chart and analyze global meat and animal products production.  
Compare cost of producing animal foods based on outputs and inputs. (impact on environment)  
Identify local food production

Compare the nutritive values of different sources of protein including both animal and plant sources  
How many grams of protein are consumed in the USA? What percent of the American diet is due to protein? Graph with pie charts.

Graph and compare the consumption of foods (containing nutrients like protein) of males and females over time.

Adolescent boys (12–19 years) consumed an average of 442 kcals from added sugars daily whereas girls consumed 314 kcals daily. What percentage of adolescent males and females diets were from added sugar?

#### INFORMATION AND CURRICULUM

##### *This Land is Our Land, Lesson Plan*

[www.nass.usda.gov/Education\\_and\\_Outreach/Lesson\\_Plans/X-09-this%20land%20is%20our%20land.pdf](http://www.nass.usda.gov/Education_and_Outreach/Lesson_Plans/X-09-this%20land%20is%20our%20land.pdf)  
**Team Nutrition, USDA, Nutrition Voyager, Trek 3 From Farm to You**  
[http://teamnutrition.usda.gov/Resources/nutvoyage8\\_trek3.pdf](http://teamnutrition.usda.gov/Resources/nutvoyage8_trek3.pdf)

##### *Plant Protein vs. Animal Protein, Difference Between*

[www.differencebetween.net/science/health/difference-between-plant-protein-and-animal-protein/](http://www.differencebetween.net/science/health/difference-between-plant-protein-and-animal-protein/)  
**How Much Protein Do We Need? CDC**  
[www.cdc.gov/nutrition/everyone/basics/protein.html](http://www.cdc.gov/nutrition/everyone/basics/protein.html)

##### *Big Math and Fries, Illuminations*

[illuminations.nctm.org/LessonDetail.aspx?id=L849](http://illuminations.nctm.org/LessonDetail.aspx?id=L849)  
**Using Food to Teach Pie Graphs**  
[http://wikieducator.org/Sample\\_math\\_lesson](http://wikieducator.org/Sample_math_lesson)  
**Using Nutrition Labels to Teach Math, ehow**  
[www.ehow.com/info\\_7877480\\_math-activities-using-nutrition-labels.html](http://www.ehow.com/info_7877480_math-activities-using-nutrition-labels.html)  
**Nutrition Essentials, MyPyramid Amounts of Foods—FOR YOU, Team Nutrition, USDA**  
[http://teamnutrition.usda.gov/Resources/ne\\_amounts4u.pdf](http://teamnutrition.usda.gov/Resources/ne_amounts4u.pdf)

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### Language Arts and Protein

- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (CCSS.ELA.W)
- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (CCSS.ELA.SL)
- Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation. (CCSS.ELA.7.W)

DID YOU KNOW?	LESSONS IDEAS	INFORMATION AND CURRICULUM
<p><b><i>Growing food...</i></b> There are many great documentaries on the subject of food production, such as "Food Inc.," "King Corn" and "Fresh."</p>	<p>Watch films about food and discuss the differences between opinion and fact. Have students take notes and prepare to engage in a debate for each side displayed in the films.</p>	<p><b><i>Teaching the Food System, Johns Hopkins University</i></b> <a href="http://www.jhsph.edu/research/centers-and-institutes/teaching-the-food-system/curriculum/">www.jhsph.edu/research/centers-and-institutes/teaching-the-food-system/curriculum/</a> <b><i>Historical Timeline, Farm Machinery, Growing a Nation</i></b> <a href="http://www.agclassroom.org/gan/timeline/farm_tech.htm">www.agclassroom.org/gan/timeline/farm_tech.htm</a></p>
<p><b><i>Eating food...</i></b> Many countries have food guides that capture the ethnic and cultural characteristics of that country while conveying recommendations based on nutrition science.</p>	<p>Search for a variety of pictorial food guides and compare how different foods are categorized and displayed. What can you learn about each country? Do they place an emphasis on plant based foods or animal based foods?</p> <p>Make your own food guide that represents a healthy diet within your community.</p>	<p><b><i>MyPlate, Protein, USDA</i></b> <a href="http://www.choosemyplate.gov/food-groups/protein-foods.html">www.choosemyplate.gov/food-groups/protein-foods.html</a> <b><i>Comparison of International Food Guide Pictorial Representation</i></b> <a href="http://intraspec.ca/pictorials_nutrition_guides.pdf">http://intraspec.ca/pictorials_nutrition_guides.pdf</a> <b><i>Harvard Healthy Eating Plate, Harvard University</i></b> <a href="http://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/">www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/</a> <b><i>Japanese Food Guide Spinning Top</i></b> <a href="http://www.mhlw.go.jp/bunya/kenkou/pdf/eiyousyokuji5.pdf">www.mhlw.go.jp/bunya/kenkou/pdf/eiyousyokuji5.pdf</a></p>