

5-Biological molecules and Food

We are familiar with the molecules of life in the textbook because they are things we encounter all the time. We *eat* macromolecules for breakfast, lunch, and dinner (and late night snacks). Deciding what foods to eat, and how much of these different foods is so important there are nutritionists who get paid to study these things and advise us.

There will probably always been fad diets, and there is always going to be variation among us as individuals in terms of diet. That said, some basic knowledge will go a long way.

Based on your reading (or the videos), what are the 4 classes of biological molecules?

1

2

3

4

Food labels: Part 1: ingredients list

There are 2 useful parts to food labels. The first is the ingredients lists. Ingredients are listed in order of amount, so the first ingredient is the most common. Let's take a few ingredients list, and put each ingredient into the best fit for a category.

Label 1: Nature Valley Granola Bars:



Label 2: From Oikos Yogurt

INGREDIENTS: CULTURED GRADE A NON FAT MILK, WATER, STRAWBERRY, SUGAR, FRUCTOSE, CONTAINS LESS THAN 1% OF MODIFIED CORN STARCH, NATURAL FLAVOR, CARRAGEENAN, CARMINE AND BLACK CARROT JUICE CONCENTRATE (FOR COLOR), SODIUM CITRATE, POTASSIUM SORBATE (TO MAINTAIN FRESHNESS), MALIC ACID, VITAMIN D₃.

CONTAINS ACTIVE YOGURT CULTURES.

The top of the following chart has been filled in for you. **Fill in the bottom** as best you can. You'll notice some foods in the ingredient list fit more than 1 category. For something like oats, the bulk of the calories come from carbohydrates, but they have some protein, and even a bit of fat. (I don't expect you to memorize this for a test!!)

For help visit quithealthy.com. At the bottom of the home page there are links for food labels (see the next section) for common foods. You can look up some of the above ingredients there.

Product	Examples of: Protein	Carbohydrate (complex or sugar?)	Fat	Unknown/other
Granola	Almonds, whole grain oats*	Whole grain oats	Almonds, whole grain oats*	Natural flavor, Sodium citrate

How many different types of carbohydrates did you find in the granola bar?

Here are a few more foods that might be easier to classify (circle any that apply):

Tofu: protein carbohydrate fat

White meat chicken: protein carbohydrate fat

Dark meat chicken: protein carbohydrate fat

Gluten: protein carbohydrate fat

Food labels: Part 2: Percent Daily value

We require things from our food. First, we need energy. **Calories** are a way of measuring the energy food provides. Different types of foods are more or less calorically dense.

Table 2: Calories in different macromolecules

Type of macromolecule	Calories per gram
Protein	4
Carbohydrates (sugars and complex carbohydrates)	4
Fat	9

Luckily, we store spare energy as fat, otherwise it would take more than twice the amount of space to store energy as proteins or carbohydrates!

But different people use more or less calories. The daily values are based on averages. For an average woman, around 2,000 calories per day are needed and an average man, around 2,500 calories per day are needed.

Really, this is a one-size-fits-nobody issue, but it is a place to start.

What sorts of things will affect how many calories you need?

But besides calories, we need other nutrients: vitamins, minerals, and things like fiber. Ideal foods are **nutrient dense**; they provide a lot of nutrients (like vitamins and fiber) for not as many calories. Then again, if you're going for a week-long hike and burning a lot of calories, you also want your food to be **calorically dense**; you need a lot of energy and it needs to be light to carry.

Back to the food labels.

Label 3: Percent daily value for Granola

Nutrition Facts	
Serving Size 1 bar (35g)	
Servings Per Container 6	
Amount Per Serving	
Calories	160
Calories from Fat	60
% Daily Value*	
Total Fat 7g	10%
Saturated Fat 2g	10%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 150mg	6%
Total Carbohydrate 23g	8%
Dietary Fiber 2g	7%
Sugars 13g	
Protein 3g	
Calcium 2%	• Iron 2%
Not a significant source of vitamin A, vitamin C.	
*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
Dietary Fiber	25g 30g

This gives you both the grams of saturated fat (2g) and the % of your total daily saturated fat intake for a 2,000 per day diet (10%). So I could eat 10 granola bars to get all my saturated fat requirement for that day.

Does this granola bar provide any protein and if so, how much?

Does this granola bar provide any fiber and if so, how much?

Label 4: Yogurt Percent Daily Values

Nutrition Facts	Amount/Serving	%DV*	Amount/Serving	%DV*
	Total Fat 0g	0%	Potassium 170mg	5%
Serving Size 1 Container (150g)	Saturated Fat 0g	0%	Total Carbohydrate 19g	6%
Calories 120	<i>Trans Fat</i> 0g		Dietary Fiber 0g	0%
Calories from Fat 0	Cholesterol 5mg	2%	Sugars 18g	
<small>*Percent Daily Values (DV) are based on a 2,000 calorie diet.</small>	Sodium 50mg	2%	Protein 12g	24%
Vit A 0% • Vit C 0% • Calcium 15% • Iron 0% • Vit D 15%				

Does this yogurt provide any protein and if so, how much?

Does this yogurt provide any fiber and if so, how much?

Does this yogurt provide any other vitamins or minerals and if so what and how much?

Would you say that yogurt or granola is better than the other?

Part 4: various activities mostly using MyPlate

Suggested Activities That Incorporate the Nutritional Uses of Biological Molecules

1. Two Food Instant Food Comparison: Compare the amounts of the biological molecules (macromolecules) of two similar foods side by side:
<http://www.twofoods.com/compare/query/b3JhbmdlIGp1aWNI/YXBwbGUganVpY2U=>
2. My Food Plate Frisbee Toss Game: Make Frisbees out of paper plates (one plate per food). On one side of each plate, paste a photo of a common food. On the other side, paste a copy of the nutrition label of the food. Do this for all of the foods you want represented. Pick five students to catch the frisbees. Each representing a different food group on MyPlate (dairy, grains, protein, veggies, and fruit). Discuss which

biological molecules are represented in each of the five groups. Some can be found in more than one. Evenly distribute the frisbees among the rest of the students, or divide the students into groups and divide the frisbees evenly among the groups. One at a time, and without looking at the food label on the back of the frisbee, have each student or student group take turns tossing the frisbee to the person that represents the corresponding food group. When everyone or every group has tossed all of their frisbees, the students that caught the frisbees will check the backs of the frisbees for accuracy to make sure they were tossed to the person corresponding to the correct food group. The most accurate student or group wins.

3. **Make a MyPlate Meal:** Give each student one paper plate and set of colored pencils or markers. Have each student design and draw a meal based on the MyPlate guide (<http://www.choosemyplate.gov>) that they would realistically eat. Have them think about trying a fruit or vegetable they have never tried or would like to eat more of. Have them try a source of protein, whole grain (carbohydrate), or dairy they would like to try or eat more of. Challenge the students to make a real meal at home identical to the one they created and report on how they and their family liked it. Could each family member design some meals similar to what they have eaten before but more in line with the USDA's recommendations?
4. **Serving Size Comparison:** Compare four different common snack foods, two with no empty calories (examples: carrots (carbohydrates and micronutrients), bananas (carbohydrates, protein, micronutrients), avocados (protein, fat, carbohydrates), nuts (protein, fat), Doritos® (simple carbohydrates, artificial flavors, and colors), M&M's® (simple carbohydrates, artificial flavors and colors). Have the students find the suggested serving size on the food label. Give each student group four paper plates. Have the groups put the amount for 1 serving of each snack food onto each of the four plates (one food per plate). Discuss the nutritional values of each of the foods. Would one serving, as suggested on the food label fill them up? After visualizing what one serving for each snack looks like on a plate, what would they choose next time. Discuss how the biological molecules of each food would benefit or compromise body functions, if these foods were to be eaten on a regular basis.
5. **Amounts of Sugar In Common Beverages:** You will need one box of sugar cubes and six different beverages in original containers (juice, sodas, milk, etc.). Students can bring in their own favorite. Use the following formula to figure out the number of teaspoons of sugar in each drink:

teaspoons of sugar = $\frac{\text{\# grams of sugar (from food label)}}{\text{\# servings (from food label)}}$

*1 sugar cube will represent 1 teaspoon of sugar

1. The class will predict the order, from least to greatest, of sugar content (write it on the board or have them write it on paper)
2. Next, have each person figure out how many sugar cubes they will need to represent the amount of grams of sugar in their beverage, based on the above formula. Students will count out one sugar cube per teaspoon of sugar and place it on a paper plate. The class will compare sugar amounts and visualize the amounts of sugar contained in one serving of each beverage. Discuss alternatives and ways they can incorporate more water in their daily intake.