BIO9 LABORATORY – NUTRITION

Part A: Calculating Energy Use – Your Basal Metabolic Rate

To determine your daily energy needs you must first calculate your Basal Metabolic Rate (BMR) and then add your energy needs based on how much physical activity you do. Use the following equations & record your results on the assignment in the designated area.

BASAL METABOLIC RATE (BMR) IS THE AMOUNT OF ENERGY YOU NEED TO MAINTAIN BODILY FUNCTIONS. TO DETERMINE AN APPROXIMATE VALUE OF YOUR BMR FOLLOW STEPS 1 to 3.

***STEP 1*:** Convert your weight in pounds to kg by dividing the number of pounds by 2.2. _____kg
***STEP 2*:** Convert your height to centimeters by multiplying your height IN INCHES by 2.54. _____cm
***STEP 3*:** Input your weight in kg, height in cm, and age in years into the appropriate Harris-Benedict Equation depending on your sex:

Females: 665.09 + (9.56 X weight in kg) + (1.84 X height in cm) - (4.67 X age in years) = BMR
Males: 66.47 + (13.75 X weight in kg) + (5 X height in cm) - (6.75 X age in years) = BMR

NEXT, DETERMINE AMOUNT OF ENERGY YOU USE TO DO PHYSICAL ACTIVITY AND DIGEST FOOD BY FOLLOWING STEPS 4 to 6:

STEP 4: DETERMINE THE CALORIES YOU BURN THROUGH PHYSICAL ACTIVITY

Select ONE of the following categories based on the amount of muscular activity you perform in a day. Choose ONLY ONE of these categories that best fits you.

***Category 1*:** Sedentary activity (mostly sitting): multiply your BMR by 1.2 =

Category 2: Light activity (light exercise 1-3 days a week, i.e. a clerk involved in a walking program): multiply your BMR by 1.375 =

Category 3: Moderate activity (moderate exercise or sports 3-5 times a week, i.e. a teacher involved in daily vigorous exercise): multiply your BMR by 1.55 =

Category 4: Very active (you do vigorous exercise 6-7 days a week), multiply your BMR by 1.725 =

Category 5: Extra active (a mail carrier who walks the route or an adult involved in a twice daily exercise program): multiply your BMR by 1.9 =

STEP 5: DETERMINE THE THERMIC EFFECT OF FOOD

A quick way to approximate this value is to take 10% of the physical activity kcal.
(Step #4) X 0.10 = thermic effect of food

STEP 6: DETERMINE YOUR TOTAL ENERGY USE OR TOTAL CALORIC EXPENDITURE PER DAY

(The value from Step #4 + the value from Step #5) = Approximate Total energy use per day in kcals

Note: The value you calculate in STEP #6 should be between 1,500 calories (kcals) and 4,000 calories (kcals) PER DAY

1. **What was your (BMR) as determined by the Harris-Benedict Equation (the answer you got from Step 3)?**

2. **What is your estimated overall caloric expenditure (the answer from Step #6))?**

3. **Why are these equations only estimates?**

4. **Studies show that people who want to lose weight and lose about one pound per week are most successful and do not put their health at risk. One pound is about 3,500 calories. How many calories per day should you consume if you wanted to lose one pound per week?**

Part B: Body Mass Index

To determine your body mass index (BMI), find your height in inches (remember there are 12 inches per foot) along the left column. Follow the line with your height across until you find the number closest to your body weight in pounds. Follow that column to the very top and record your BMI. Note: this number should be between 19 and 35.

Weight (in Pounds)

Height (in Inches)	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260
82	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
80	13	14	15	16	18	19	20	21	22	23	24	25	26	27	29
78	14	15	16	17	18	20	21	22	23	24	25	27	28	29	30
76	15	16	17	18	19	21	22	23	24	26	27	28	29	30	32
74	15	17	18	19	21	22	23	24	26	27	28	30	31	32	33
72	16	18	19	20	22	23	24	26	27	28	30	31	33	34	35
70	17	19	20	22	23	24	26	27	29	30	32	33	34	36	37
68	18	20	21	23	24	26	27	29	30	32	33	35	36	38	40
66	19	21	23	24	26	27	29	31	32	34	36	37	39	40	42
64	21	22	24	26	27	29	31	33	34	36	38	39	41	43	45
62	22	24	26	27	29	31	33	35	37	38	40	42	44	46	48
60	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51
58	25	27	29	31	33	36	38	40	42	44	46	48	50	52	54
56	27	29	31	34	36	38	40	43	45	47	49	52	54	56	58
54	29	31	34	36	39	41	43	46	48	51	53	55	58	60	63

Normal Overweight Obese

BMI chart from http://www.build-muscle-and-burn-fat.com/images/bmi_chart.gif

1. What can a BMI calculation be used for?

2. Why do BMI measurements have limitations?

Part C: Calculating the percentage of nutrients in different foods.

What's in food? The major components are carbohydrates, proteins, fats and fiber. Each of these components is important to have in a healthy and balanced diet. These components are so important, in fact, that the USDA requires food manufacturers to label food with the amounts of these components.

So - you look at your Captain Crunch Cereal, and find out that there are 1.47 grams of fat, and 22.12 grams of carbohydrate. What does this mean?

Well - if you look at the contribution of each of the important components of food (carbohydrates, fats, proteins and fiber) as a PERCENTAGE of total calories, then it starts to make more sense. Let's look at protein, fat and carbohydrate:

Now it's easy to see that Cap'n Crunch is largely composed of carbohydrates. But you know that carbohydrates include molecules like starch (digestible) and cellulose (fiber - undigestible) as well as sugar (usually disaccharides or monosaccharides). What percentage of Cap'n Crunch is sugar?

Nutrition Facts

Serving Size: 3/4 cup (26g)

Amount Per Serving	
Calories 104	Calories from Fat 13
	% Daily Value*
Total Fat 1.47 g	**2%**
Saturated Fat 0.37 g	**2%**
Trans Fat	
Cholesterol 0 mg	**0%**
Sodium 181.74 mg	**8%**
Potassium 53.56 mg	**2%**
Total Carbohydrate 22.12 g	**7%**
Dietary Fiber 0.65 g	**3%**
Sugars 11.58 g	
Sugar Alcohols	
Protein 1.16 g	
Vitamin A 37.44 IU	1%
Vitamin C 0.03 mg	0%
Calcium 5.46 mg	1%
Iron 4.94 mg	27%

We can use a calculator to figure this out, but first, lets get a better feel for what is going on.

1. Look at the nutrition label on the right hand side of this page. How many grams of SUGARS are in Cap'n Crunch?

2. **Obtain a beaker full of sugar, a scoop, a balance, and two "bowls". Weigh out the number of grams of sugar from question #1 on the triple beam balance, and place it into a bowl.**

3. Now measure out 3/4 of a cup of sand using the measuring cup provided and place into a second bowl. Why are we measuring out 3/4 of a cup?

4. Approximately what percentage of a 3/4 cup of Cap'n Crunch is made of sugar? Make your best guess, looking at the amount of sugar in 11 grams and the amount of sand that is in 3/4 of a cup.

5. Now, let's do this more accurately. We know that there are 4 calories per gram of sugar. How many calories are there in 11 grams of sugar?

6. How many calories are there in a 3/4 cup serving of Cap'n Crunch?

7. What is the precise PERCENTAGE of calories in Cap'n Crunch that come from sugar?

NOW - select one of the containers on your lab bench, and answer the following questions.

8. What is the name of your product?

9. How many servings are in your product? Would you eat this all in one sitting, or is the serving size realistic?

10. Weigh out the number of grams of sugar in a single serving. What percentage of the CARBOHYDRATES in this food/drink come from sugar?

11. What percentage of the total CALORIES in this food/drink come from sugar?

12. What percentage of the total CALORIES in this food/drink come from protein? There are 4 calories per gram of protein.

13. What percentage of the total CALORIES in this food/drink come from fat? There are 9 calories per gram of fat (Check you work - the percentages from #11, #12, & #13 should add up to about 100%).

14. Examine the Nutrition labels on the other foods available at your table. Which of the foods at your lab table do you think is the healthiest? Why?

15. Which of the foods at your lab table do you think is the least healthy? Why?

16. About 20% of a "normal weight" human being's body weight is composed of fat. That means that a 150 pound adult is carrying around about 30 lbs of fat, which is the same as about 13,608 grams.

    •If fat contains 9 calories per gram, how many calories of energy are stored in 13,608 grams of fat?

    •Carbohydrates contain 4 calories per gram. How many grams of carbohydrate would you need to store the same number of calories?

    •How much would our 150 lb person weigh if extra calories were stored as carbohydrate instead of fat? One pound (lb) is about 454 grams.

17. What type of molecule is the most energy dense? Fat, carbohydrate, or protein?

Part D: Analyzing nutrient content of fast food - Complete at Home using Nutrition Facts (linked through course website or found at McDonald's or Subway's websites)

I. Your favorite McDonald's Meal

A. Select foods in your favorite McDonald's meal (3-4 items). If you don't eat at McDonald's just choose something as you don't have to actually eat it. On the table below, list your food choices and the number or calories, grams of fat, and calories from fat in each food you select.

B. Add up the total number of calories in your list of food choices.

C. Add up the total number of calories from fat in your list of food choices.

D. To find the percent of calories in the meal that were provided by fat, divide the number of calories from fat (from step C) by the total number of calories in your food choices (from Step B).

Step A – list foods for your favorite McDonald's meal

FOODS	CALORIES	FAT (GRAMS)	CALORIES FROM FAT
Totals			

Step B Total Calories = _____

Step C Total calories from fat = _____

Step D Step C divided by Step B X 100 = _____ % of calories from fat

C. Repeat steps A-D of the instructions, but choose a McDonald's meal that provides less than 30% of the calories from fat. Make sure it's a meal and not something like 5 sandwiches! **This may take some trial and error.**

Step A – list foods for your favorite McDonald's meal that has 30% or less of calories from fat.

FOODS	CALORIES	FAT (GRAMS)	CALORIES FROM FAT
Totals			

Step B Total Calories = _____

Step C Total calories from fat = _____

Step D Step C divided by Step B X 100 = _____ % of calories from fat

II. Determine the total % Daily Value of Vitamin A, Vitamin C, Calcium, and Iron from a Subway "kids" meal and a McDonald's Happy Meal. You have some choices for the McDonald's Happy meal.

Subway "kid's" meal:

Turkey Minisub, apple slices, Minute Maid Apple Juice Box (use McDonald's data)

Subway Kid Pak	Vitamin A	Vitamin C	Calcium	Iron
Totals				

McDonald's Happy meal:

small fry, hamburger OR cheeseburger OR 4-piecechicken McNuggets (choose one), child size soft drink OR milk OR chocolate milk OR apple juice (choose one)

McDonald's Happy Meal	Vitamin A	Vitamin C	Calcium	Iron
Totals				

How do the two Kid's meals compare as far as these essential nutrients are concerned?

III. Subway often advertises itself as a healthy alternative to fast food. It touts its "Jared" sandwiches as low fat. BUT their calculations do not include any cheese or condiments. Calculate how adding 1 tablespoon (1T) of light mayonnaise and Swiss cheese to a 6-inch Turkey Breast and Ham sub changes the following values (**repeat the steps you did from the previous two sections** using the Subway information for the Jared turkey sandwiches plus cheese plus the mayonnaise):

	Without cheese or mayo	WITH cheese & mayo
Total calories		
Total grams of fat		
Grams of saturated fat		
Calories from fat		
Percent of total calories from fat		

Did you notice anything different? Do you think that Subway's advertising campaign is "honest"? (Read the materials on the next page before answering)

The SUBWAY® chain's sandwiches with 6 grams of fat or less have a calorie range of 230-380 and have as little as 3 grams of fat. Choosing one of these subs can save hundreds of calories and at least 21 grams of fat in just one meal.

RESTAURANT	CALORIES	FAT (Grams)
SUBWAY® Sweet Onion Chicken Teriyaki	380	4.5
SUBWAY® 6-inch Turkey Breast	280	3.5
Burger King Whopper	670	40
KFC original recipe chicken (1 chicken breast, 1 wing)	480	28
Taco Bell 3 regular beef tacos	510	30
McDonald's Big Mac	540	29

*Individuals lost weight by exercising and eating a balanced, reduced-calorie diet that included SUBWAY® sandwiches with 6 grams of fat or less. Their results are not typical. Your loss if any will vary. The SUBWAY® chain does not endorse the diet Jared created and cautions anyone embarking on a weight-loss plan to consult their physician. Vegetable servings based on guidelines set forth by The National Cancer Institute.

Nutritional information obtained 07/2009 from www.burgerking.com, www.kentuckyfriedchicken.com, www.mcdonalds.com, www.tacobell.com.