UVRA Nutrition Series
Session 1 - Understanding Human Metabolism:
What is a Calorie?

Summer 2021
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Plan for Today

1. Why do we eat?

2. What is a calorie?

3. How many calories do you need?

4. From what foods should you get these calories?

5. How do you know how many calories you eat in a day?

6. What happens if you eat too little or too much?

7. Weight control/loss

8. Tools for Healthful Diets

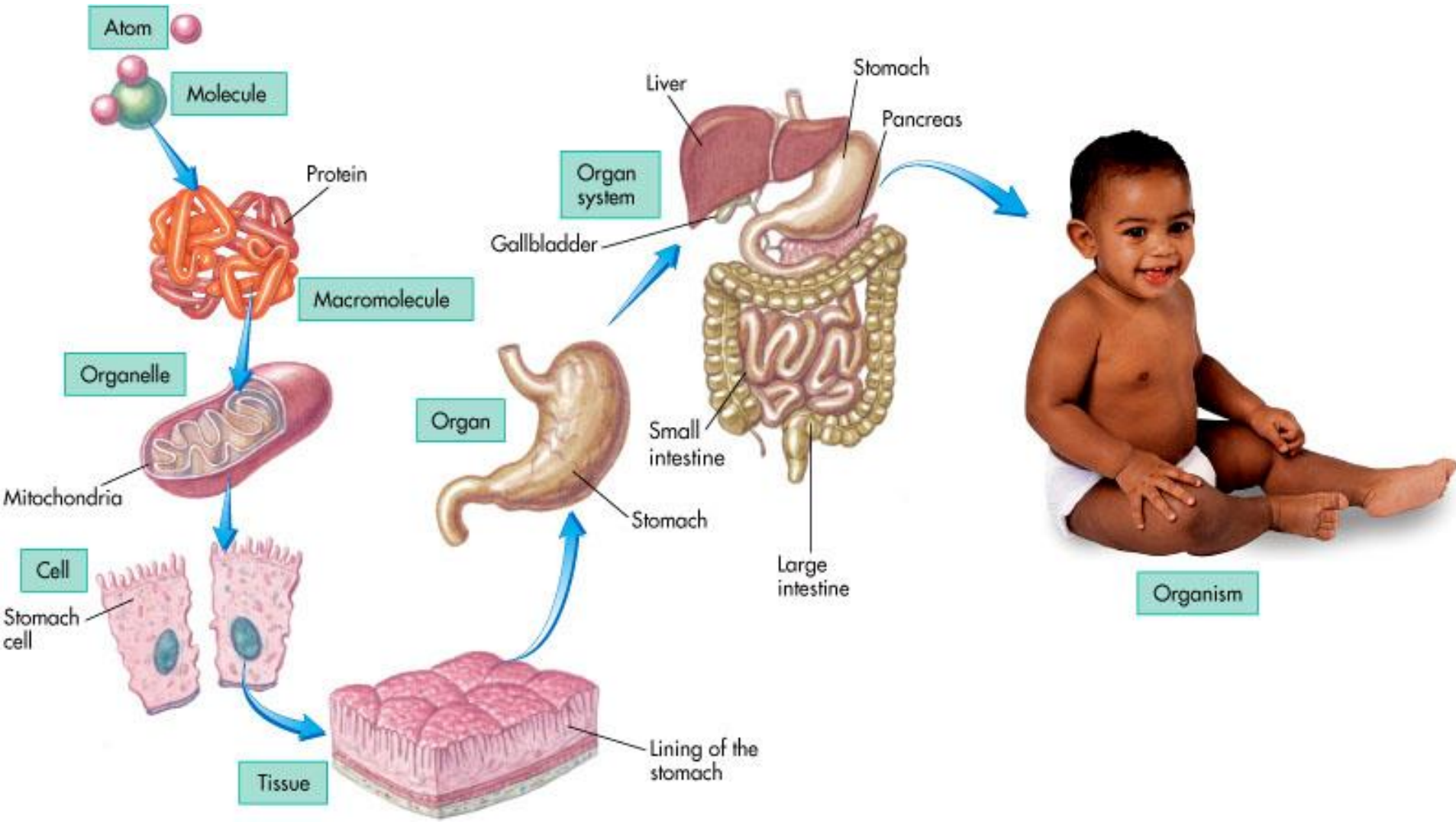Timeline for today:

5-minute break around 3 pm

Questions for about 5-minutes

End of presentation around 3:45 pm

Questions until 4 pm

Why do we eat? The constant turnover of cells/tissues requires;
- *Energy (i.e. calories)*
- *Building blocks (e.g. proteins, vitamins, minerals, etc)*

What is a calorie?

- A **calorie** (cal) is …
  - "*Energy required to raise the temperature of one gram of water one degree Celsius*"
  - 1 kg of water for one kcal or Cal
  - Physiologically/Biologically [what does this mean](#)?

- A **kilocalorie** (kcal) is 1000 calories

- A **Calorie** (Cal), as it appears on food labels and in popular media/discussions, is a **kcal or 1000 cal**

- Food labels and most popular diet discussions are for **2000 kcal per day**
  - Problems with this?
  - What is actually required?

How many calories do you need?

Energy Expenditure (EE)

Basal Metabolic Rate (BMR)
– Amount of energy needed to maintain **basic physiological functions**

Resting Metabolic Rate (RMR)
– Energy required to maintain *basic physiological functions* (BMR) but in a **relaxed, awake, & reclined state**

Estimated Energy Requirement (EER) or
Total Daily Energy Expenditure (TDEE)
– Energy required to maintain *resting metabolic rate* (RMR) and **physical activity (PA)**
– Often referred to simply as "Metabolic Rate" or "EE"

Energy Expenditure (EE)
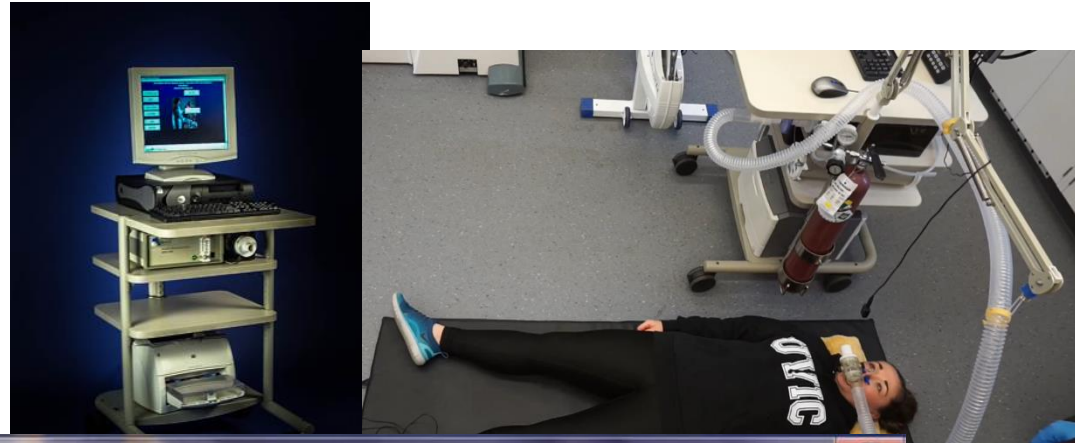
Metabolic Rate is a function of Fat-Free Mass (FFM)

This is discussed in some common ways:

- Body size
- Body composition
- Age
- Sex
- Development (children/adolescents/pregnancy/lactation)
- Physical Activity (PA) level
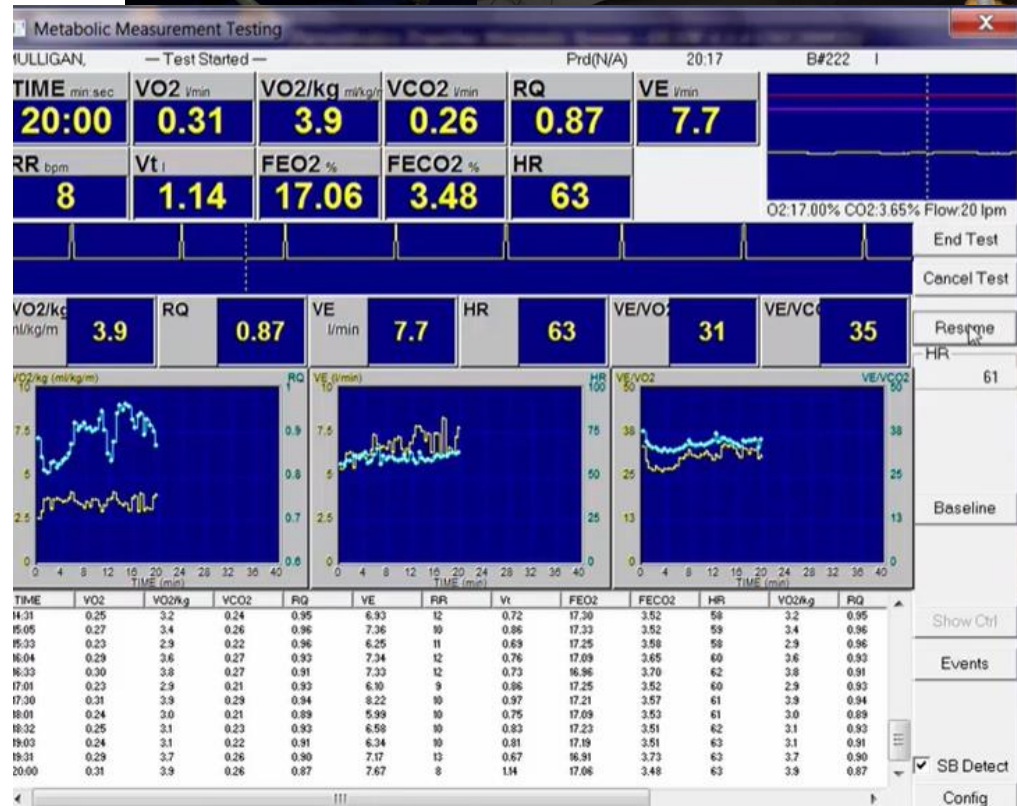
How do we measure metabolic rate?

Direct measurement
- Expensive
- Time consuming
- Not practical
- High-precision

Estimates
- Free
- Quick
- Practical
- Low-precision

Equations for Estimated Energy Requirement (EER)
from [Health Canada](#)/[USDA](#)/[textbook](#)

Adults 19 years and older

Estimated Energy Requirement (kcal/day) = Total Daily Energy Expenditure

Men

EER = 662 - (9.53 x age [y]) + PA x { (15.91 x weight [kg]) + (539.6 x height [m]) }

Women

EER = 354 - (6.91 x age [y]) + PA x { (9.36 x weight [kg]) + (726 x height [m]) }

Note the differences for Children, Adolescents, Pregnancy, and Lactation:

https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables.html#eeer

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Physical Activity Coefficients (PA values) for use in EER equations

	Sedentary: Typical daily living activities (e.g. household tasks, walking to the bus)	Low Active: Typical daily living activities PLUS 30-60 minutes of daily moderate activity (e.g. walking at 5-7 km/h)	Active: Typical daily living activities PLUS at least 60 minutes of daily moderate activity	Very Active: Typical daily living activities PLUS At least 60 minutes of daily moderate activity PLUS an additional 60 minutes of vigorous activity or 120 minutes of moderate activity
Boys 3 - 18 y	1.00	1.13	1.26	1.42
Girls 3 - 18 y	1.00	1.16	1.31	1.56
Men 19 y +	1.00	1.11	1.25	1.48
Women 19 y +	1.00	1.12	1.27	1.45

Source: https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables.html#eeer

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> **Example:**
>
> A 22 year old female that is 148 cm tall, weighs 154 lbs, and does a brisk-paced 45 minute walk most days of the week.
>
> EER = 354 - (6.91 x **22**) + **1.12** x { (9.36 x **70**) + (726 x **1.48**) }
>
> **EER = 2139 Calories per day**

Estimated Energy Requirement (EER)

Table 8.4 Estimated Daily Calorie Needs

Sex	Age (years)	Sedentary	Moderately Active	Active
Child (female and male)	2–3	1,000	1,000–1,400 (male)1,000–1,200 (female)	1,000–1,400
Female	4–8	1,200–1,400	1,400–1,600	1,400–1,800
Female	9–13	1,400–1,600	1,600–2,000	1,800–2,200
Female	14–18	1,800	2,000	2,400
Female	19–30	1,800–2,000	2,000–2,200	2,400
Female	31–50	1,800	2,000	2,200
Female	51+	1,600	1,800	2,000–2,200
Male	4–8	1,200–1,400	1,400–1,600	1,600–2,000
Male	9–13	1,600–2,000	1,800–2,200	2,000–2,600
Male	14–18	2,000–2,400	2,400–2,800	2,800–3,200
Male	19–30	2,400–2,600	2,600–2,800	3,000
Male	31–50	2,200–2,400	2,400–2,600	2,800–3,000
Male	51+	2,000–2,200	2,200–2,400	2,400–2,800

Source: Textbook

What's to eat?

Now that you have an estimate of your daily energy expenditure,
from where should you get these calories?

AMDR
Acceptable Macronutrient Distribution Ranges

Males & Females [34]	Total Carbohydrate	Total Protein	Total Fat	n-6 polyunsaturated fatty acids (linoleic acid)	n-3 polyunsaturated fatty acids (α-linolenic acid)
	Percent of Energy	Percent of Energy	Percent of Energy	Percent of Energy	Percent of Energy [35]
1-3 years	45 - 65 %	5 - 20 %	30 - 40 %	5 - 10 %	0.6 - 1.2 %
4-18 years	45 - 65 %	10 - 30 %	25 - 35 %	5 - 10 %	0.6 - 1.2 %
19 years and over	45 - 65 %	10 - 35 %	20 - 35 %	5 - 10 %	0.6 - 1.2 %

[34]   Includes pregnant and lactating women.

[35]   Up to 10% of the AMDR can be consumed as eicosapentaenoic acid (EPA) and/or docosahexaenoic acid (DHA).

Source: Health Canada - https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-macronutrients-dietary-reference-intakes-tables-2005.html

AMDR
Acceptable Macronutrient Distribution Ranges

Males & Females 34	Total Carbohydrate	Total Protein	Total Fat
	Percent of Energy	Percent of Energy	Percent of Energy
1-3 years	45 - 65 %	5 - 20 %	30 - 40 %
4-18 years	45 - 65 %	10 - 30 %	25 - 35 %
19 years and over	45 - 65 %	10 - 35 %	20 - 35 %

34   Includes pregnant and lactating women.

35   Up to 10% of the AMDR can be consumed as eicosapentaenoic acid (EPA) and/or docosahexaenoic acid (DHA).

Example:
A 22 year old female that is 148 cm tall, weighs 154 lbs, and does a brisk-paced 45 minute walk most days of the week.

EER = 354 - (6.91 x **22**) + **1.12** x { (9.36 x **70**) + (726 x **1.48**) }

EER = 2139 Calories per day

55% CHO = 1176 Calories
25% PRO = 535 Calories
20% FAT = 428 Calories

Source: Health Canada - https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-macronutrients-dietary-reference-intakes-tables-2005.html

Food Calories

Net energy value is the actual biological yield

Nutrient	Energy (Cal/g)
Carbohydrate (CHO)	4
Protein	4
Fat	9
Alcohol ("empty Cals")	7

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Example: A 22 year old female that is 148 cm tall, weighs 154 lbs, and does a brisk-paced 45 minute walk most days of the week.

EER = 354 - (6.91 x **22**) + **1.12** x { (9.36 x **70**) + (726 x **1.48**) }

EER = 2139 Calories per day

55% CHO = 1176 Calories = 294 grams
25% PRO = 535 Calories = 134 grams
20% FAT = 428 Calories = 48 grams

How do you know how many calories you are eating in a day?

Food Labels in Canada

Since 2005 have included **Nutrition Facts** tables

- Includes:
  - Serving size
  - Calories per serving
  - Macronutrients
    - Fats includes Saturated, Trans, Cholesterol
    - Carbohydrates includes Fiber & Sugars
  - Micronutrients
    - Limited to key nutrients
  - % Daily Value
- Based on 2000 Cal/day

Nutrition Facts	
Per 3/4 cup (175g)	
Amount	**% Daily Value**
Calories 160	
Fat 2.5 g	**4** %
Saturated 1.5 g	
+ Trans 0 g	**8** %
Cholesterol 10 mg	
Sodium 75 mg	**3** %
Carbohydrate 25 g	**8** %
Fibre 0 g	**0** %
Sugars 24 g	
Protein 8 g	
Vitamin A	2 %	Vitamin C 0 %
Calcium	20 %	Iron 0 %

USDA Food Database

Searchable database listing nutrient contents - https://fdc.nal.usda.gov

Search Tips:

1. Use "SR Legacy Foods" for whole foods

- Include the word "raw" or "cooked" etc to limit search returns

- E.g. "raw apple"

2. Use "Branded Foods" for packaged foods

3. Select the amount you eat

Canadian Nutrient File (CNF)

Searchable database listing nutrient contents

https://food-nutrition.canada.ca/cnf-fce/index-eng.jsp

MyFitnessPal

Free food & activity tracker on desktop & mobile apps

https://www.myfitnesspal.com

What happens if you eat too much
or
too little?

What Does It Take To Lose or Gain a Pound?

- Body fat contains ~**3500 Cal per pound**
- Must have an **energy deficit** of 3500 Cal per week to lose a pound week

If you do the math…

To lose one pound you must create a deficit of 3500 kcal.

So to lose a pound in 1 week (7 days), try cutting back on your kcal intake and increase physical activity so that you create a deficit of about 500 kcal per day

$$\frac{- \text{ 500 kcal}}{\text{day}} \times \frac{\text{7 days}}{\text{week}} = - \text{ 3500 kcal} = \sim \text{ 1 pound of weight loss in 1 week}$$

Weight-Loss Maintenance

Fat loss of 5-10% of body mass sustained for at least 1-year

e.g. 150 lbs body weight x 5-10% = 7.5-15 lbs lost

Why this amount?

Fat losses of this amount statistically reduce your risk of diseases such as:

- cardiovascular disease (heart attack & stroke)

- type 2 diabetes

- some cancers

Advice from Dieticians & Academics

1. Low-fat, high-fiber approaches
   - Most successful in long-term studies (5-10 years)

2. No diet has a "metabolic advantage"

3. Keep a food log

4. Frequent weight-tracking

5. Weigh food (portion distortion)

6. Drink water before and during eating

Weight Loss Guidelines
from the
Dieticians of Canada

- Caloric deficit of 200-700 Cal/day from diet
- Be physically active for at least 60-minutes every day
- Eat at least five times a day
  - Within one hour of waking
  - Every 2-4 hours
  - Fiber and protein

- Eating the right nutrients, on time, in the right amounts:
  - Avoids disruptions in circadian rhythm
  - Minimizes reductions in metabolic rate
  - Normalizes blood sugar concentrations
    - Reduces cravings
    - Stabilizes mood

Weight Loss Guidelines
from the
ACSM

- Well balanced diet
- Weight loss should not exceed 2 lbs/wk
- Calorie deficit should not exceed 1000 Cal/d
  - PA decreases with severe deficit
- Caloric intake minimum of 1200 Cal/d
- 3 meals per day minimum – more is better

- Adjust eating habits
- Adjust exercise habits

How Much Activity
(same source)

PA to prevent weight gain;

– 150-250 min/wk

– prevents weight gain in most adults.

PA for weight loss;

– <150 min/wk = minimal weight loss,

– >150 min/wk = moderate loss (2 - 3 kg),

– >225-420 min/wk = high loss (5 - 7.5 kg),

– dose-response relationship exists.

– Resistance Training (RT) is important for bone health but

• does not result in weight loss or reduced fat mass.

Benefits of Exercise in Controlling Body Weight

↑ energy expenditure

↑ wt maintenance

↑ preservation of lean tissue

↑ epi & norepi → fat mobilization

↑ fat utilization

↑ post exercise metabolic rate

↓ the decrease in metabolic rate from caloric restriction

Metabolism & Calorie Restriction

When caloric intake is less than your daily requirement, your metabolism slows

- i.e. you burn fewer calories per day
- With weight loss of 10% of body mass this averages 500-600 Cal per day
  - ~2/3 from resting energy expenditure (REE or RMR)
  - ~1/3 from non-resting energy expenditure (NREE)

People who have reduced weight will have to *eat less* and/or *exercise more* than their never-obese peers of the same weight and body composition if they wish to sustain weight loss.

Decreasing Intake

- Change **what** you eat
  - Carbs, fruits, veggies, protein, fat
- Change **how** you eat
  - Serving size, helping, cooking methods
- Change **where** you eat
  - No TV, focus on food, home vs restaurant
- Change **when** you eat
  - Time of day, number of meals, late night snacking

Explore Some
Tools for Healthful Diets

Tools from Dieticians of Canada

1. *Find a Dietician*

2. *Example one-week meal plan*

3. *Meal planning resources*

4. *Online tool "My Menu Planner"*

5. *Food Portions Toolkit*

Tools from Health Canada

1. *Canada's Food Guide*

2. *Nutrition Facts Tables*, *including an interactive nutrition facts table*

Interactive nutrition facts table

Select any item in the table to find out more.

Nutrition Facts
Per **3/4 cup (175g)**

Amount		**% Daily Value**
Calories 160		
Fat 2.5 g		**4** %
Saturated 1.5 g		**8** %
+ Trans 0 g		
Cholesterol 10 mg		
Sodium 75 mg		**3** %
Carbohydrate 25 g		**8** %
Fibre 0 g		**0** %
Sugars 24 g		
Protein 8 g		
Vitamin A	2 %	Vitamin C 0 %
Calcium	20 %	Iron 0 %
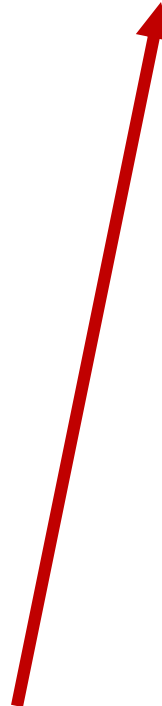
What's Next?

Presentation 2 (June 8th): "Fads & Facts: What are effective diets?"

There is no shortage of diets claiming to help you lose weight and better your life, make your hair shine, and all types of promises. We will look at examples of diets that are clearly fads with no substance as well as those that have legitimate scientific evidence supporting their efficacy. When it seems like everyone is a diet expert, you will learn how to spot the frauds and other strategies to help you navigate the world of diets.

Presentation 3 (June 15th): "Farm to Table & Food to Human Cells: Eating to Support Healthful Aging"

Learn how the concepts of a farm-to-table ethos can lead you on a path of healthful aging. We will examine the food choices you can make to facilitate aging with a healthful mind and body and how you can start eating for your future self.

Presentation 4 (June 22nd): "Dietary Choices: How Your Food Environment Shapes Your Eating"

If you've wondered how your surroundings affect your food choices, then this talk is for you! We will look at strategies used by food vendors to sell you products, and we will look at how you can create home and work settings that lead you to making healthy food choices without even thinking about it.