Chapter 1: Nutrition: Everyday Choices
Student learning outcomes: At the end of this chapter, you should be able to:

- Reflect on factors that influence food choices
- Compare and contrast the 6 nutrient classes
- Describe ways to obtain balance, variety, and moderation to avoid under and over nutrition
- Describe how genes and diet interact to promote health and result in disease
- Evaluate nutrition information and claims
The Basics of Nutrition

Nutrition is the scientific **study of nutrients**

Chemicals necessary for proper body function and how the body uses them.

Understanding nutrition also involves learning about **human physiology**, the study of how the body functions.

Learning about foods and nutrients will provide you with **information you can use to make informed decisions concerning the foods you eat**.

By making **smart decisions** about the foods you eat, you can **improve your health and prevent chronic disease**.

70% eat whatever they want

Poor eating habits are associated with 4 of the leading causes of death (heart disease, cancer, stroke, and type 2 diabetes).

Studies suggest 18% of American deaths could be eliminated by adopting “recommended dietary behaviors”.
Why Study Nutrition?

- Link between nutrition, wellness, and disease
- Poor diet and sedentary lifestyle are risk factors for chronic diseases:
  - Disease of the heart (24.6% of all deaths)
  - Cancer (23.3%)
  - Stroke (5.3%)
  - Diabetes (2.8%)
  - Accounts for ~2/3 of all deaths
- Drives up the cost of health care!
Nutrients

- Provide energy (calories = measure of energy)
- Provide structure
- Regulate body processes

**Essential nutrients**: our bodies cannot make them, so it is **essential** that we consume them

**Non-essential nutrients**: our bodies can make them from other nutrients, so it is **not essential** that we consume them
Nutrient Functional Categories

- Provide calories
- Required for cellular replacement, growth, and repair
- Regulate body processes / homeostasis
Three Features of Essential Nutrients

1. If missing from diet, a nutrient deficiency disease occurs.

2. Adding missing nutrient back to diet corrects signs and symptoms of the deficiency.

3. Scientists can explain why lack of the nutrient caused abnormalities.
Nutrient Density

High nutrient density foods: contain more nutrients per calorie (*minerals & vitamins*)
- Examples: vegetables, fruits, whole-grains

Low nutrient density foods: contain fewer nutrients per calorie
- Examples: cake, sugary drinks, French fries
Nutrient Density

- **Calories**
  - Low-fat milk: 100
  - Sweetened iced tea: 110

- **Calcium (mg)**
  - Low-fat milk: 300
  - Sweetened iced tea: 350

- **Vitamin D (IU)**
  - Low-fat milk: 120
  - Sweetened iced tea: 150

- **Vitamin A (μg)**
  - Low-fat milk: 150
  - Sweetened iced tea: 180

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Nutrient Density

Instead of this ...  
Low Nutrient Density

5 chicken nuggets: 230 Cal, 12 g protein

Have this ...  
High Nutrient Density

Skinless chicken breast: 162 Cal, 25 g protein

Medium order of fries: 380 Cal, 9 mg vitamin C

Medium baked potato: 161 Cal, 17 mg vitamin C

Slice of apple pie: 411 Cal, 4 g fiber

Medium apple: 95 Cal, 2 g fiber

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Fortified foods

- Nutrients added to foods
- The Food and Drug Administration (FDA) requires fortification & enrichment of some foods in an attempt to prevent disease
- Companies voluntarily add nutrients
- What is enrichment?
- What is fortification?
Phytochemicals and Zoochemicals

- Non-nutrient substances in food thought to be beneficial to the human body

- **Phytochemicals** are in foods from plants (phyto refers to plants)

- **Zoochemicals** are in foods from animals (zoo refers to animals)
Phytochemicals

Garlic, broccoli, and onions provide sulfur-containing phytochemicals that help protect us from some forms of cancer by inactivating carcinogens or stimulating the body’s natural defenses.²,³

Yellow-orange fruits and vegetables, such as peaches, apricots, carrots, and cantaloupe, as well as leafy greens, are rich in carotenoids, which are phytochemicals that may prevent oxygen from damaging our cells.⁷

Soybeans are a source of phytoestrogens, hormone-like compounds found in plants that may reduce the risk of certain types of cancer and cause small reductions in blood cholesterol.⁴,⁵,⁶

Purple grapes, berries, and onions provide red, purple, and pale yellow pigments called flavonoids, which prevent oxygen damage and may reduce the risk of cancer and heart disease.⁸,⁹
Functional Foods

- Provide health benefits beyond functions of nutrients

  - Examples:
    - Broccoli prevents cancer
    - Oatmeal lowers cholesterol
    - Salmon prevents heart disease
Designer foods/Nutraceuticals

- Functional foods with added nutrients

  - Examples:
    - Water with added vitamins
    - Margarine with added plant sterols
    - Orange juice with added calcium
Six classes of nutrients

- Nutrients
  - Macronutrients
    - Carbohydrates
    - Proteins
    - Lipids
  - Micronutrients
    - Water
    - Vitamins
    - Minerals

- Carbon containing (organic) & calorie containing
- Carbon containing (organic)
Examples of nutrients

- Carbohydrates: Starch, Sugar, Fiber
- Proteins
- Lipids/Fats: Saturated fat, Monounsaturated fat, Polyunsaturated fat, Cholesterol
- Water
- Vitamins: A, D, E, K, C, B12
- Minerals: Sodium, Folic acid, Calcium, Niacin, Fluoride
Six Classes of Nutrients

How much of each nutrient do you need to consume daily?

1. Carbohydrate (125g – 200g daily)*
2. Lipids (100g/day)
3. Proteins (60g/day)
4. Minerals (3.3 g/day)
5. Vitamins (60 mg/day)
6. Water (2.5 liters/day)

* Note: Brain requires 120g/day
Examples of nutrients
Examples of nutrients
Examples of nutrients
Nutrient functions

- Provide energy (calories)

- Provide building blocks for structures
  - Bones, hair, skin
  - Cell membranes and structures

- Regulate body processes
  - Body temperature
  - Blood pressure
  - Hormones and cell communication
  - Speed up reactions
What is a calorie?

- Measurement of energy

- “The amount of heat it takes to raise the temperature of 1 gram of water by 1 degree Celsius”

- 1,000 calories = 1 kcal = 1(food) Calorie

- Note: Bomb Calorimeter / next slide
Thermometer

Wire to ignite food

Insulation around chamber

Oxygen-filled chamber for food

Air space

Water
Kilocalorie Contributors in Diets

- 1 g of **carbohydrate** provides 4 kcal.
- 1 g of **protein** provides 4 kcal.
- 1 g of **fat** provides 9 kcal.
- 1 g pure **alcohol** (a non nutrient) provides 7 kcal.
Calorie (with a capitol “C”)

- Calorie = kilocalorie = 1000 calories
- Measure of energy in food
- Proteins and carbohydrates = 4 Calories/gram
- Fat = 9 Calories/gram
- Alcohol = 7 Calories/gram (not a nutrient)
Malnutrition

- **Overnutrition**: too much of a nutrient or nutrients or calories

- **Undernutrition**: too little of a nutrient or nutrients or calories
Undernutrition
Over-nutrition
Over-nutrition / Is this a problem?

Based on this graph showing leading causes of death in the U.S., about what percentage of all deaths are due to nutrition-related diseases?

a) 5%
b) 10%
c) 50%
d) 90%
Genetic material

- DNA is in the nucleus of each cell.

- In humans, there are 46 long strands of DNA.

- Each DNA strand is condensed and packaged into a chromosome.

- Each chromosome contains many shorter genes.

- Each gene is the instructions to make one protein (generally).

- There are 20,000–30,000 genes in humans.
Human inheritance

- There are 46 chromosomes or 23 pairs of chromosomes.

- Each egg or sperm has one half of each chromosome pair, or 23 total chromosomes.

- During fertilization, an egg and sperm fuse.

- An embryo has 46 chromosomes: 23 from the father and 23 from the mother.
Disease genetics

- Some diseases occur when one gene is mutated
  - examples: cystic fibrosis, sickle cell anemia

- Most diseases result from both genetics and the environment where genes increase risk
  - examples: obesity, heart disease, diabetes
Your actual risk of disease results from the interplay between the genes you inherit and the diet and lifestyle choices you make.

The genes you inherit may give you a greater or lesser tendency to develop conditions like obesity, heart disease, high blood pressure, or diabetes.

The nutrients and food components you consume and the amount of exercise you get can increase or decrease your risk of developing nutrition-related diseases.
Nutritional genetics or Nutrigenomics

- The study of interactions between genes and nutrition
- Personalized nutrition: diets based on a person’s genes
- What is lactose intolerance?
Healthy diet

- Variety, Balance, Moderation
- “Eat Food, Not Too Much, Mostly Plants”
- High in // Fruits, vegetables, whole grains
- Moderate in // Calories, sodium, sugar
- Low in // Unhealthy fats (trans fats, saturated fats, cholesterol)
Variety

- Eating foods from a *variety* of food groups

- Eating a *variety* of foods within each food group

- **Benefits**: increased nutrients and phytochemicals, decreased toxins
Balance

- **Balance** unhealthy choices with healthy choices
- **Balance** calories in with calories burned
- **Balance** foods within food groups
- **Benefits**: wider variety of nutrients and weight control
Moderation

- Moderate portion sizes
- Moderate consumption of each food
- **Benefits**: results in not too much of any nutrient or calories
Healthy diet

To keep your weight stable, you need to burn the same number of calories as you consume. Extra calories consumed during the day can be balanced by increasing the calories you burn in physical activity.

If you have a Big Mac for lunch instead of a smaller plain burger, you will have to increase your energy expenditure by 300 Calories.

If you have a grande Mocha Frappuccino instead of a regular iced coffee, you will have to increase your energy expenditure by 370 Calories.

You could do this by playing golf for about an hour, carrying your own clubs.

You could do this by jogging for about 30 minutes.

Clockwise from top left: Andy Washnik; Picturenet/Blend Images/Getty Images, Inc.; Kate Thompson/NG Image Collection; Andy Washnik
Science of nutrition—scientific method

1. The first step of the scientific method is to make an observation and ask questions about that observation.

   Observation
   More people get colon cancer in the United States than in Japan.

2. The next step is to propose an explanation for this observation. This proposed explanation is called a hypothesis.

   Hypothesis
   The lower incidence of colon cancer in Japan than in the United States is due to differences in the diet.

3. Once a hypothesis has been proposed, experiments like this one are designed to test it. To generate reliable theories, the experiments done to test hypotheses must produce consistent, quantifiable results and must be interpreted accurately.

   Experiment
   Compare the incidence of colon cancer of Japanese people who move to the United States and consume a typical U.S. diet with Caucasian Americans who eat the same diet. Result: The Japanese people who eat the U.S. diet have the same higher incidence of colon cancer as Caucasian Americans.

4. If the results from repeated experiments support the hypothesis, a scientific theory can be developed. A single experiment is not enough to develop a theory; rather, repeated experiments showing the same conclusion are needed to develop a sound theory.

   Theory
   The U.S. diet contributes to the development of colon cancer.

5. If experimental results do not support the hypothesis, a new hypothesis can be formulated. As new information becomes available, even a theory that has been accepted by the scientific community for years can be proved wrong.

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Healthy diets & recommendations are based on research

How are studies conducted?

How do we know which information to believe and which advice to follow?

Nutritional scientist use the “scientific method” to develop nutritional recommendations.
1. Make observations that generate questions
2. Formulate hypotheses to explain events
3. Design studies, perform tests, and collect data
4. Analyze data and draw conclusions based on the results
5. Share results with peers (report findings)
6. Conduct more research, the results of which may confirm or refute previous findings
• Observation: My flashlight doesn’t work.

• Question: What’s wrong with my flashlight?

• Hypothesis: The flashlight’s batteries are dead.

• Prediction: If I replace the batteries, the flashlight will work.

• Experiment: I replace the batteries with new ones.

• Predicted Effect: The flashlight should work.
Science of nutrition—types of studies

**Epidemiological:** studies populations  //
example: fatty fish & heart disease in Alaska natives

**Laboratory:** conducted on cells, animals, or humans completely within a laboratory  //
example: eat a meal and test blood glucose

**Experimental or clinical:** compares an experimental or treatment group with a control group  //
example: treatment group drinks takes supplement and control group takes placebo
Science of nutrition - types of studies
Use the following slides to access your knowledge and to prepare for your unit exam.
THINK about this – then share within a PAIR – then SHARE with the class

- What are nutrients? Why do we need them?
- What are the benefits and risks of consuming calories?
- What is one high-calorie food and one low-calorie food you consumed recently?
Apply to your life

What are examples of low nutrient density foods in your diet?

What are examples of high nutrient density foods in your diet?

How could you replace low nutrient density foods with high nutrient density foods in your diet?
THINK about this – then share within a PAIR
– then SHARE with the class

- Think about foods you have consumed in the last week. What influenced your choices?
- What is the strangest food you have consumed (by American standards)?
- Describe a celebration in your family. Who would be there? What would you do?
THINK about this – then share within a PAIR – then SHARE with the class

- What are examples of nutrients?
Concept Check

- How are essential and non-essential nutrients similar and different?

- What are benefits of high nutrient density foods?

- How are fortified foods, functional foods, and designer foods similar and different? What are examples of each?
Concept check

Which of the following does NOT contain calories?

a) vitamins
b) fats
c) carbohydrates
d) proteins
Concept check

Cholesterol is an example of a:

a) vitamin  
b) fat  
c) carbohydrate  
d) protein
Concept check

Starch is an example of a:

a) vitamin
b) fat
c) carbohydrate
d) protein
Concept Check

- What are the six classes of nutrients?
- Which classes of nutrients contain calories? Which contain carbon?
- What are examples of carbohydrates, lipids, vitamins, and minerals?
- What are functions of nutrients?
THINK about this – then share within a PAIR – then SHARE with the class

- What is DNA? Where is it located?
- What is a chromosome? What is a gene?
- How are traits inherited?
What are similarities and differences between:

- Carbohydrates, proteins, fats, water, vitamins, and minerals?
Ask yourself

- What 2 factors affect your risk of developing a nutrition-related disease such as obesity?

- Can you still become obese even if both of your parents are thin?
THINK about this – then share within a PAIR – then SHARE with the class

- A friend of yours wants advice on what to eat as a healthy diet. What advice would you give?
Apply to your life

What are examples of balance, variety, and moderation from your diet?

What are ways you could improve your diet?
Apply to your life

1. Make an observation // example: I received 3 compliments on my hair cut

2. Propose a hypothesis: make a prediction based on your observation // example: my hair looks good when it is short; it will look better if it is even shorter

3. What information would you need to test this hypothesis? How could you gather it? // example: cut hair shorter and notice compliments
Apply to your life

1. Make an observation about college student nutrition habits // example: there is a lot of bottled water in class

2. Propose a hypothesis: make a prediction based on your observation // example: college students drink more bottled water than tap water

3. What information would you need to test this hypothesis? How could you gather it?
What are similarities and differences between:

- Hypothesis and theory?
- Epidemiological laboratory, and experimental studies?
- Treatment group and control group?
Questions to ask about nutrition data

Does it seem too good to be true?

Who is providing the information?
Do they have something to gain?
Who performed the study?

Are there other studies that support this information?
Debate

Super-fortified foods:

Are they a healthy addition to your diet?
Checking student learning outcomes

- What influences food choices?
- How are the 6 nutrient classes similar and different?
- How can you obtain variety, balance, and moderation in your diet to avoid malnutrition?
- Which diet-related diseases run in your family? How can you modify your risk?
- What questions can you ask to help determine if data can be trusted?
Images & Miscellaneous Slides
Nutrient functions
Types of nutritional information

4 out of 5 users report:

“It increased my muscle strength.”

“It pumped up my drive and motivation!”

RESULTS
The weight lifters gained an average of 5.2 pounds of lean muscle and lost 4.5 pounds of unwanted fat.

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Types of nutritional information
Limitations of nutritional studies

VITAMIN E SUPPLEMENTS INCREASE LONGEVITY

Joel Sartore/NG Image Collection

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Why Are You So Hungry?

- **Hunger** = Physiological drive
  - changes our behavior so see seek food

- **Appetite** = Psychological drive
  - often influenced by marketing / “you deserve a treat today”

- **Diet** = What we eat
Satiety

- No longer have a desire to eat
- Regulated by the brain
- Feeding center / hunger center
- Satiety center
Percent of Kcalories per Day

- 33% Fat
- 17% Protein
- 50% Carbohydrate (16% refined sugars)