



FOOD PROCESSING

LESSON PLAN

Overview

Estimated lesson time: 115 minutes

Before this module, we recommend students become familiar with the [vocabulary definitions](#) for this module. Refer to [vocabulary builders](#) for suggested activities.

10 min Introduction

Brainstorm and discussion

Students will share their existing knowledge about food processing and discuss some of the essential questions (see below). A definition of food processing is provided.

15 min Degrees of food processing

Activity and lecture

Students will place foods on a continuum from less to more processed. The lecture covers the differences between minimally processed foods, processed food ingredients and highly processed foods.

30 min Why are foods processed?

Brainstorm, lecture and discussion

Students will brainstorm reasons why foods are processed, identify examples of techniques that apply to each reason and identify those who benefit from those techniques. The lecture that follows covers these topics in detail.

20 min How are foods processed?

Group activity

In groups, students will determine the steps involved in manufacturing several common processed foods.

30 min Concerns over food processing

Lecture and discussion

The lecture will cover dietary and food safety concerns, worker justice impacts, changes in the processing industry (concentration and consolidation) and the environmental and health concerns related to food packaging.

10 min Reflection

Journal and discussion

Students will reflect on the essential questions raised in this lesson.

Essential questions

Essential questions¹ point to the big ideas of a module. They can be discussed, written on the board and posed on essays and exams.

- How do foods differ by their degree of processing?
- Why and how are foods processed? Who benefits from food processing?
- How do practices in the food processing industry affect food, people and the environment?

Learning objectives

Students will be able to:

- Evaluate and rank foods with regard to their degree of processing;
- Describe how foods differ by their degree of processing, and provide examples of products and processing techniques that apply to each category;
- Describe the reasons why foods are processed, provide examples of processing techniques that apply to each reason and reflect on who (e.g., consumers or manufacturers) benefits most from each technique;
- Depict the steps involved in processing a common food item;
- Explain the health, social and economic concerns associated with the food processing industry.

Materials

Materials that educators must provide:

- Foods and food ingredients that represent a range of levels of processing, such as fresh produce, frozen produce, milk (unprocessed or minimally processed foods), flour, sugar, oil (processed food ingredients), breakfast cereal, cookies and soda (highly processed foods). It's fine to bring some foods that do not fit easily into these categories—this will prompt discussion.

Materials available on the *Teaching the Food System* website:

- Background reading, intended to brief educators on the concepts covered in this module but also suitable as a reading assignment for students
- Vocabulary definitions
- Slides
- Student handouts (print copies before the lesson begins)
 - *Why are foods processed?*
 - *How are foods processed? Frozen orange juice concentrate*
 - *How are foods processed? Packaged chicken meat*
 - *How are foods processed? Chicken nuggets*

10 min Introduction

Brainstorm and discussion

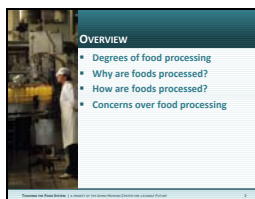
Students will share their existing knowledge about food processing and discuss some of the essential questions. A definition of food processing is provided.

Note: Instructions to the educator are written in italics; talking points to students are written in plain font. Talking points are not intended to be delivered verbatim—we expect educators will adapt them to best suit their audiences.



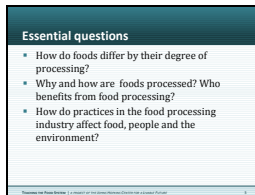
Title slide

- In this lesson, you will:
 - Explore the steps involved in manufacturing orange juice, chicken nuggets and other processed foods;
 - Learn, through examples, why and how foods are processed;
 - Examine the benefits of food processing, along with the dietary, health, justice, economic and environmental concerns associated with certain aspects of the industry.



Overview

- *Briefly indicate some of the topics that will be covered.*



Essential questions

- These questions point to the big ideas of this module.
 - *Give students a few moments to read the essential questions. Notify them that they may be used after the lesson as exam or essay questions.*
- What is **food processing**? How would you define a processed food?
 - Food processing refers to the practices used by food and beverage industries to transform raw plant and animal materials, such as grains, produce, meat and dairy, into products for consumers.²⁻⁴ Nearly all of our food has been processed in some way.⁵
 - What are some examples of processed foods and food processing techniques?
 - Examples include freezing vegetables, milling wheat into flour and frying potato chips. Slaughtering animals for meat is also sometimes considered a form of food processing.
 - Although some forms of food processing use the latest technology, others have been practiced for centuries. Can you name some?
 - Early Egyptians brewed beer and discovered how to bake leavened bread.³
 - Ancient Greeks made salted pork, a precursor to ham and bacon.³
 - In this curriculum, modern food processing is defined as taking place at a plant or factory.³ This is distinct from food preparation, which usually takes place in kitchens.³ Many activities—washing and cooking, for example—are common to both processing and preparation.
 - The companies that process foods are sometimes called food manufacturers.⁶

- What have you heard about processed food? Think about what you may have read on the internet, in magazines or in newspapers.
- A search for “processed food” on Google brings up results with words and phrases like “danger,” “harmful” and “should be avoided.”⁷ Why do you think processed food has garnered such media criticism?
- What do you think are the actual concerns associated with food processing? How do practices in the food processing industry affect food, people and the environment?
- While food processing can offer many benefits to businesses and consumers, certain aspects of the industry raise concerns over nutrition, food safety, worker justice, local economies and the environment.

10 min Degrees of food processing

Activity and lecture

Students will place foods on a continuum from less to more processed. The lecture covers the differences between minimally processed foods, processed food ingredients and highly processed foods.

- Some foods are more processed than others. How do foods differ by their degree of processing?
 - Some foods may undergo only a few processing steps, like washing or peeling, that don't substantially change its structure or nutritional properties.
 - Other foods undergo complex processing steps, often involving many different ingredients.
- *Present students with the foods and food ingredients (refer to Materials, above). If you brought in enough products, split the class into groups and provide each group with a set of products.*
 - *Alternatively, if you didn't bring in any foods or food ingredients, list several products on the board and have students write their responses on paper.*
- *Draw two arrows on the board, pointing to opposite ends of the classroom, labeled "less processed" and "more processed." Example:*

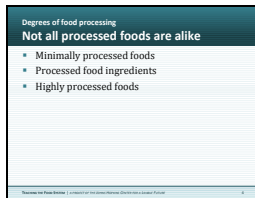


- *Have students (or groups) arrange their products in order from less processed to more processed, using the directions indicated on the board as reference. Encourage students to examine each product, including the ingredient labels (where available), for clues as to how processed it is.*
- *Alternatively, have students place their products into categories that reflect how they have been processed (if at all). For example, students might create categories for unprocessed food, minimally processed food, processed food ingredients and highly processed food.*
- *Once students have finished, ask them to explain why they arranged their products where they did. If the class was split into groups, invite groups to critique others' arrangements. The relative extent of processing between some foods is subjective, so there may be more than one "correct" arrangement.*



Overview: Degrees of processing

- Not all foods undergo the same degree of processing.



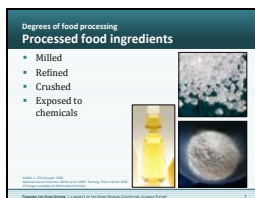
Not all processed foods are alike

- Some nutritionists classify processed foods into three categories: minimally processed food, processed food ingredients and highly processed food.⁴
- Even though there is no universally accepted method of categorizing processed foods, it is helpful to make the distinction between foods like toaster pastries, which are highly processed; flour, which is a processed food ingredient; and milk, which is generally considered minimally processed. These distinctions allow for a more nuanced discussion of processed food.



Minimally processed foods

- Fruit, vegetables, legumes, nuts, meat and milk are often sold in minimally processed forms. Foods sold as such are not substantially changed from their raw, unprocessed form and retain most of their nutritional properties.^{5,8,9}
- Minimal forms of processing include washing, peeling, slicing, juicing and removing inedible parts.^{4,8,10} Some nutritionists also characterize freezing, drying and fermenting as minimal forms of processing.⁴
- To prolong **shelf life** and inhibit the growth of **pathogens**, perishable foods may have preservatives added to them, or they may be sealed in sterile packaging.^{8,10,11}
- Some minimally processed foods and beverages may be exposed to controlled amounts of heat, or in some cases radiation, to inactivate pathogens.^{8,11} Milk, for example, is commonly heat **pasteurized**.^{8,11}
- After purchase, consumers may cook these foods and mix them with other ingredients as part of their preparation.



Processed food ingredients

- This group includes flours, oils, fats, sugars, sweeteners, starches and other ingredients. High fructose corn syrup, margarine and vegetable oil are common examples.⁴ Processed food ingredients are rarely eaten alone; they are typically used in cooking or in the manufacture of highly processed foods.⁴
- To create these ingredients, starting materials such as grains and oil seeds may be milled, refined, crushed or exposed to chemicals.⁴ Unlike minimal forms of processing, these techniques radically change the nature of the original raw materials.⁴
- Processed food ingredients tend to be **nutrient-poor**,⁴ meaning they are high in **calories** relative to the amount of vitamins, minerals and other key **dietary nutrients**.



Highly processed foods

- Highly processed foods are made from combinations of unprocessed food, minimally processed food and processed food ingredients.⁴
 - Many are designed with consumer convenience in mind.⁴ They are often portable, can be eaten anywhere (while driving, working at the office and watching TV, for example) and require little or no preparation.^{4,12}
 - Discussions of “processed foods” in the popular media often refer to products in this category.
 - Highly processed foods include snacks and desserts, such as cereal bars, biscuits, chips, cakes and pastries, ice cream and soft drinks;⁴ as well as breads, pasta, breakfast cereals and infant formula.^{4,5,12} Highly processed animal products include smoked, canned, salted and cured meats¹² and products made from extruded remnants of meat, such as nuggets, hot dogs and some sausages and burgers.⁵ Many vegetarian alternatives to meat are also highly processed.¹²
 - Highly processed foods are made using techniques like mixing, baking, frying, curing, smoking and the addition of vitamins and minerals.⁴
 - Does the degree to which a food has been processed tell you something about how healthy it is? Can you think of a highly processed food that you consider healthy, or a minimally processed food that you consider unhealthy?
 - Given the wide variety of foods that could qualify as highly processed and the lack of any clear, widely accepted criteria for defining them as such, it is difficult to make any generalizations about the nutritional value of highly processed foods. Some health professionals, however, have expressed concern over the growing popularity of certain highly processed foods in diets.^{5,13-15} These concerns are discussed further below.
- *Ask students to revisit their continuum lines. See how they would rearrange their products according to the three categories they just learned.*

30 min Why are foods processed?

Brainstorm, lecture and discussion

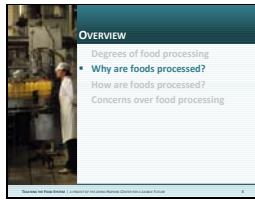
Students will brainstorm reasons why foods are processed, identify examples of techniques that apply to each reason and identify those who benefit from those techniques. The lecture that follows covers these topics in detail.

Brainstorm

- Provide each student with a copy of the handout *Why are foods processed?*
- Create a 3-column table on the board, with the headers “Reasons foods processed” “Examples” and “People and groups who benefit.” Work together as a class to generate some initial responses.
- Have students work in groups of 3-5 to generate additional responses on their handouts. Float between groups, providing clues as needed.
- Have students share their responses aloud. Write them on the board beneath the corresponding headers. Provide guidance, as needed, so that the table on the board is roughly consistent with the example below. Refer to the background reading for more details.

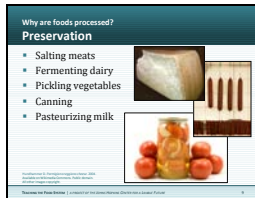
Reasons foods are processed:	Examples of techniques and foods:	People and groups who benefit from these techniques:
To make them last longer before spoiling (preservation)	Pasteurizing milk or juice Fermenting dairy into cheese or yogurt Pickling or canning produce Salting meats	Distributors can ship products over greater distances Retailers can stock products longer Consumers can keep foods longer
To remove, destroy or inhibit pathogens and toxins (food safety)	Washing, pasteurizing, cooking, salting, drying, refrigerating, freezing	Consumers are at a lower risk of foodborne illness
To change flavor, texture, aroma, color or form (variety)	Milling grains Mixing ingredients Adding flavors, colors and fortifications Molding foods and ingredients into shapes	Manufacturers may gain higher profits and a foothold in a competitive market Consumers have access to a wider variety of products.
To reduce preparation times and make food more portable (convenience)	Fast foods: Burgers, fries, etc. Convenience foods: Bottled drinks, meat jerky, cakes, cookies, breakfast cereal bars, frozen pizzas, baby food	Manufacturers may gain higher sales by responding to consumer demand for convenience food Consumers can eat virtually anywhere, at any time, with minimal effort (<i>Is there a downside to this benefit? Discuss.</i>)
To restore and/or raise nutrient levels in food (nutrition)	Fortifying milk with vitamin D, salt with iodine, and grains with B vitamins, iron and folic acid	Manufacturers can use fortification as a selling point, potentially generating greater sales Consumers are at lower risks for certain nutrient deficiencies

Lecture and discussion



Overview: Why are foods processed?

- As a follow-up to their brainstorm, students will learn additional details about why and how foods are processed.
- Food manufacturers process foods and raw ingredients to add value to their products,² in the form of longer shelf lives, added dietary nutrients, appealing textures and other features.



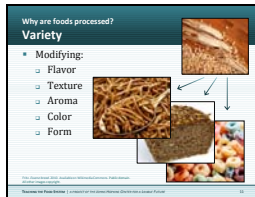
Preservation

- Historically, the most important reason to process or prepare foods has been to make them last longer before **spoiling**.¹⁶
- Early civilizations used techniques like salting meats, fermenting dairy (into cheese or yogurt, for example) and pickling vegetables.¹⁶
- More recently, in the 1790s, Napoleon Bonaparte offered a prize to the scientist who could best develop ways to preserve foods for the armies of France; the competition prompted the discovery of safe canning practices by Nicolas Appert.²
- Louis Pasteur, working with beer and wine, would later discover pasteurization,² a process that uses controlled amounts of heat to extend the shelf life of milk, juice and other products.
- Some argue that preservation is still the most important reason to process food because illness, even death, can result from eating spoiled food.²
- When perishable products have longer shelf lives consumers can enjoy them for a greater part of the year,^{2,3} distributors can ship them over greater distances, and retailers can stock them on shelves for extended periods.¹⁷



Food safety

- Processing and preparing foods can make them safer to eat by destroying toxins and eliminating or inhibiting pathogens.³
- Techniques such as refrigerating, freezing, fermenting, drying and adding salt or sugar can slow or stop the growth of pathogens.³
- Heat processes, such as pasteurization and cooking, can eliminate pathogens.³
- Because these techniques help protect consumers, most cases of **foodborne illness** involve raw animal products, fruits and vegetables that have been contaminated by pathogens.¹⁸



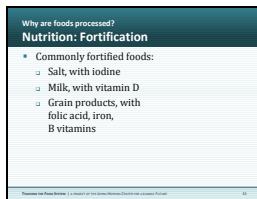
Variety

- Every year, food manufacturers introduce roughly 20,000 unique processed foods on retail shelves;¹⁹ of these, only the most highly successful remain.²⁰ How is this possible? Are manufacturers discovering new foods?
 - Most new products are variations on candy, gum, snacks and beverages.¹⁹
 - Some are fortified, low-fat, low-sugar, low-cholesterol or low-salt versions of existing products.²⁰
- By modifying the flavors, textures, aromas, colors and form of foods and raw ingredients, food processing can create greater variety in our food supply.^{6,21} Grains, for example, can be milled into flour, which is then used to make a wide variety of products.^{6,21}
- Grains are the core ingredients in most ready-to-eat breakfast cereals. In 1860, Dr. J. H. Kellogg invented a form of granola-like cereal designed to fit the austere diets of Seventh Day Adventists; he and his brother later founded the company that bears his name.²²
- Today, a trip down the breakfast aisle of a supermarket reveals a tremendous variety of products that are derived, in part, from wheat, rice, corn and several other grains.
- Breakfast cereal manufacturers achieve this by using techniques like adding flavors, cooking, drying, toasting and spraying on vitamins.²³ Processes like shredding, flaking, puffing and extruding can alter the shapes of cereal grains (*refer to the background reading for details*).²³
- Changing the qualities of foods in these and other ways can make products more appealing to some consumers,³ helping manufacturers to increase sales in a highly competitive marketplace.



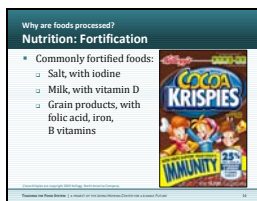
Convenience

- Food processing can create products that require little or no preparation on the part of consumers.^{3,22,24}
- Among the early examples of processed **convenience food** was pemmican, strips of dried buffalo meat mixed with fat and berries that could be eaten “on the go” by First Nations peoples of the Great Plains.²²
- Modern examples include baby food, canned foods, frozen pizzas, instant noodles, bottled juices and ready-to-serve cakes, cookies and pies.^{22,24}
- Fast food offers another form of processed, ready-to-eat calories for busy eaters.²²
- From 1966 to 1999, the amount of time U.S. adults ages 25 to 54 spent cooking meals decreased by 25% (43% among women).²⁵ Americans, in general, are consuming fewer calories at home and more at full-service and fast-food restaurants.²⁶ These trends may reflect a growing demand among busy consumers for convenient food.⁶



Nutrition: Fortification

- Enrichment and fortification are two of the ways that processing can restore or raise nutrient levels in food.
- **Enrichment** means the restoration of some of the nutrients that are lost during certain forms of processing, such as milling grains.²²
- **Fortification** goes a step further; it means adding certain nutrients *above* the levels that naturally occur in a food.²²
- The term fortification is also used more generally to refer to any addition of nutrients to a food.²⁰
- Fortification was designed to prevent nutrient deficiencies in the general population.²⁰
- In the 1830s, French chemist Jean Boussingault advocated adding iodine to table salt to prevent goiter (enlarged thyroid glands),²⁰ a condition frequently caused by iodine deficiency.
- Today, many foods are typically fortified in the U.S., including salt (with iodine), milk (with vitamin D) and grain products (with thiamin, niacin, riboflavin, iron and folic acid).²⁰



Nutrition: Fortification (continued)

- Are there any potential concerns with fortifying foods?
- These additions have helped prevent nutrient deficiencies in the U.S. diet, but food manufacturers sometimes use fortification as a selling point for foods of questionable nutritional quality, such as candy, snacks and sweetened breakfast cereals.²⁰
- Some research also suggests that synthetic vitamins may not offer the same nutritional benefits as vitamins that occur naturally in food.²⁷



Nutrition: Preserving nutrients

- Some forms of preservation can also maintain nutrient levels in certain foods.
- After fruits and vegetables are harvested, they begin to lose their nutritional quality.²⁸ Freezing or canning can preserve levels of certain nutrients.²⁸
- Despite a common belief, canned foods are not necessarily less nutritious than their fresh or frozen counterparts.²⁸
- Factors such as when the produce was harvested, how long it had been stored and how it will be prepared determine whether the fresh, frozen or canned version of a food is the most nutritious choice.²⁸

20 min How are foods processed?

Group activity

In groups, students will determine the steps involved in manufacturing several common processed foods.

- Place students into groups of 3. Provide each student with a different *How are foods processed?* storyboard.
- Students will hypothesize the processing steps for the product depicted on their worksheet, then write the steps in the space provided. If time allows, students may wish to draw pictures illustrating each step.
- Encourage discussion within groups.
- Invite volunteers to present their results. Present the actual steps, listed below, to verify students' results.



Overview: How are foods processed?



Frozen orange juice concentrate

- After they are harvested, oranges are sent to a processing facility, usually located near the orchard where they are grown;
- Oranges are unloaded, washed and inspected for quality;
- Oranges are mechanically sorted by size;
- Oranges are directed to the most suitable juice extractor for their size;
- After extraction, the pulp is separated from the juice using sieves and a centrifuge;
- Juice is preheated to a pasteurizing temperature;
- Juice is heated to the point where much of the water evaporates, leaving a concentrate;
- During evaporation, some of the flavor components are lost. They are reclaimed in a process called “essence recovery” and later added back into the product;
- Concentrate is cooled and kept in frozen storage tanks;
- Concentrate is packaged in cardboard tubes and distributed to retailers.¹⁶



Packaged chicken meat (3 slides)

- Live chickens are shipped to a processing plant;
- Processing plant workers shackle chickens, by their feet, to an automated assembly line;
- Chickens are stunned;
- Chickens are “bled”—their jugular veins are cut by an automated knife;
- Carcasses are “scalded” in warm water, to loosen their feathers;
- A mechanical plucker removes feathers;
- The feet, head and neck are removed;
- Carcasses are “eviscerated”—their internal organs are removed;
- Carcasses are washed to remove pathogens;
- Carcasses are chilled;
- Carcasses are graded for quality;
- Carcasses are cut up (into breast meat, drumsticks, etc.) and deboned;
- Meat cuts are packaged and shipped out for sale or further processing.²⁹



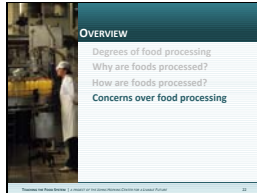
Chicken nuggets

- Nuggets can be made from a variety of ingredients. Chopped poultry meat may be mixed with skin and other parts of the carcass that have been mechanically de-boned. Salt is added for flavor and to aid binding. Egg whites, soy products and other fillers and binders may be added;
- Mixed ingredients are formed into the desired shape;
- Nuggets are dusted with flour, battered and breaded;
- Nuggets are deep fried;
- Nuggets are frozen, vacuum-packed and distributed to retailers.^{16,30}
- Fast food restaurants typically use nuggets that have been partially fried (par-fried) before freezing. When they are prepared at the restaurant, they are deep-fried again before serving.³¹

30 min Concerns over food processing

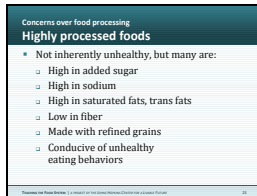
Lecture and discussion

The lecture will cover dietary and food safety concerns, worker justice impacts, changes in the food processing industry (concentration and consolidation) and the environmental and health concerns related to food packaging.



Overview: Concerns over food processing

- While food processing can offer many benefits to businesses and consumers, certain aspects of the industry raise dietary, health, justice, economic and environmental concerns.



Highly processed foods

- Is the nutritional quality of food related to how processed it is? Are highly processed foods, for example, less healthy than minimally processed foods?
- Although highly processed foods are not inherently unhealthy, many foods in this category are high in added sugar, sodium, saturated fats or trans fats and contain little dietary fiber.⁴
- Some of these foods, such as cakes, cookies and soft drinks, are among the major sources of calories among U.S. adults³² and children.³³
- Breads and snack foods are often made with **refined grains**—grains that have been processed to remove the bran and germ, which contain important nutrients like B-vitamins, iron and fiber.³⁴ Since fortification replaces only a small fraction of nutrients in the diet, 100 percent **whole grains** and other whole foods are recommended over refined alternatives.²⁰
- The convenience that many highly processed foods offer may also encourage unhealthy eating patterns, such as skipping meals and overconsuming calories.⁵



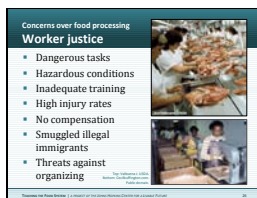
Premium products

- “Premium” versions of highly processed products exist, such as those with less sugar, fat or salt, no trans fats and various fortifications.^{5,20}
- Are premium products part of the solution to improve American diets?
- Some of these may be an improvement, while others simply replace reduced levels of fat with higher amounts of sweeteners.⁵
- Premium products also tend to be more expensive, making them available only to those who can afford them.⁵
- Given these concerns, some nutritionists recommend diets based primarily on unprocessed and minimally processed foods.⁵



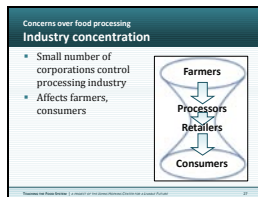
Food safety

- Although many forms of food processing are designed to minimize food safety risks, rapid growth in the food processing industry can contribute to foodborne illness outbreaks.³⁵
- How might food processing plants contribute to foodborne contamination?
- The Food and Drug Administration (FDA) is an organization responsible for ensuring the safety of our food supply.
- In 2009, the FDA alerted consumers to the widespread contamination of products made with peanut meal. Samples from a peanut processing plant in Texas were found to contain *Salmonella*, a bacterial pathogen that can cause serious illness or death. Over 2,000 products were recalled from stores, including varieties of peanut butter, cookies, crackers, cereal, candy, ice cream and pet food.³⁶
- As processing plants have become larger, they handle larger volumes of products—sometimes from many different sources—and distribute them over a broader geographic area.³⁵ This can increase the risk of widespread exposure to contaminated products.³⁵
- The FDA has been criticized for inadequately inspecting food processing facilities.^{37,38} To help address this gap, the FDA has been advised to hire more food safety inspectors and provide them with additional training.³⁷



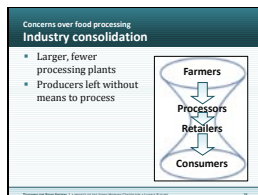
Worker justice

- In addition to affecting our food supply, the practices common to certain food processing industries affect the people who work for them. In particular, workers in U.S. meat and poultry processing plants often suffer health risks, poor working conditions and labor violations.³⁹⁻⁴¹
- They may be expected to perform dangerous tasks, such as working with sharp knives, hooks and circular saws (*bottom photo*), under hazardous and exhausting conditions, sometimes without adequate training.⁴⁰
- Injuries, some life-threatening or fatal, are not uncommon;³⁹⁻⁴¹ 36 percent of employees in the meat industry are injured each year.³⁵ Compared to all other job categories, the food processing industry as a whole ranks among the highest for job-related injuries.³⁵
- Injured employees of meat and poultry processing plants are not sufficiently protected under U.S. labor laws; they are often unable to receive compensation and an injury may cause them to lose their jobs.⁴⁰
- Processing plants frequently hire migrant workers who are willing to accept low wages and poor working conditions.³⁵ In some cases, illegal immigrants are smuggled into the country by the companies that hire them^{35,41} and face fears of deportation.^{40,41}
- These and other threats of retribution can squelch efforts on the part of employees to organize unions.⁴⁰



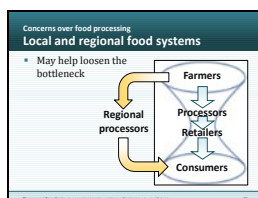
Industry concentration

- The U.S. **food system** has been compared to an hourglass:⁴² at the top are many producers, at the bottom millions of consumers. The narrow part of the hourglass represents the small number of companies that largely control how food is passed between producers and consumers. The industries at this bottleneck, including food processors and retailers, can have considerable influence over who produces food, how it is produced and what is eaten.^{42,43}
- Flour milling, soybean processing, dairy processing and livestock slaughter are among the processing industries that have grown more concentrated under the control of a small number of companies.^{44,45} For example, only four companies control over 80 percent of the beef packing industry.⁴⁶
- The extent to which a small number of corporations control most of the sales in an industry is called **industry concentration**.⁴⁴
- How do you think industry concentration affects farmers?
- Farmers may have fewer choices of where to bring their crops and animals for processing.⁴³
- They may be pressured into adopting the production practices dictated by the dominant companies—particularly when they are locked into contracts—and may lose the autonomy to set their own prices.⁴³



Industry consolidation

- Some processing industries have also become more **consolidated**,⁴⁷ meaning there are fewer and larger processing plants.⁴⁴ As smaller processing plants shut down, producers may be left without any nearby facilities to process their crops and animals.



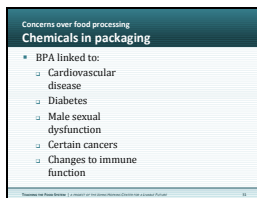
Local and regional food systems

- In some areas, the addition of more **regional** and **local** food processors may help “loosen” the bottleneck between producers and consumers by offering farmers more options on where to process their goods.^{48,49}
- Partnering with nearby processing and slaughtering facilities can also help farmers sell their products directly to consumers, as opposed to shipping their products to a far-off facility.⁵⁰
- By dealing with fewer middlemen, farmers can retain a larger share of profits, keep money within their own region and strengthen its economy.⁵⁰



Packaging waste

- Food packaging can offer numerous benefits, such as making products easier to store and transport, preserving them and making them easier to prepare.^{6,51} It also allows for the display of marketing, labels, recipes and other information.⁵¹
- Solid waste from food packaging, however, poses an environmental concern. Food packaging accounts for roughly two-thirds (by volume) of total packaging waste in the United States.⁵¹ Discarding packaging materials in landfills has the potential to pollute air and water, while combusting them for energy can release **greenhouse gas** emissions, dioxins and other pollutants (depending on the materials used) that are harmful to health and the environment.⁵¹
- Recycling, **composting** and reusing containers offer more environmentally sound alternatives. Manufacturers can also reduce the amount of materials used in food packaging, ideally without compromising benefits to consumers.^{6,51}



Chemicals in packaging

- Some forms of food packaging also pose health concerns.
- Bisphenol A (BPA) is a chemical commonly used in the linings of metal cans and in the manufacture of hard plastics, such as some bottles and food storage containers.⁵²
- Studies have found links between BPA exposure and cardiovascular disease, diabetes, male sexual dysfunction, certain cancers and changes to immune function.⁵²
- A recent study of products packaged in metal cans and plastic wrap, including soups, vegetables and infant formula, detected low levels of BPA in those foods.⁵²
- As a precautionary measure, some manufacturers have stopped using BPA in bottles and packages.

10 min Reflection

Journal and discussion

Students will reflect on the essential questions raised in this lesson.

- Most of our food has been processed to some degree, sometimes using techniques that have been practiced for centuries.
- Processing food offers many benefits—it can enhance preservation, reduce food safety risks and create greater variety in the food supply.
- The practices and ingredients used in some highly processed foods raise dietary concerns, while the nature of the current food processing industry can have a negative impact on food safety, worker justice, the economy and the environment.
- *In their journals, students will revisit one of the following essential questions:*
 - How do foods differ by their degree of processing?
 - Why and how are foods processed? Who benefits from food processing?
 - How do practices in the food processing industry affect food, people and the environment?
- *Invite volunteers to share responses.*

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