

The Ice Cream Sundae – A perfect model for food science in the FCS classroom

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THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

What is food science?

The discipline in which the engineering, biological, and physical sciences are used to study the nature of foods, the causes of deterioration, and the principles underlying food processing, and the improvement of foods for the consuming public.



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What is food safety?

Programs and policies that are implemented by farmers, food processors, retailers, and consumers to prevent illness or injury from resulting in a consumer as a result from eating contaminated food products.



How does it relate to FCS?

Food science is a related discipline

Often, those who study FCS will take some background food science classes

Principles of food chemistry, food microbiology, nutrition, and sensory evaluation are all related to key aspects of FCS!



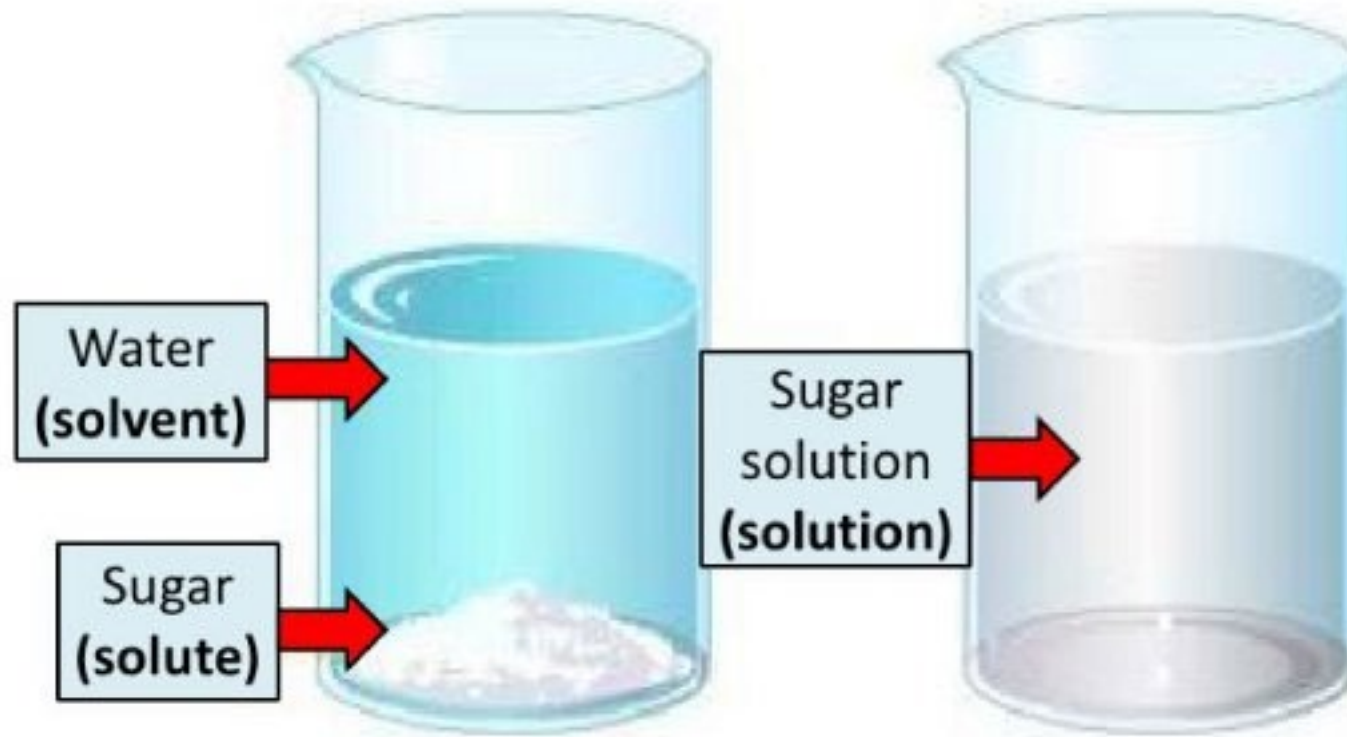
The ice cream sundae



Caramel sauce
Maraschino cherries
Ice cream

The ice cream sundae

Colligative properties



Colligative properties

Colligative properties are properties of solutions that depend on the concentration of solute, but not what it is.

For example, although the structure and mass of sugar and salt are very different in terms of size, the impact they have on the properties of solutions is dependent on the number of molecules not their size.





The three components we'll focus on

First: The caramel sauce

- Who has made caramel sauce before?
- How do you make it?
- Does anyone make candy at home?
- How do you make it?
- Have you used a candy thermometer?
- What kind of temperatures does the candy mixture reach during cooking?



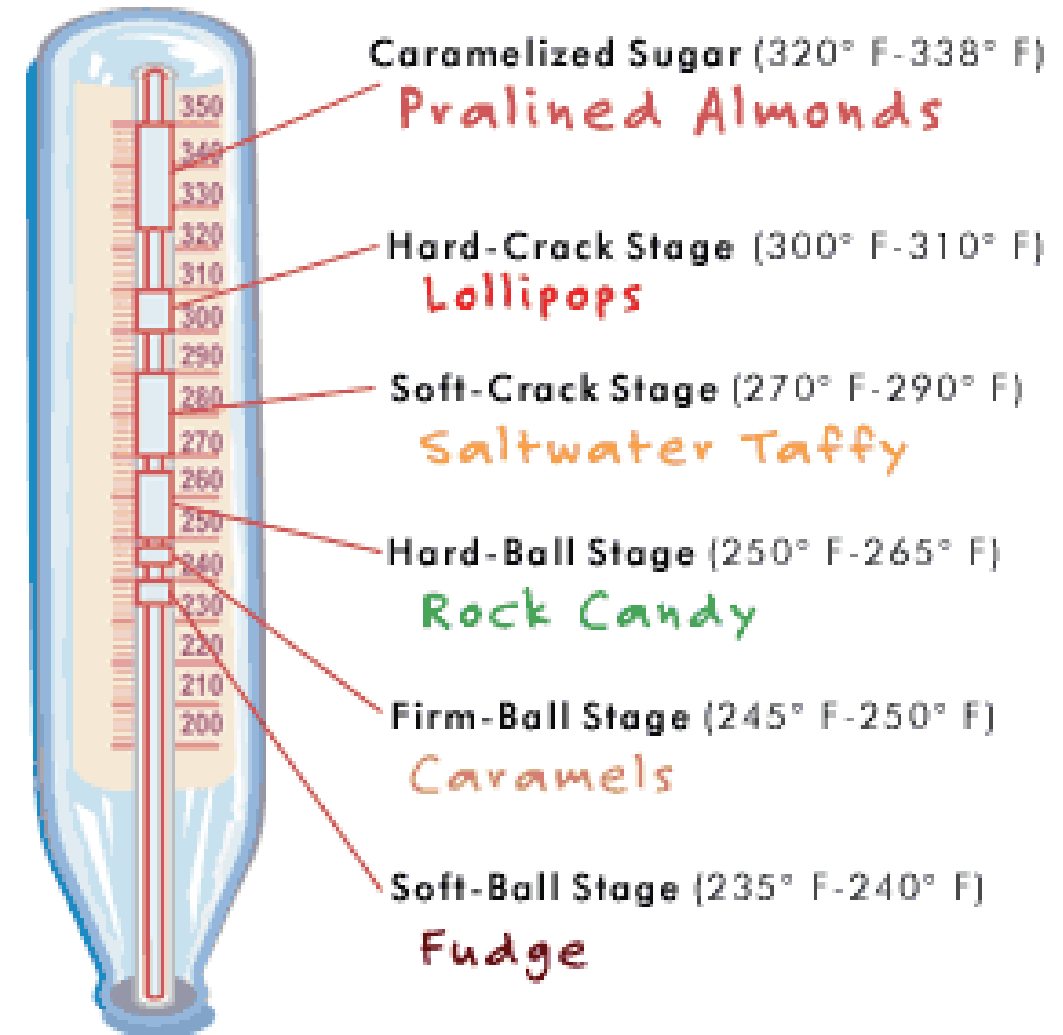
Boiling point elevation

Candy making usually involves very high temperatures

At what temperature does water boil?



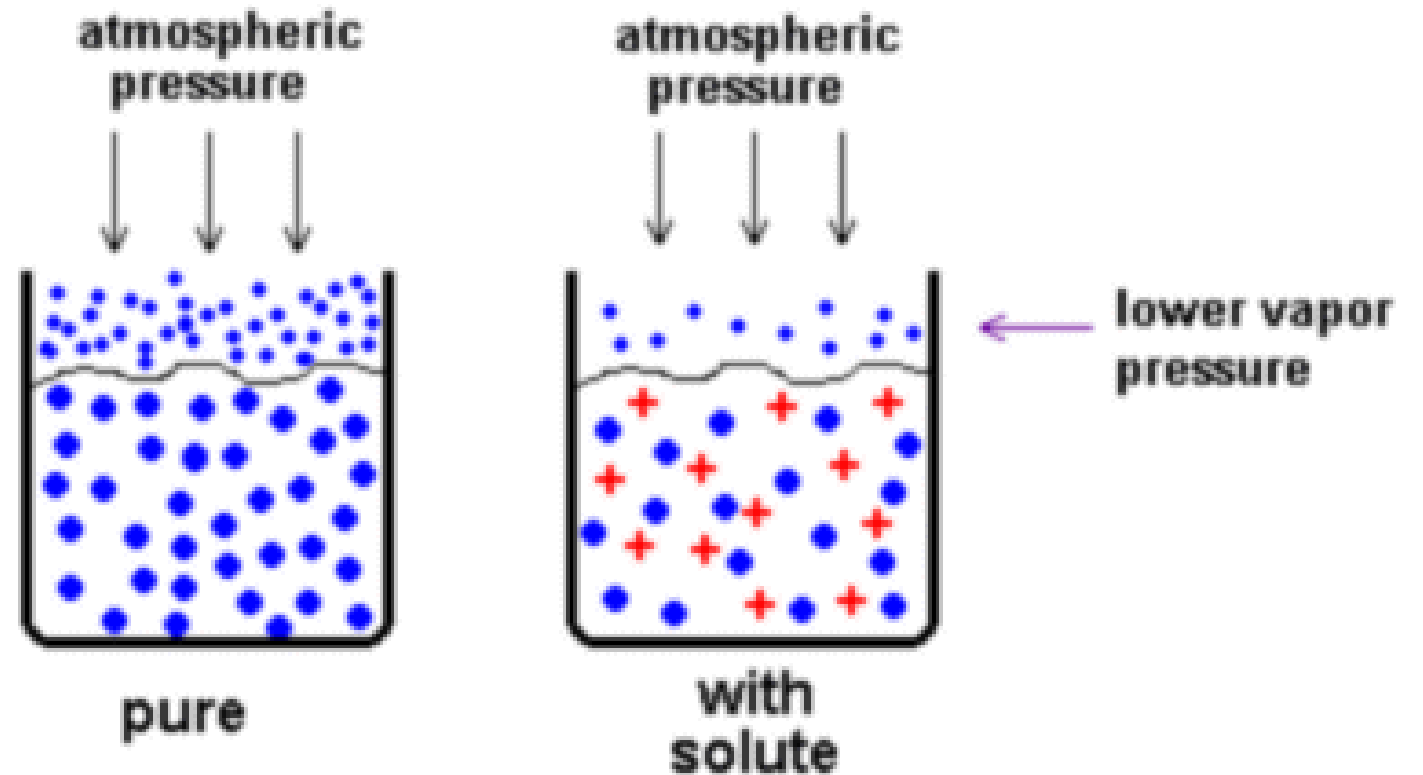
Other candy making



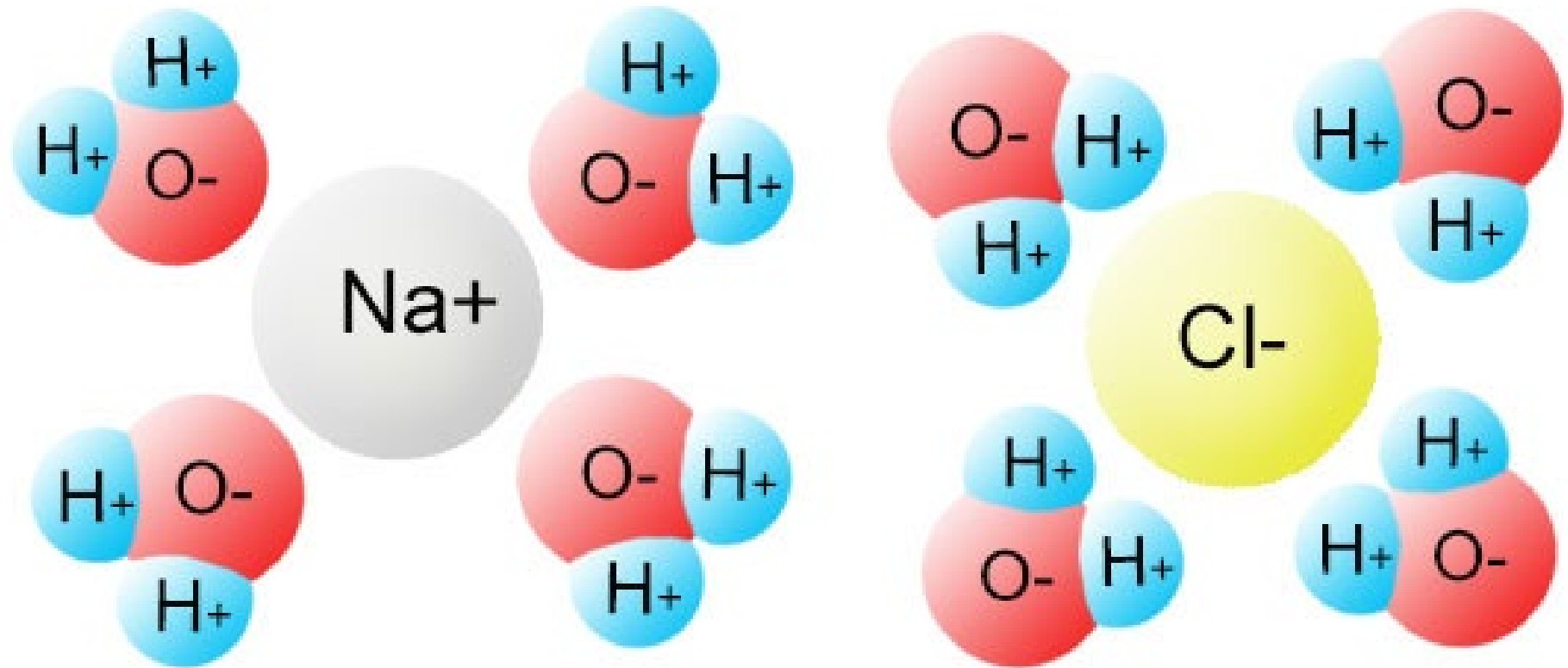
The science

When you add salt or sugar to the solution, the solute "blocks" some of the water from escaping through boiling

When you add salt or sugar to freezing water, the solute interferes with the ice crystals' formation



Student model



Freezing point depression

Does anyone make
homemade ice-cream?

Why do you add salt to
the ice?



Salt on roads

For the same reason we salt the roads in the winter –

Adding ice lowers the temperature at which water freezes



Activity in the classroom



Demonstration



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How confections are made

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Teaching takeaways

- Adding sugar to water changes its physical properties
- This allows us to heat the mixture to temperatures above the boiling point of water
- This creates unique texture attributes depending on the temperature the mixture is heated to
- That's how we get different types of candies

How well students retained the information

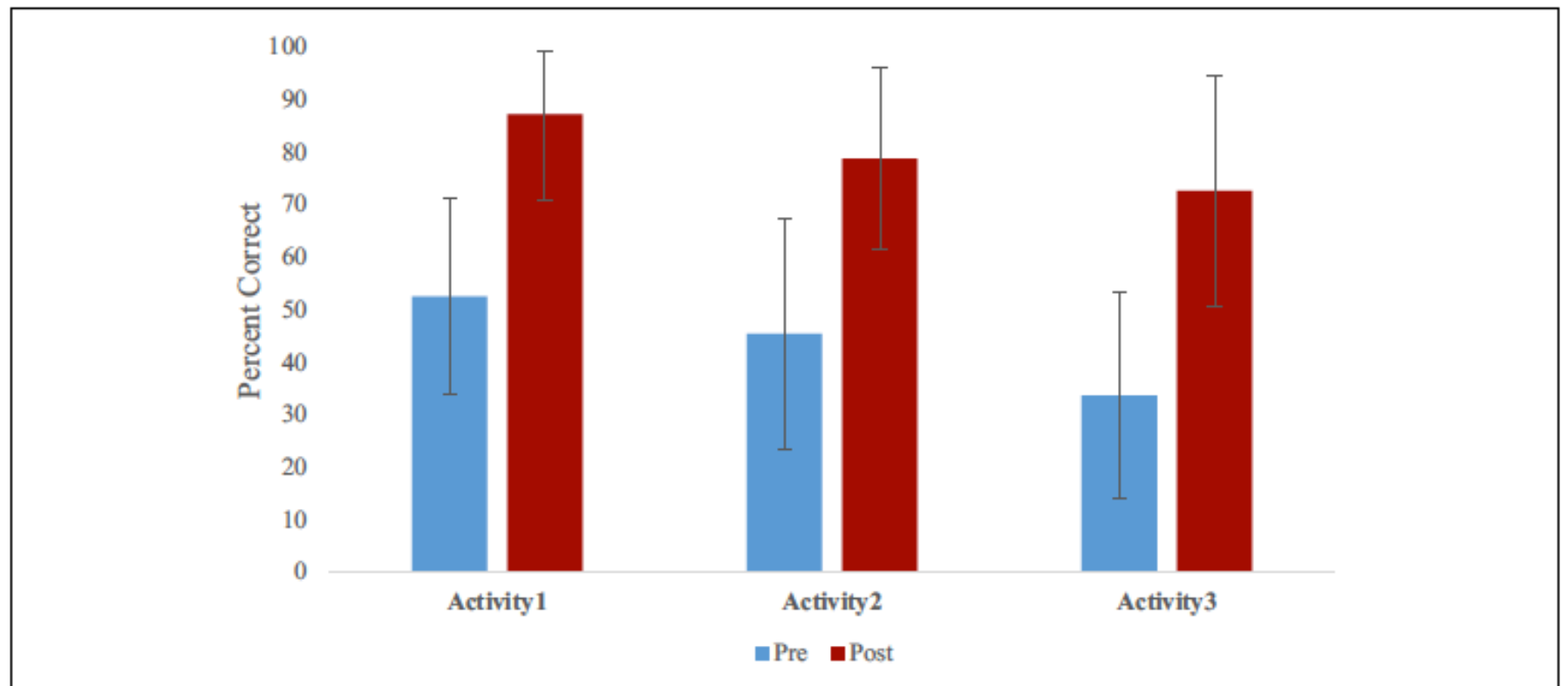


Figure 4–Average percent correct answers by Activity. Activity 1, caramel sauce and boiling point elevation unit. Activity 2, maraschino cherries and osmotic pressure unit. Activity 3, ice cream and standards of identity unit. Percentages are an average of all five questions for five classes ($n = 77$).

Two: the cherry on top



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Maraschino cherries

a preserved, sweetened [cherry](#), typically made from light-colored sweet cherries such as the [Royal Ann](#),^[1] [Rainier](#), or Gold varieties. In their modern form, the cherries are first preserved in a [brine](#) solution usually containing [sulfur dioxide](#) and [calcium chloride](#) to bleach the fruit, then soaked in a [suspension](#) of [food coloring](#) (common red food dye is [FD&C Red 40](#)), [sugar syrup](#), and other components

How maraschino cherries are made



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What is the shelf-life of these cherries?



Food preservation – what makes food shelf-stable?



Food spoilage

- Quality changes that render a product unacceptable
- Can be caused by microbial growth
- Typically not a food safety hazard
- What techniques do we use in food production and handling that prevent or slow spoilage?

Osmotic pressure

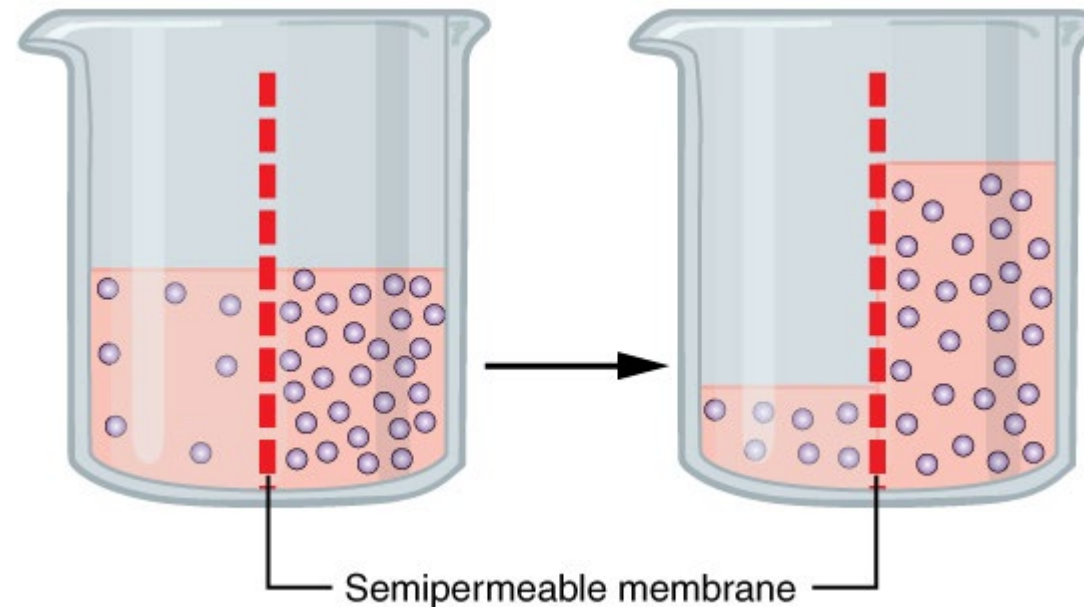
Osmotic pressure is defined as a pressure that would need to be applied to a solution to interfere with osmosis (Ebbing and Gammon 2009). Therefore, changing the colligative properties changes the movement of solvent across a permeable membrane as a system tries to achieve equilibrium. Increasing the concentration of solute increases the osmotic pressure, and because sugar and salt solutions are common in various foods, osmotic pressure plays an important role in the microbial stability of some foods.

In “The Science of a Sundae”

Osmosis — diffusion of water across a semi-permeable membrane from an area of low concentration to an area of high concentration. A semi-permeable membrane allows the solvent to pass, but not the solute.

Pink = solvent

Blue = solute



Osmosis egg experiment

<https://www.stevespanglerscience.com/lab/experiments/growing-and-shrinking-egg/>

Teaching activity

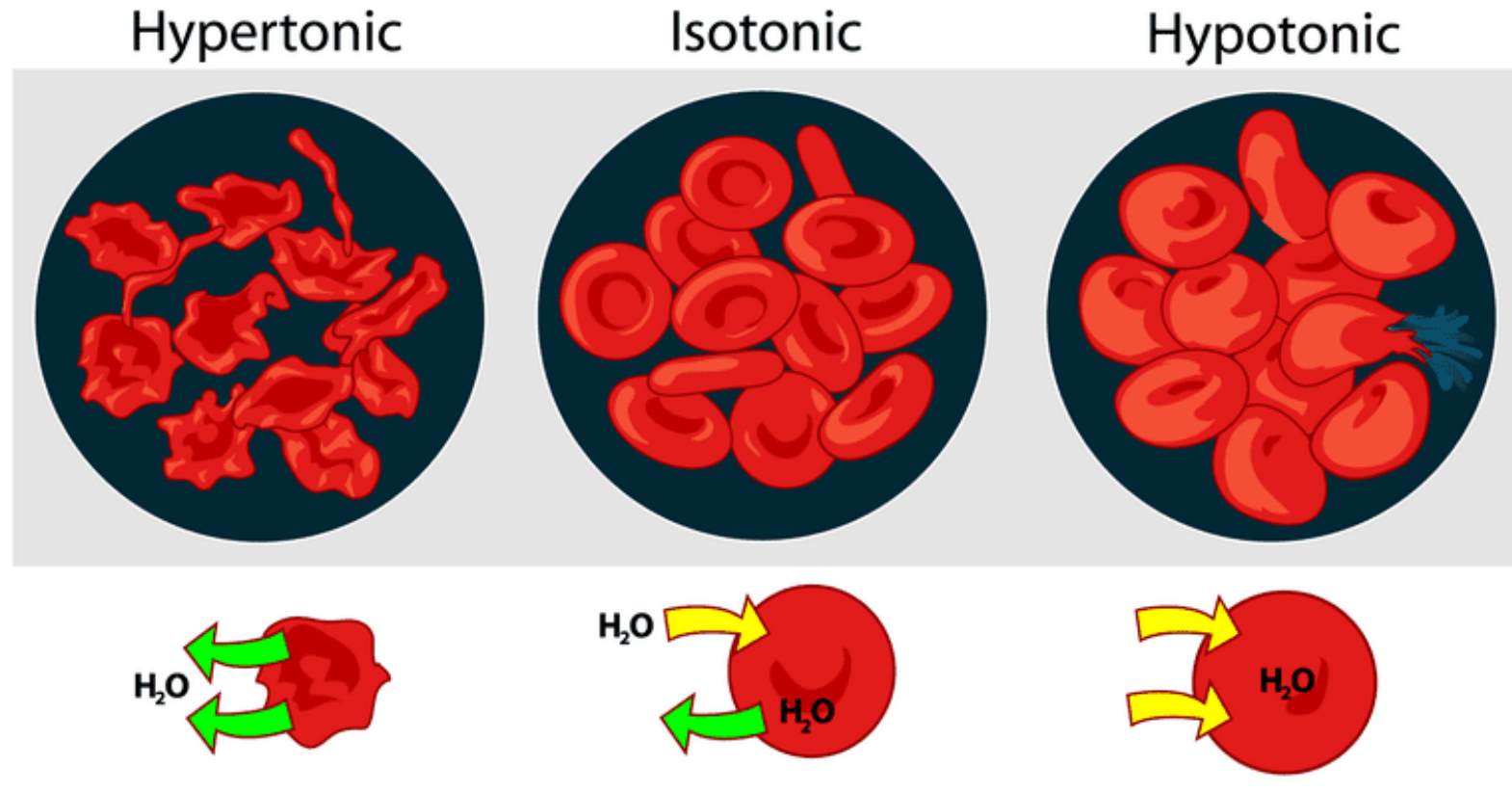
Brix – a measure of “soluble solids” which are solutes that are dissolved in the product

In cherries, this is sugar

A refractometer is used to measure Brix



The science





Salt preserved
foods



Caramel sauce

Heat is important too!



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Demonstration

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Learning outcomes

- Sugar and salt taste good but have also been used in food preservation
- These preservatives act by limiting the water available to support microbial growth and through osmotic pressure
- High salt or sugar shelf-stable foods, including cherries, have a long shelf-life

Learning outcomes

- Brix refractometers are used to measure sugar content and other soluble solids
- Lab/Demo - Comparing Brix content between fresh cherries and maraschino cherries
- Discuss how shelf-life is correlated to the Brix results

What our students retained

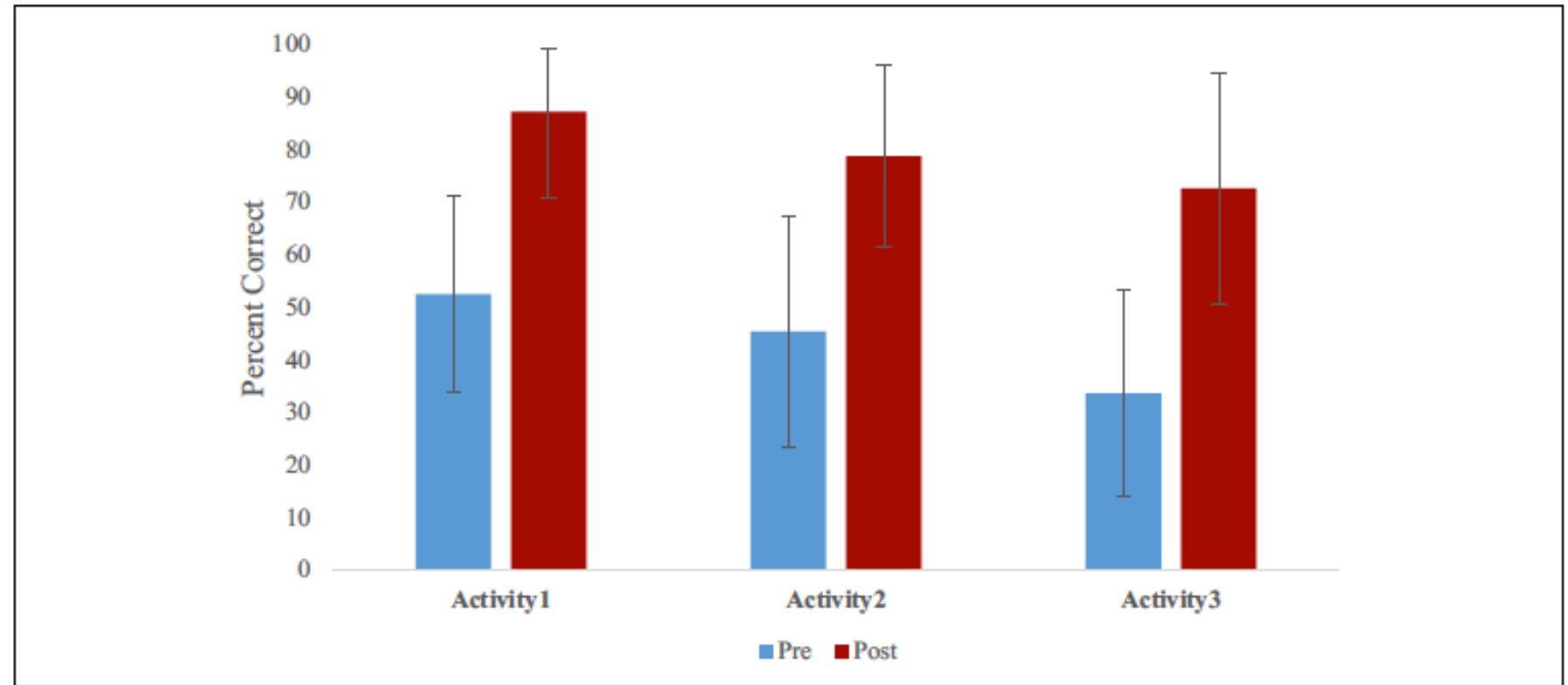


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Three: The ice cream



How is ice cream made?



What is ice cream made from?





Standard of
identity

Standard of Identity

Standards of identity for food are mandatory requirements that are set by a governing body to determine what a food product must contain to be marketed under a certain name in allowable commerce. Mandatory standards, which differ from voluntary grades and standards applied to agricultural commodities, protect the consumer by ensuring a label accurately reflects what is inside (for example, that mayonnaise is not an imitation spread or that ice cream is not a similar but different frozen dessert).

Ice Cream Standard of Identity

Ice cream contains not less than 1.6 pounds of total solids to the gallon, and **weighs not less than 4.5 pounds to the gallon**. Ice cream contains **not less than 10 percent milkfat**, nor less than 10 percent nonfat milk solids, except that when it contains milkfat at 1 percent increments above the 10 percent minimum

Standard of identity activity



What is carrageenan on a food label?



How does carrageenan work?

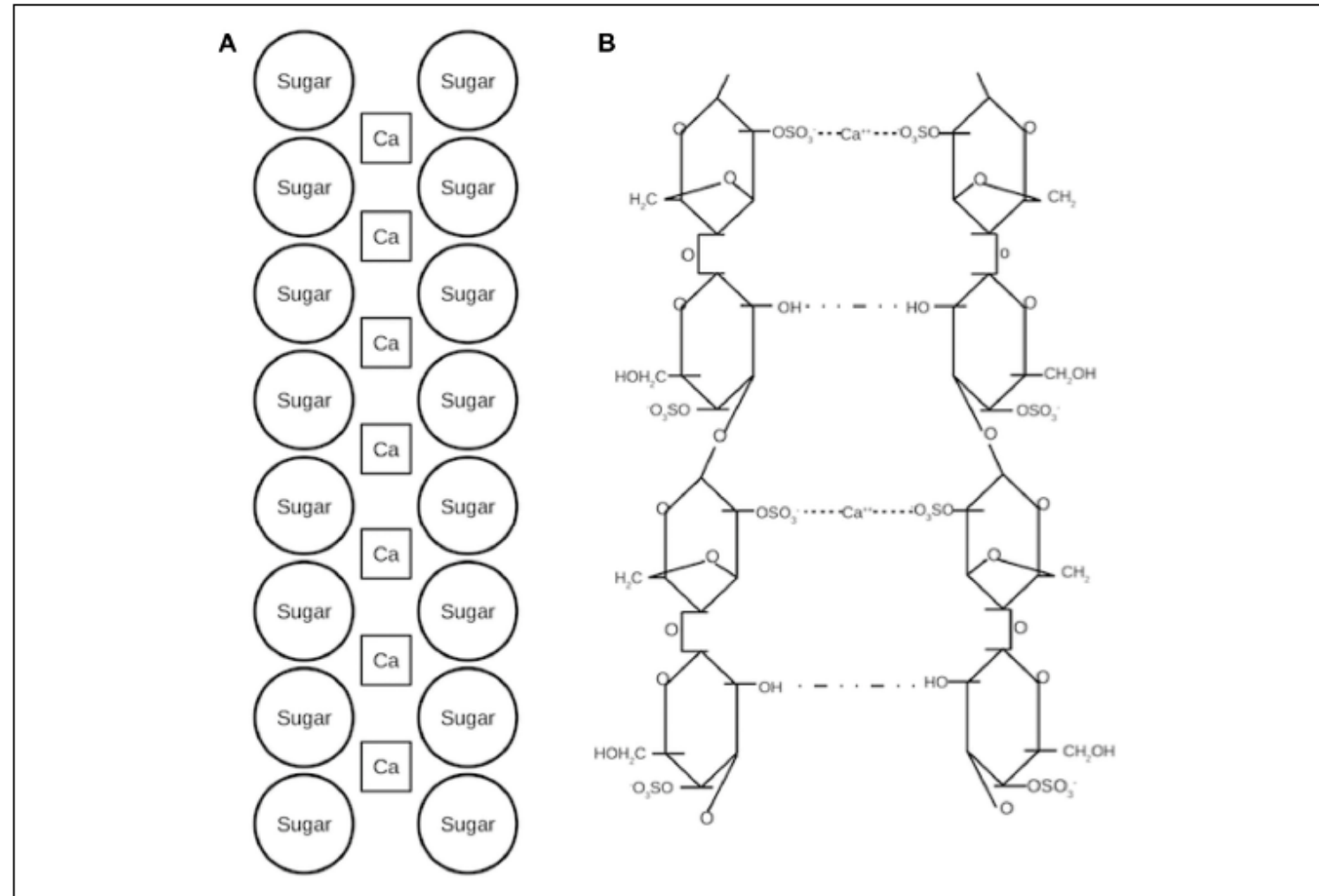
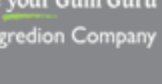



Figure 3—(a) Simple illustration of carrageenan as two carbohydrate chains with linking calcium ions. (b) More complex illustrations of the chemical structure of iota-carrageenan with ionically bound calcium and hydrogen bonds (adapted from Rhein-Knudsen and others 2015).

Project and activity ideas




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Resources



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Teaching activity

https://youtu.be/I-m36MCE_bl



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Teaching takeaways

At the completion of the activity, students will be able to: (1) explain the concept of standard of identity for a food product, (2) determine the source of nutrients from the ingredients list (that is protein from skim milk, fat from cream, etc.), and (3) explain the functional properties of ice cream as they relate to specific ingredients and production methods.

What our students retained

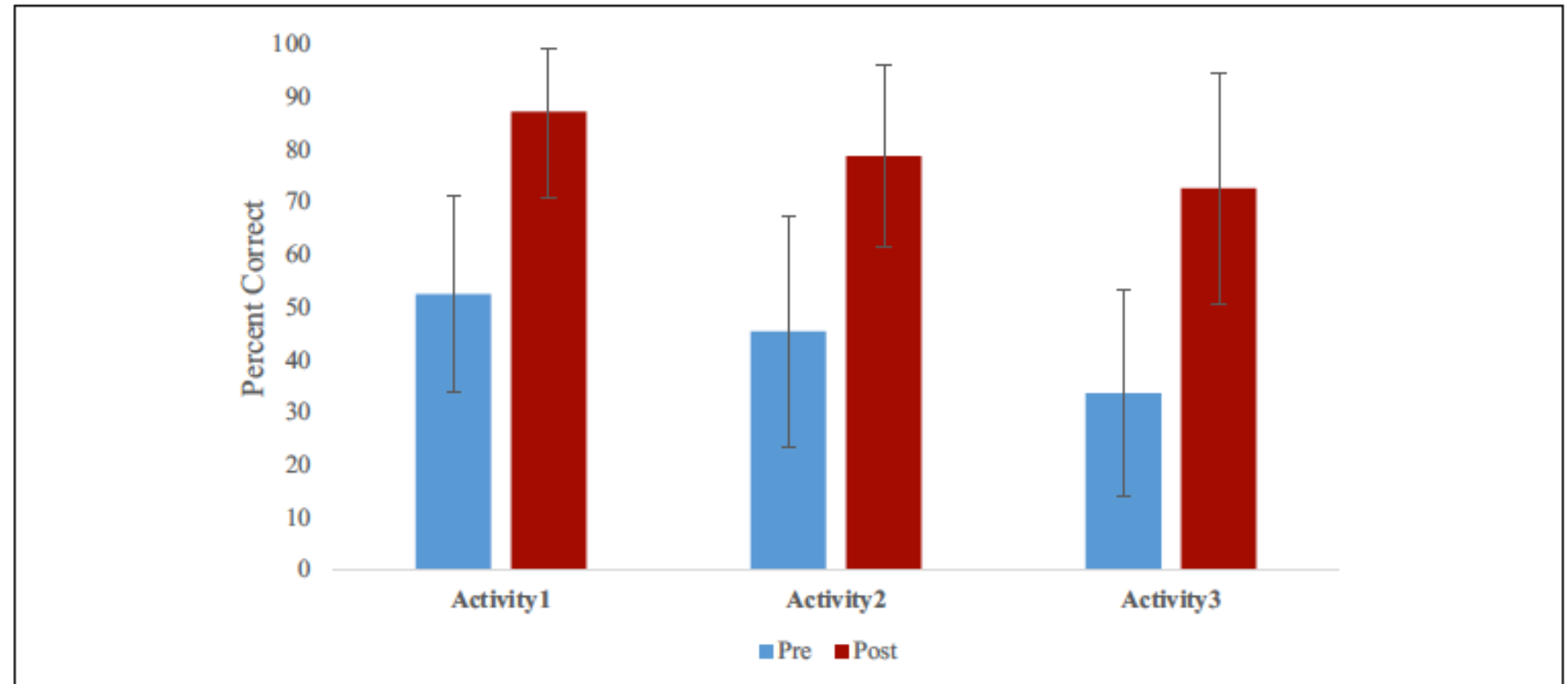


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Overall lesson

- Concepts of shelf-life
- Concepts of colligative properties
- Intersect with food safety and nutrition
- How food is made
- Careers in food science, nutrition, microbiology, chemistry and education

Other resources for food science/safety in the classroom

- IFT web site: <http://www.ift.org/knowledge-center/learn-about-food-science/classroom-resources.aspx>
- Food safety extension website: <https://u.osu.edu/foodsafety/>
- Local extension office contact:
<https://fulton.osu.edu/people/melissa-j-rupp-med>
- FCS OSU extension: <https://fcs.osu.edu/>
- Grow Next Gen:
<https://grownnextgen.org/curriculum/tag:food%20science>

<https://www.eventbrite.com/e/experience-food-science-field-to-package-registration-53913231928>



JUN
24

Experience Food Science: Field to Package

by Ohio Soybean Council &
GrowNextGen

Free



[Register](#)

Description

Want to increase your knowledge of food science? This workshop is targeted to Biology, Chemistry, Food and Consumer Science, AFNR Bioscience (A3), and any other teachers interested in how the principles of Chemistry, Biology, and Physics apply to the research, development, processing, packaging and distribution of food products

Date And Time

Mon, Jun 24, 2019, 8:00 AM –
Tue, Jun 25, 2019, 4:00 PM EDT
[Add to Calendar](#)

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Questions?
