



**UNIT 3:  
FOOD AND POWER**

L.27

**FOOD  
INDUSTRY  
SCIENCE**

## Note to Teachers

The food industry works hard to make products that we cannot resist. While the knowledge and processes on which processed foods are based are not intrinsically bad, they have been used by the food industry to develop products that offer poor nutrition and have contributed to the obesity epidemic. Today's lesson will explore how and why.

### Goals *In this lesson, students will*

- understand that food scientists consciously and carefully engineer foods so that they have maximal appeal to eaters, often without regard for health impacts.
- understand that food scientists work to make foods irresistible to support the economic success of their companies, rather than the health of eaters.

### Objectives

- Students will use a short writing prompt to begin the process of understanding why snack foods are so appealing as to be addictive.
- Students will study and discuss a short reading to learn about specific goals—and the language to describe them—that the food industry uses to shape the development of its products.

### Materials

- Student reading



## FOOD INDUSTRY SCIENCE

Please use this margin to notate how to best adapt this curriculum to your students.

### Instructions

#### Part I: Starting with Potato Chips

1. **FOCUSED FREE WRITE:** What are the characteristics of a perfect potato chip? Describe in detail.
  - a. Share responses. Encourage students to provide as much detail as they can. Use those responses to highlight which of the senses are activated by potato chips – taste and smell, but also sound, sight and touch.
  - b. Ask students to think about the chip itself but also about the crinkle of the bag and that whoosh of air that escapes when it opens. They should also consider the moments when they are likely to eat potato chips—and any positive associations they might therefore evoke.
  - c. They may all agree that potato chips can be delicious and fun, though they may also recognize that potato chips are not a particularly healthy food and should be eaten in moderation.

**NOTE TO TEACHERS:** this lesson is not a condemnation of the potato chip, but an attempt to set a context for a discussion of food science and an exploration of its consequences.

2. The more specific students can be, the more likely they will be to understand the concept that you want to introduce next: the idea that processed foods are highly engineered.
  - a. Explain the following: Each aspect of their responses is carefully studied, developed in the lab and kitchen, and subjected to various levels of tasters.
  - b. Today's discussion will address some of the key concepts that drive the work of food scientists.

#### Part II: Food Industry Science

1. Distribute the handout, and ask a student to read the introduction.
  - a. Address the issue of “mouth feel” as a group.
  - b. Ask a student to read the paragraph aloud.
  - c. Ask students whether this concept is familiar to them, and if so to add to the description. If not, ask students what this concept brings to mind.
2. To help students, ask them to imagine the experience of drinking water. Then to imagine eating ice cream or pudding. How does the ice cream or pudding feel differently in their mouth than water?

Some students will undoubtedly focus on the coldness of ice cream or pudding, but hopefully will also identify that way the creaminess of the thick and rich dessert feels in their mouth.

3. Divide students into three groups and assign one remaining section to each of the three groups.
  - a. Explain that each section addresses one concept central to food product development.
  - b. Ask students to read carefully and to take notes, highlight, or annotate (whatever works best for your group).

Give students 10 to 15 minutes.



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4. Ask each group to discuss what they have read, and to consider any questions they have about it. Their goal here is to identify:
  - a. The theme addressed in their excerpts.
  - b. The reason(s) why the theme is important to food scientists.

Ask students to remember that they will be teaching an idea to students who have not read the same text as they have and will need to be very clear that they understand and can communicate what they have learned.
  - c. If you have time, and think that it might stir the students to push a bit further, ask them to design a food company motto on the basis of that concept.
5. Ask each group to share their findings, beginning with their motto.
  - a. Give other students time to ask questions, and then open the floor for follow up discussion.
  - b. **NOTE TO TEACHERS:** although it can be hard to do, it is helpful to try to keep this conversation as neutral as possible. We can criticize the practices of food companies, but need to recognize that many of our students live almost completely on the products they make.

### Part III: Cooking Lab

Lesson 27's cooking lab encourages students to explore health snacks that are delicious but homemade. Simple snacks can be satisfying without having the addictive qualities of processed foods. The recipe included here, Super Seedy Granola Bars, can be paired with fruit or a simple hummus prepared in a mortar and pestle with carrot sticks. Because these bars contain seeds rather than nuts and can use sun butter (from sunflower seeds), they avoid common allergens.



# FOOD INDUSTRY SCIENCE

Have you ever wondered who creates all of those varieties of breakfast cereal and frozen dinners, and how they make the packaged food you buy? Processed and packaged foods are carefully engineered and their development is the painstaking work of food scientists, who “optimize” foods to maximize their appeal to us, the consumers. The excerpts below from Michael Moss’s *Salt, Sugar, Fat* and Nicola Twilley’s “Accounting for Taste” illustrate some of the principles and techniques that lay behind food science:



Use the space below to note key ideas, themes, or surprising takeaways from the reading.

Handwriting lines for notes

## I. Mouth Feel

In testing new food products, tasters evaluate the taste and smell of food products along with “the powerful sensory force that food scientists call ‘mouth feel.’ This is the way a product interacts with the mouth, as defined more specifically by a host of related sensations, from dryness to gumminess to moisture release. These are terms more familiar to people in tasting wines, but the mouth feel of soda and many other food items, especially those high in fat, is second only to the bliss point [see below] in its ability to predict how much craving a product will induce.”<sup>1</sup>

## II. The Bliss Point

Based on the pioneering work of food engineer Howard Moskowitz, “bliss point” is a term coined to describe the perfect amount of sugar, salt and fat added to a food product “to create the ‘greatest crave.’”<sup>2</sup>

“Moskowitz’s path to mastering the bliss point began. . . whe[n] the U.S. Army hired him to work in its research labs. The military has long been in a peculiar bind when it comes to food: how to get soldiers to eat more rations when they are in the field, running operations. . . .Soldiers would gradually find the[ir meals-ready-to-eat] so boring that they would toss them away, half-eaten, and not get all the calories they needed. But what was causing this M.R.E.-fatigue was a mystery. ‘So I started asking soldiers how frequently they would like to eat this or that, trying to figure out which products they would find boring,’ he said. The answers he got were inconsistent. ‘They liked flavorful foods like turkey tetrazzini, but only at first; they quickly grew tired of them. On the other hand, mundane foods like white bread would never get them too excited, but they could eat lots and lots of it without feeling they’d had enough.’

“This contradiction is known as ‘sensory-specific satiety.’ In lay terms, this is the tendency for big, distinct flavors to overwhelm the brain, which responds by making you feel full, or satiated, really fast. Sensory-specific satiety not only

1) Michael Moss, *Salt Sugar Fat* (New York: Random House, 2013), 42.  
2) Moss, 29.



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helped shape the Army’s mass-production of MRE’s; it also became a guiding principle for the processed-food industry. The biggest hits—be they Coca-Cola or Doritos or Kraft’s Velveeta Cheese Skillets dinner kits—owe their success to formulas that pique the taste buds enough to be alluring but don’t have a distinct overriding single flavor that tells the brain: Enough already!”<sup>3</sup>

### III. Engineering for Addiction

Robert I-San Lin worked for Frito-Lay, “the \$4-billion-a-year manufacturer of blockbuster brands like Lay’s, Doritos, Cheetos, and, of course, Fritos. . . He was its chief scientist, which meant that it was his job to figure out ways to keep consumers buying these snacks.”<sup>4</sup>

“Lin was working for Frito-Lay when consumer advocates in the United States had launched their first attacks on salty foods. Alarmed by the links to high blood pressure and heart disease, they asked federal regulators in 1978 to reclassify salt as a ‘risky’ food additive, which could have subjected it to severe controls. No company took this threat more seriously than Frito-Lay, Lin explained. This was due in part to the salty nature of the company’s snacks but also to its strong. . . corporate culture that tolerated no meddling—in the form of regulation—from the fools up in Washington, D.C. The company’s top officials took the push against salt personally. Lin found himself caught between corporate and public interests, struggling to reconcile what was best for the company with what was best for its customers.

“The details that emerged from [records kept by Lin] underscored concern that Lin had for consumers and of the company’s intent on using science not to address the health concerns but to thwart them. While at Frito-Lay, Lin and other company scientists spoke openly about the country’s excessive consumption of sodium and the fact that, as Lin said to me on more than one occasion, ‘people get addicted to salt’.”<sup>5</sup> Lin left the company in 1982.

In 1986, Frito-Lay experienced “a rare cold streak,”<sup>6</sup> with the failure of several new products. Yet, sales were up, and craving expert Dwight Risky realized “baby boomers were not eating fewer salty snacks as they aged. Quite the contrary. ‘In fact, as those people aged, their consumption of all those segments—the cookies, the crackers, the candy, the chips—was going up!’ Risky said. ‘They were not only eating what they ate when they were younger, they were eating more of it’. . . Baby boomers were eating more at age thirty than they had at twenty—and they weren’t alone. Everyone in the country, on average, was eating more salty snacks than they used to.”

“Risky had a theory about what caused this surge in snack eating by the boomers. Eating real meals had become a thing of the past. Baby boomers, especially, seemed to have abandoned the traditional concept of breakfast, lunch, and dinner—or, at least, they were not conducting these rituals as regularly as

3) Moss, 32 and 33.

4) Moss, 303.

5) Moss, 304 and 305.

6) Moss, 315.



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they once had. . . When they skipped meals, they replaced them with convenient snacks—pulled from cupboards, convenience stores, or the office vending machine. ‘We looked at this behavior, and said, “Oh, my gosh, people were skipping meals right and left,”’ Risky told me. ‘It was amazing.’ This led to the next realization, that baby boomers was not a category that is mature, with no growth. This is a category that has huge growth potential. So we started working hard to realize that growth”<sup>7</sup>

“The food technicians. . . stopped worrying about inventing new products. . . and instead embraced the industry’s most basic—and reliable—method for getting consumers to buy more food: the line extension. They took their existing snacks and spun them into endless varieties. The classic Lay’s were joined by Salt & Vinegar, Salt & Pepper, and Cheddar & Sour Cream. They put out Frito’s in Barbecue and Chili-Cheese varieties, and Cheetos. . . were transformed into twenty-one varieties.”<sup>8</sup>

Michael Moss visited food scientist Steven Witherly, to better understand the inventiveness of food engineers. “Witherly has written a fascinating guide for industry insiders titled, ‘Why Humans Like Junk Food’, and I brought him two shopping bags filled with a variety of chips to taste. He zeroed right in on the Cheetos.

“‘This. . . is one of the most marvelously constructed foods on the planet, in terms of pure pleasure’, ticking off a dozen attributes of the Cheetos that make the brain say “more.” A key one is the puff’s uncanny ability to melt in the mouth like chocolate. ‘It’s called vanishing caloric density,’ Witherly said. ‘If something melts down quickly, your brain thinks that there’s no calories in it. . . you can just keep eating it forever.’ . . .

“Frito-Lay had a formidable research complex near Dallas, where nearly 500 chemists, psychologists and technicians conducted research that cost up to \$30 million a year. Their tools included a \$40,000 device that simulated a chewing mouth to test and perfect the chips, discovering things like the perfect break point: People like a chip that snaps with about four pounds of pressure per square inch, no more or less.”<sup>9</sup>

“In 1986, as obesity rates in America started their climb, a massive multiyear study began that tracked the eating habits of Americans. The study was hardly representative of all Americans. The subjects all worked in the health field . . . These men and women were . . . likely to be more conscious about the nutritional aspects of the foods they ate, so the findings might well understate the overall American trend. The study followed 120,877 women and men. The researchers excluded people who were already overweight and monitored everything that they ate as well as their physical activity and smoking. In the ongoing study, the participants have been surveyed every four years.

7) Moss, 317 and 318.

8) Moss, 320.

9) Moss, 320-321.



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“In 2011, the *New England Journal of Medicine* published the latest results. Every four years since 1986, the participants exercised less, watched TV more, and gained an average of 3.35 pounds. The researchers wanted to know what foods were causing the largest share of the weight gain, so they parsed the data by the caloric content of the foods being eaten. The top contributors to weight gain included red meat and processed meats, sugar-sweetened beverages, and potatoes, including mashed and French fries. But far and away, the largest weight-inducing food, outstripping all others, was the potato chip.”

While generously-sized packages were part of the reason, “[t]he chip’s ingredients were likely just as effective, if not more so, in leading people to overeat. This starts with the coating of salt, which the tongue hits first, but there is much more inside the chip. They are loaded with fat, which gives them most of their calories. It also delivers the sensation called mouthfeel the moment they are chewed. As food scientists know, fat in the mouth. . . is a marvelous sensation, which the brain rewards with instant feelings of pleasure.

“Potato chips are also loaded with sugar. . . The sugar in regular chips is the kind of sugar that the body gets from the starch in the potatoes. Starch is considered a carbohydrate, but more precisely it is made of glucose. . . and the glucose starts working on you like sugar the moment you bite into it, said Eric Rimm, an associate professor of epidemiology and nutrition at the Harvard School of Public Health and one of the study’s authors. ‘The starch is readily absorbed,’ he told me. ‘More quickly even than a similar amount of [pure table] sugar. The starch, in turn, causes the glucose levels in the blood to spike’”—a result that causes the body to crave more of that food.<sup>10</sup>

### IV. Packaging and Auditory Stimuli

Experimental psychologist Charles Spence wondered whether sound could shape the perception of taste. “Over the next few weeks, Spence invited twenty research subjects to his basement lab and sat them in front of a microphone in a soundproof booth. There they were handed a pair of headphones and instructed to bite, one by one, into nearly two hundred Pringles original-flavor chips. After a single crunch, each subject spat out the chip and gave it a rating: crisper or less crisp, fresh or less fresh. The subjects could hear each crunch as it looped from the mike into the headphones. But, without letting the participants know, Spence funneled the crunching noises through an amplifier and an equalizer, allowing him to boost or muffle particular frequencies or the over-all volume. About an hour later, released from the booth, each subject was asked whether he or she thought all the chips were the same.

“The chips were identical, of course, but nearly all the volunteers reported that they were different—that some had come from cans that had been sitting open awhile and others were fresh. When Spence analyzed his results, he saw that the Pringles that made a louder, higher-pitched crunch were perceived to be a full fifteen per cent fresher than the softer-sounding chips. The experiment was the first to successfully demonstrate that food could be made to taste different through the addition or subtraction of sound alone. . .

Going beyond taste and smell, Spence explores how sight, sound and touch shape our experiences of food. “Over the past decade, Spence has conducted a

<sup>10</sup>) Moss, 328-329.









**FOOD INDUSTRY SCIENCE****SUPER  
SEEDY  
GRANOLA  
BARS**

16 students

Double this recipe for a class of 16. Split the class in half and have each group make the recipe once.

**Equipment List**

- Oven/toaster oven
- Food processor
- 2 large mixing bowls
- Small saucepan
- Burner
- 3 mixing spoons
- Parchment paper
- 2 cutting boards
- 2 knives
- 2, 8x8 baking dishes or other small pans
- Access to fridge or freezer
- Airtight container for storage
- 2 x ½ cup dry measure
- 2 x 1-cup dry measure
- 4 x 1 Tbsp
- 1 x 2 cup wet measure cup
- 1 x ¼ cup dry measure

**Food Items**

- 1 ½ cups rolled oats
- 1 ½ cup raw almonds, walnuts or pecans
- 2 Tbsp pepitas (roasted or raw)
- 1 heaping packed cup dates, pitted
- 2 Tbsp chia seeds
- 2 Tbsp flax seeds (ground or whole)
- 2 Tbsp hemp seeds
- ¼ cup agave nectar, maple syrup or honey
- ¼ cup creamy salted peanut butter, almond butter, or other alternative butter



## FOOD INDUSTRY SCIENCE

SUPER  
SEEDY  
GRANOLA  
BARS

YIELD: 6 servings as a side dish

## Ingredients

- 1 ½ cups rolled oats
- 1 ½ cup raw almonds, walnuts or pecans, roughly chopped
- 2 Tbsp pepitas, roughly chopped (roasted or raw)
- 1 heaping packed cup dates, pitted
- 2 Tbsp chia seeds
- 2 Tbsp flax seeds (ground or whole)
- 2 Tbsp hemp seeds
- ¼ cup agave nectar, maple syrup or honey
- ¼ cup creamy salted peanut butter, almond butter, or other alternative butter

## Directions

1. Toast oats, almonds and pepitas in a 350F oven for about 13-15 minutes or until slightly golden.
2. Process dates in a food processor until small bits remain, about 1 minute. It should form a dough-like consistency.
3. Place oats, almonds and dates in a large mixing bowl. Add seeds and set aside.
4. Warm agave and nut butter in a small saucepan over low heat. Stir and pour over oat mixture and then mix, breaking up the dates to disperse throughout. Use a spoon or your hands to mix thoroughly.
5. Transfer to an 8x8 dish or other small pan lined with plastic wrap or parchment paper so they lift out easily.
6. Cover with parchment or plastic wrap and press down with something flat to get them really packed tight. This will help them from being crumbly. Chill in the fridge or freezer for 15-20 minutes to harden.
7. Remove bars from dish and cut into 10 even bars. Store in an airtight container for up to a few days.

