

TEACHER GUIDE



**Activities and resources based on the Tampa Bay
Times Newspaper in Education publication
*Science of Chocolate.***

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About Newspaper in Education

The Tampa Bay Times Newspaper in Education program (NIE) is a cooperative effort between schools and the Times Publishing Co. to encourage the use of newspapers, in both print and digital form, as educational resources.

NIE serves educators, students and families by providing schools with classroom access to the Pulitzer Prize-winning [Tampa Bay Times](#), plus award-winning original educational publications, teacher guides, lesson plans, educator workshops and many more resources – all at no cost to schools, teachers or families. NIE teaching materials cover a variety of subjects and are aligned with Florida’s education standards.

For more information about NIE, visit tampabay.com/nie, call 727-893-8138 or email ordernie@tampabay.com. Follow us on Facebook at facebook.com/TBTNIE.

NIE is a member of Florida Press Educational Services (FPES), a non-profit 501(c)(3) organization of newspaper professionals that promotes literacy, civic engagement and critical thinking, particularly for young people. To learn more about FPES, visit fpesnie.org.

Newspapers as informational text

The newspaper is an excellent source of informational text.

Informational text is nonfiction text whose primary purpose is to inform the reader about the natural or social world. Reading and interpreting informational text is a fundamental component of the Florida’s [B.E.S.T. Standards for English/Language Arts](#).

Informational text employs a variety of structures to assist the reader in finding information quickly and efficiently. These can include a table of contents, an index, bold or italicized text, glossaries for specialized vocabulary, embedded definitions for specialized vocabulary, realistic illustrations of photos, captions and other labels, and graphs and charts – all elements commonly found in newspapers.

Newspapers as primary and secondary sources

“Working with primary sources builds a wide range of student skills, from reading complex texts to assessing the credibility of sources to conducting research.”

- Library of Congress

The newspaper is both a primary and secondary source.

Primary sources are the raw materials of history – original documents and objects that were created at the time under study. Primary sources found in newspapers include news articles, photographs, drawings, interviews, eyewitness accounts and maps.

Secondary sources are accounts that retell, analyze or interpret events, usually at a distance of time or place. Secondary sources found in newspapers include reviews, critical analyses and second-person accounts.

Read more from the [Library of Congress](#).

Using the newspaper to teach science

Newspapers are a critical tool for exploring science beyond the classroom and for developing scientific literacy and critical thinking skills. They provide a “living textbook” that updates and extends information contained in textbooks. They also demonstrate practical applications of skills and concepts presented in school curriculum by helping students relate science to daily news relevant to their lives, happening *right now* in *their* state, community and neighborhood.

[This article](#) examines how newspapers and advertisements can be used as a context for developing scientific literacy and for promoting the development of critical thinking skills.

[This study](#) found that the use of newspapers in science teaching effectively enhanced the science learning performance of sixth-grade students.

Activities: Hands-on lab activities

Welding with chocolate

Watch the four-minute video *Welding with Chocolate* from The Institution of Engineering and Technology at [youtube.com/watch?v=YQVVle1vtEY](https://www.youtube.com/watch?v=YQVVle1vtEY).

As you watch, write down the answers to the following questions:

1. What is the purpose of this experiment?
2. How much weight does the single bar of chocolate hold?
3. How much weight does the box girder hold?
4. According to the presenter, why is the box girder so much stronger than the single bar?

As a class, discuss how the video demonstrates the scientific method.

1. Ask a question.
2. Do background research.
3. Form a hypothesis (a possible explanation that can be tested).
4. Test the hypothesis with an experiment.
5. Analyze the results of the experiment.
6. Draw a conclusion.
7. Communicate the results.

What other shapes do you think might form strong bridges?

Materials

- Bars of chocolate, unwrapped
- Hot water source
- Refillable glass bottles, 1 per group
- Refrigerator
- Solo cups, 2 per group
- Weights

Procedure

1. Working in small groups, research common bridge types.
2. Choose a shape to build out of chocolate. Form a hypothesis of how much weight it will hold compared to the shapes tested in the video.

3. Following the procedure shown in the video, use a bottle full of hot water to melt the edges of the unwrapped chocolate bars. Stick them together to form the bridge shape chosen by your group to test.
4. Place your bridge in a refrigerator to cool for at least one hour.
5. Once cooled, place your bridge across two upside-down solo cups with approximately one inch resting on each support.
6. Carefully place weights on the middle of your bridge until it collapses. Be sure to record any bending or other changes during the loading process. Record how much it successfully holds and at what weight it collapsed.
7. Compare your results with the hypothesis you formed.
8. As a class, compare your results. What shape held the most weight? The least? What conclusions can you draw?

Florida Standards: SC.6.N.1.1; SC.6.N.1.2; SC.6.N.1.4; SC.6.N.1.5; SC.6.N.2.1; SC.7.P.11.1; SC.7.N.1.1; SC.7.N.1.2; SC.7.N.1.3; SC.7.N.1.4; SC.7.N.1.6;; SC.8.P.9.1; SC.8.P.9.2; SC.8.P.9.3; SC.8.N.1.1; SC.8.N.1.2; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.4; ELA.68.C.2.1; ELA.68.C.5.1; ELA.68.V.1.1

How strong is your chocolate?

In this activity, students will test different types of chocolate bars to explore how material properties, such as microstructure, can influence the strength of a material.

Strength is a measurement of the maximum stress that a material can withstand. Stress is the force applied per the unit area. Using this metric, an engineer can determine the strength of any object, from a tiny bobby pin to a gigantic beam for a skyscraper.

Materials

- Milk chocolate bars, 1 per group
- Milk chocolate bars with almonds, 1 per group
- Milk chocolate bars with crisped rice, 1 per group
- Solo cups
- Weights
- Rulers

Procedure

1. Working in small groups, measure and record the following information about each chocolate bar:
 - a. type
 - b. width of the bar
 - c. thickness of the bar
2. For each type of chocolate bar, write down your prediction of how much weight you think it can hold.
3. Beginning with the plain milk chocolate bar, place each bar across two upside-down solo cups with approximately one inch resting on each support.
4. Carefully place weights on the middle of the bar until it collapses. Be sure to record any bending or other changes during the loading process. Record how much it successfully holds and at what weight it collapsed.
5. Compare your results with the predictions you made before the experiment. If they are different, why do you think that might be?
6. As a class, compare your results. What type held the most weight? The least? Did everyone see the same thing? Did bars of the same type perform differently for different groups? If yes, why do you think those differences occurred? What conclusions can you draw?
7. Calculate the class average for each type using the following formula:
$$\text{Average} = \frac{\text{Sum of all measurements}}{\text{\# of measurements}}$$

Source: Ceramic and Glass Industry Foundation, "How Strong is Your Chocolate?"

Florida Standards: SC.6.N.1.1; SC.6.N.1.2; SC.6.N.1.4; SC.6.N.1.5; SC.6.N.2.1; SC.7.P.11.1; SC.7.N.1.1; SC.7.N.1.2; SC.7.N.1.3; SC.7.N.1.4; SC.7.N.1.6;; SC.8.P.9.1; SC.8.P.9.2; SC.8.P.9.3; SC.8.N.1.1; SC.8.N.1.2; SC.K.P.8.1; SC.8.P.8.1; SC.8.P.8.2; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.4; ELA.68.C.2.1; ELA.68.C.5.1; ELA.68.V.1.1; MA.6.NSO.1.4; MA.6.AR.2.3; MA.7.NSO.2.2; MA.8.NSO.1.6

Cocoa butter separation

In this activity, students will explore emulsion.

An emulsion is a mixture of two liquids that would ordinarily not mix together, such as oil and vinegar. In an emulsion, one liquid (the dispersed phase) is dispersed in the other (the continuous phase).

To make an emulsion, you need an emulsifier and a force, such as whisking or beating, to break the oil droplets apart so they mix with the watery liquid.

Emulsifier molecules work by having a hydrophilic end (water-loving) and a hydrophobic end (water-hating). The hydrophilic end of the emulsifier molecule is attracted to the water, while the hydrophobic end is attracted to the fat or oil. By vigorously mixing the emulsifier with the water and fat or oil, a stable emulsion can be made.

There are two types of emulsions. The first is when water gets dispersed into fat or oil (such as butter, margarine or chocolate). The second is when fat or oil gets dispersed in water (such as milk, mayonnaise or salad dressing).

Materials

- Chocolate bars containing lecithin as an emulsifier (2)
- Butter knife
- Oven-safe beakers (2)
- Stirrer
- Oven

Procedure

1. Use the butter knife to scrape each chocolate bar into small flakes.
2. Fill both beakers $\frac{3}{4}$ full with hot water (approximately 60° C or 140° F).
3. Slowly pour the flakes from one bar into each beaker and let them settle on the bottom.
4. Gently agitate the flakes in one beaker with the stirrer. Do NOT mix vigorously.
5. Vigorously stir the flakes in the second beaker with the stirrer.
6. Place both beakers in a warm oven (approximately 50°-60° C or 120°-140° F) for 12 hours.
7. Carefully remove the beakers from the oven and let them come to room temperature.
8. Record your observations. What differences do you see between the substances in the two beakers?

9. As a class, discuss the following topics: In a chocolate emulsion, the fat (cocoa butter) is the continuous phase. In the beaker that was gently stirred, the fat remained in large globules, so when it melted, it separated and formed a separate layer. In the beaker that was vigorously stirred, the fat formed small droplets that could be coated with the emulsifier lecithin and thus remained suspended within the water as an emulsion.

Sources: *The Science of Chocolate* by Stephen T. Beckett; Institute of Food Science & Technology

Florida Standards: Florida Standards: SC.6.N.1.1; SC.6.N.1.2; SC.6.N.1.4; SC.6.N.1.5; SC.6.N.2.1; SC.7.P.11.1; SC.7.N.1.1; SC.7.N.1.2; SC.7.N.1.3; SC.7.N.1.4; SC.7.N.1.6;; SC.8.P.9.1; SC.8.P.9.2; SC.8.P.9.3; SC.8.N.1.1; SC.8.N.1.2; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.4; ELA.68.C.2.1; ELA.68.C.5.1; ELA.68.V.1.1

Distributions and percentages

Watch the 3½-minute video “How M&Ms Are Made” from the Food Network at [youtube.com/watch?v=FMojC4-xilA](https://www.youtube.com/watch?v=FMojC4-xilA).

According to the video, each bag of M&Ms contains 25% orange, 25% blue, and 12.5% each of brown, red, yellow and green candies.

In this activity, students will investigate number distributions and percentages.

Materials

- Individual bags of M&Ms (at least 20)
- Individual bags of Skittles, tubes of Smarties, or similar multicolored candy (at least 20)
- Student worksheets ([Appendix 8](#))

Procedure

1. For each package, record the total number of candies and the number of each individual color.
2. Calculate the overall percentage of colors present in the M&Ms. Do your percentages confirm the statement in the video? Create a pie chart illustrating your findings.
3. Calculate the overall percentage of colors present in the Skittles or Smarties. Are the percentages similar to, or different from, the M&Ms? Create a pie chart illustrating your findings.
4. Plot the number distribution and create a histogram of the total number of M&Ms in each package. (View a video from Khan Academy about creating a histogram by hand at youtu.be/gSEYtAjuZ-Y.)
5. Plot the number distribution and create a histogram of the total number of Skittles or Smarties in each package.
6. What conclusions can you draw?

Source: *The Science of Chocolate* by Stephen T. Beckett

Florida Standards: MA.6.NSO.1.1; MA.6.NSO.1.2; MA.6.AR.1.1; MA.6.AR.2.3; MA.6.AR.3.1; MA.6.AR.3.2; MA.6.AR.3.4; MA.6.AR.3.4; MA.7.NSO.1.1; MA.7.NSO.1.2; MA.7.NSO.2.2; MA.7.AR.2.1; MA.7.AR.3.1; MA.7.AR.3.2; MA.7.AR.4.3; MA.7.DP.1.3; MA.7.DP.1.5; MA.8.NSO.1.1; MA.8.NSO.1.2; MA.8.NSO.1.5; MA.8.NSO.1.6; MA.8.DP.1.1

Chocolate and gum: Like dissolves like

Chewing gums are typically composed of sugar, flavorings, softeners, and a polymer gum base. Chocolate is a natural food that contains cocoa butter, a fat, as the main ingredient.

Intermolecular forces are defined as attractive forces that molecules experience based on their dipole moments (which depend on the polarity of the bonds).

In order for one substance to dissolve in another, they must share similar intermolecular forces; this is known as the “like dissolves like” concept. In this activity, students will investigate the solubility of various components of chewing gum.

Watch the 6-minute video “Like Dissolves Like” at [youtube.com/watch?v=3pu86blm558](https://www.youtube.com/watch?v=3pu86blm558).

Materials

- Chewing gum, 1 piece per student
- Chocolate, 1 piece per student
- Tissues

Procedure

1. Distribute one piece of chewing gum and one piece of chocolate to each student.
2. Have students unwrap the gum. As a class, discuss: What does it look, smell, and feel like?
3. Have students put the gum in their mouths and chew it (keep the wrapper). Ask: What do you feel in your mouth when chewing the gum? How does it taste?
4. Have students spit the gum out onto the wrapper and observe any new properties. What does it look, smell, and feel like? Have participants share a few observations.
5. Have students put the gum back in their mouths.
6. Have students unwrap the chocolate and make some observations. What does it look, smell, and feel like? Have participants share a few observations.
7. Have students put the chocolate in their mouths and chew it with the gum, trying not to swallow any chocolate.
8. What do students observe about the properties of the gum now? Have participants share a few observations.
9. Have students spit everything into the tissue. What properties have changed? Is it still sticky? Have participants share a few observations.

As a class, discuss:

Knowing that chocolate is a mixture of milk, sugar, and cocoa butter, among other ingredients, which one of these do you think is the solvent for the gum base polymer?

You are experiencing a phenomenon that chemists sometime describe as “like dissolves like.” In this case, gum and chocolate have something chemically in common: they are both oil-based.

Can you think of any other instances when you have seen or experienced the “like dissolves like” phenomenon? Discuss with your classmates.

Source: *Journal of Chemical Education*, “A Sticky Situation: Chewing Gum and Solubility, JCE Classroom Activity #105”

Florida Standards: SC.6.N.1.1; SC.6.N.1.4; SC.6.N.1.5; SC.7.N.1.1; SC.7.N.1.2; SC.7.N.1.4; SC.8.N.1.1; SC.8.N.1.4; SC.8.N.1.6; SC.8.P.9.1; SC.8.P.9.2; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.4; ELA.68.C.2.1; ELA.68.C.5.1; ELA.68.V.1.1

Chemicals in chocolate

Read the ChemMatters article “Chocolate, the new health food. Or is it?” in [Appendix 1](#).

As you read, fill out the Chocolate Chemical Compounds Worksheet in [Appendix 2](#) with examples of specific compounds found in chocolate, along with benefits and drawbacks of the chemicals.

As a class, discuss these points:

- What is an example from the article that shows how chemical structure affects chemical function?
- Can students describe the role of antioxidants in terms of electron transfer?
- What effects in terms of molecular structure of the chemicals in the cocoa beans might be caused by drying or roasting?
- Chemically speaking, why do oils and fats have so many calories?

Source: American Association of Chemistry Teachers, “Chocolate: The New Health Food”

Florida Standards: SC.6.N.1.1; SC.7.N.1.1; SC.8.N.1.1; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.4; ELA.68.C.1.3; ELA.68.C.2.1; ELA.68.C.5.1; ELA.68.R.2.1; ELA.68.R.3.2; ELA.68.V.1.1

Extension activity: Poster presentation

Research poster presentations are a common way for students and professionals to share their findings and knowledge with peers and faculty members.

Working in small groups, choose one of the following chemicals to research and present:

- Caffeine
- Theobromine
- Anandamide
- Phenylethylamine
- Epicatechin
- Epigallocatechin
- Phenol and its derivatives

Each group should analyze their chemical to determine:

- The structural formula (given in the article)
- The molecular formula ($C_xH_yN_zO_w$). Students must figure this out from the structural formula.
- Properties, both chemical and physical
- Effects in the body
- Other interesting information

Groups should present the information in an informative, engaging, attractive format on chart paper, poster board or unlined paper.

Each team will share their findings with the class. In particular, they should explain how they determined the molecular formula by using the structural formula.

Source: American Association of Chemistry Teachers, "Chocolate: The New Health Food"

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; ELA.68.C.1.2; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.1.5; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.3.2; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.V.1.3

Activities: Evaluating science news

Evaluating scientific news sources

News stories are a great way to learn about new ideas, discoveries and research in science and technology. But some sources of information are not as good as others.

Many sources compete for attention online, including social media, partisan blogs and bogus sites posing as legitimate news organizations. Before believing information, you need to figure out if that information can be trusted.

Watch the PBS Learning video “How Sensational Claims Can Spread Misleading Information” at florida.pbslearningmedia.org/resource/how-sensational-claims-spread-misleading-info/video-mediawise-student-reporting-labs/.

What three questions should you ask whenever you see scientific claims online?

- Who is behind the information?
- What is the evidence?
- What do other sources say?

Many national and large regional news organizations, such as the Washington Post, the Tampa Bay Times or network news, have a track record of publishing accurate and verifiable information. Here are five steps that you can take:

1. **Do a quick search:** Conducting a simple search for information about a news source is a key first step in evaluating its credibility.
2. **Look for standards:** Reputable news organizations aspire to ethical guidelines and standards, including fairness, accuracy and independence.
3. **Check for transparency:** Quality news sources should be transparent, not only about their reporting practices (see above), but also about their ownership and funding.
4. **Examine how errors are handled:** Credible news sources are accountable for mistakes and correct them. Do you see evidence that this source corrects or clarifies errors?
5. **Assess news coverage:** An important step in vetting sources is taking time to read and assess several news articles.

Find an article about science that is interesting to you and that includes information or facts from at least two different individuals. Read through the article.

Next, read the article again and fill out the Source: Can I Trust the Creators? worksheet in [Appendix 3](#). On a scale of 1 to 10, where 1 is no trust and 10 is deep trust, rate your overall level of trust in the article and explain your rating.

As a class, discuss your findings.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.8.E.5.12; SC.68.N.1.6

Sources: News Literacy Project, [Is it legit?](#); NewseumED.org, [Source: Can I Trust the Creator?](#); PBS Learning Be MediaWise, [Evaluating Sources](#)

Evaluating science in the news

News stories are a great way to learn about new ideas, discoveries and research in science and technology. But some sources of information are not as good as others. Before believing information in the news, you need to figure out if that information can be trusted.

Read one of the chocolate-related articles in [Appendix 7](#), or find an article about science that is interesting to you. *Before* reading your article, write down your answers to the following questions.

- Article title:
- Date published or last updated:
- Is this date recent enough for your topic? Explain.
- Is the publisher/sponsor trustworthy? What are their basic values?

For online articles only:

- What domain does the URL use?
 - .gov or .edu (generally trustworthy)
 - .com, .net or .org (can be owned by anyone)
- Does the site's name match the URL?
- Are ads on the website (if any) clearly marked?

Now, read the article, then write down your answers to the following questions.

- What are the author's credentials/qualifications?
- What is the author trying to do?
 - Inform
 - Persuade
 - Present an opinion
 - Sell something
 - Entertain
- What affiliations or conflicts of interest are mentioned?
- Does the author seem objective (uses facts, not opinions)? Explain.
- Does the author give references for data or quotations?

Read the "Criteria for Evaluating Sources" worksheet In [Appendix 4](#). Based on all the information you found, is your article trustworthy?

Explain your decision using evidence from your answers and the “Criteria for Evaluating Sources” worksheet. Share your thoughts with your classmates.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.K12.EE.6.1; ELA.5.C.1.3; ELA.68.C.1.4; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.5.E.68.3; SC.68.N.1.6

Source: BioInteractive.org, [Evaluating Science in the News](#)

Extension activity: What does this mean to me?

Write a detailed paragraph reacting to the ideas in the article and their possible impacts. Your paragraph should answer one or more of the following questions:

1. What did you find interesting or surprising about the article?
2. How does the information in the article connect with what you’ve learned in science class?
3. How does the information in the article relate to you, your community or society in general?

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.5.E.68.3 SC.68.N.1.6

Source: BioInteractive.org, [Evaluating Science in the News](#)

E.S.C.A.P.E. Junk News

E.S.C.A.P.E., an acronym for six key concepts for evaluating information, is another tool to help consumers of science news determine whether information they find online is trustworthy.

E → **Evidence:** Do the facts hold up?

S → **Source:** Who made this, and can I trust them?

C → **Context:** What's the big picture?

A → **Audience:** Who is the intended audience?

P → **Purpose:** Why was this made?

E → **Execution:** How is this information presented?

As a class, review the E.S.C.A.P.E. Junk News poster in [Appendix 5](#).

Break the class into small groups and assign each group one or two of the E.S.C.A.P.E. concepts.

In small groups, read the Daily Mail Australia article “Pass the Easter Egg! New study reveals that eating chocolate doesn’t affect your Body Mass Index!” on the following page. Use the E.S.C.A.P.E. Junk News worksheets in [Appendix 5](#) to analyze it through the lens of your specific concept(s).

Share your group’s findings with the class. As a class, decide if the story is trustworthy or not. Class discussion questions:

1. From one E.S.C.A.P.E. concept alone, could you make a determination about the reliability of this story? Why or why not?
2. Which of these concepts do you think is the most helpful in figuring out whether information is reliable? Why?
3. Which of these concepts do you think is the most difficult to understand or apply? Why?
4. Did you feel you had enough time to apply your concept to this story? In real life, how could you speed up the process of evaluating information that crosses your path?

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.5.E.68.3; SC.68.N.1.6

Source: NewseumED.org, [E.S.C.A.P.E. Junk News](#)

Pass the Easter Egg! New study reveals that eating chocolate doesn't affect your Body Mass Index!

- New research from Roy Morgan reveals there's no proof that chocolate consumption affects BMI
- Currently two thirds of Australians eat chocolate at least once a month
- Chocolate also found to benefit brain, heart and stress levels

By SAM BAILEY FOR DAILY MAIL AUSTRALIA
PUBLISHED: 02:22 EST, 31 March 2015 | UPDATED: 14:31 EST, 3 June 2015

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From the endless chocolate blocks passed around the office, to the glaring supermarket aisles and the family relatives who miraculously appear with baskets of eggs, Easter can be a minefield to navigate if you're trying to watch your waistline.

But according to new research, there's no need to go easy on the eggs this week, with a **Roy Morgan study** revealing there is no direct connection between chocolate consumption and an increasing Body Mass Index (BMI).

This should come as sweet relief for chocoholics when according to **Roy Morgan**, two thirds of Australians admit to munching on chocolate at least once a month.



+3
View gallery

Eggsellent news: A chocolate a day is found to not affect your Body Mass Index

While chocolate has long held a reputation for being an 'unhealthy' snack, evidence now indicates cocoa packs more for its punch than what we've been giving it credit for.

The research lead by **Roy Morgan** discovered while 67 per cent of Australian adults agree that they restrict how much fattening food they eat, they still will sneak some kind of chocolate into their diet over a four week period and 74 per cent will consume it at least once in a month.

Interestingly, 68 per cent of those who ticked the 'I'm constantly watching my weight' statement and the 'prefer to eat healthy snacks' still meet the once a month quota.

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ADVERTISEMENT

Evaluating scientific arguments in the news

In everyday life, an argument is a disagreement between people. But in science, an argument is a statement backed by evidence. The purpose of a scientific argument is to answer a question about the natural world. The basic components of an argument are:

1. **Claim:** A statement backed by evidence.
2. **Evidence:** The information (data or observations) that supports the claim. It should be objective and based on facts.
3. **Reasoning:** The explanation of how the evidence supports the claim. It should rely on accepted scientific theories and concepts.

Find an article about science in the Tampa Bay Times. Read through the article and write down your answers to the following questions as an outline or on a graphic organizer.

1. What is the claim?
2. What evidence is provided to support the claim?
3. What parts of the claim are supported by each data point or observation? You may find it helpful to mark up the article with highlights, underlining, circling or numbering.

As a class, discuss:

- Does the article present a strong argument? Why or why not? How might it be improved?
- How does the information in the article connect with what you've learned in science class?
- How does the information in the article relate to you, your community or society in general?
- What did you find interesting or surprising about the article?

Florida Standards: SS.68.A.1.1; SC.68.N.1.5; ELA.68.R.2.4; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.C.1.3; ELA.68.C.1.5; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.F.1.4; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.V.1.3; SC.68.N.1.6; SS.68.A.1.1; SS.68.W.1.3

Sources: BioInteractive.org, [Evaluating Science in the News](#); The Lawrence Hall of Science, [Argumentation Toolkit](#)

Reading and interpreting scientific research

Often, news articles will point to a scientific research paper. The Internet has made scientific papers widely accessible. But because they are written for medical and scientific professionals, they can be difficult for people without a medical or scientific background to understand.

Reading and understanding research papers is a skill that every scientist has had to learn during graduate school. Reading a scientific paper is a completely different process from reading an article about science in a blog or newspaper.

Here are some tips to get you started, adapted from "[How to read and understand a scientific article](#)" by Jennifer A. Raff, Ph.D.

1. **Begin by reading the introduction, not the abstract.** The abstract is that dense first paragraph at the very beginning of a paper. In fact, that's often the only part of a paper that many non-scientists read when they're trying to build a scientific argument. (This is a terrible practice. Don't do it.)
2. **Identify the big question.** Not "What is this paper about?" but "What problem is this entire field trying to solve?" This helps you focus on why this research is being done. Look closely for evidence of agenda-motivated research.
3. **Summarize the background in five sentences or less.** What work has been done before in this field to answer the big question? What are the limitations of that work? What, according to the authors, needs to be done next? You need to be able to explain why this research has been done in order to understand it.
4. **Identify the specific question(s).** What exactly are the authors trying to answer with their research? There may be multiple questions, or just one. Write them down.
5. **Identify the approach.** What are the authors going to do to answer the specific question(s)?
6. **Read the methods section.** Draw a diagram for each experiment, showing exactly what the authors did. Include as much detail as you need to fully understand the work.
7. **Read the results section.** Write one or more paragraphs to summarize the results for each experiment, each figure, and each table. Don't yet try to decide what the results mean; just write down what they are. You'll often find that results are summarized in the figures and tables. Pay careful attention to them! Also pay attention to:
 - a. The words "significant" and "non-significant." These have precise statistical meanings.

- b. Graphs. Do they have error bars on them? For certain types of studies, a lack of confidence intervals is a major red flag.
 - c. The sample size. Has the study been conducted on 10 people, or 10,000 people? For some research purposes a sample size of 10 is sufficient, but for most studies larger is better.
8. **Determine whether the results answer the specific question(s).** What do you think they mean? Don't move on until you have thought about this. It's OK to change your mind in light of the authors' interpretation -- in fact, you probably will if you're still a beginner at this kind of analysis -- but it's a really good habit to start forming your own interpretations before you read those of others.
9. **Read the conclusion/discussion/interpretation section.** What do the authors think the results mean? Do you agree with them? Can you come up with any alternative way of interpreting them? Do the authors identify any weaknesses in their own study? Do you see any that the authors missed? (Don't assume they're infallible!) What do they propose to do as a next step? Do you agree with that?
10. **Go back to the beginning and read the abstract.** Does it match what the authors said in the paper? Does it fit with your interpretation of the paper?
11. **Find out what other researchers say about the paper.** Who are the experts in this particular field? Do they have criticisms of the study that you haven't thought of, or do they generally support it? Don't neglect to do this – but do it last, so you are better prepared to think critically about what other people say.

Find a chocolate-related scientific article online. [Sciencedirect.com](https://www.sciencedirect.com) is a good place to start. Follow the steps above to read and understand the research. Using the articles in the Tampa Bay Times as models, write a news article summarizing the research for a general audience.

Share what you have learned with your class.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.5.E.68.3; SC.68.N.1.6

Source: “[How to read and understand a scientific article](#)” by Jennifer A. Raff, Ph.D. A full-length version of this article originally appeared on the author's personal blog (violentmetaphors.com).

Activities: Newspaper-based activities

Climate and chocolate

Watch the 7-minute PBS NewsHour video “Hard-hit cocoa harvests in West Africa cause chocolate prices to soar worldwide” at [youtube.com/watch?v=w2jXAf8S5DU&t=31s](https://www.youtube.com/watch?v=w2jXAf8S5DU&t=31s). As you watch, write down your answers to the following questions:

1. Who is interviewed for this story?
2. What unusual weather and other conditions have led to poor cocoa harvests?
3. When did the unusual conditions that led to poor harvests begin in West Africa?
4. How much of the world's cocoa is produced in the West African region impacted by poor harvests?
5. Why do poor harvests in West Africa have such a big impact on worldwide chocolate prices?

Next, read the Tampa Bay Times article “Chocolate prices are rising as cocoa rots in West Africa” in [Appendix 7](#).

As a class, discuss the following: Chocolate prices may represent a small part of our economy, but how greatly do you think the U.S. economy is impacted by crises outside the U.S., such as catastrophic weather? What do you think the U.S. can do to lessen the impacts of overseas crises on the economy? Write a blog post explaining what you have learned.

Source: PBS NewHour Daily News Lesson, “Climate effects in West Africa cause chocolate prices to soar worldwide”

Florida Standards: SC.6.E.7.6; SC.7.P.11.1; SC.8.P.9.3; ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4

Chocolate, the new health food

As a class, discuss:

- Do you like chocolate?
- What is your favorite way to eat chocolate?
- Can you describe specifically what you enjoy about eating it?
- What physical or chemical properties of chocolate could contribute to the experience of eating it?
- Do you think chocolate is healthy? Explain why or why not.

Work individually to fill out the first column of the What Do We Know About Chocolate? worksheet on the next page.

In the first column, write “Yes” or “No” indicating your agreement or disagreement with each statement. After making a decision about each statement compare answers with the person sitting next to you and discuss the reasons you have for differences in your choices.

Next, read the ChemMatters article “Chocolate, the new health food. Or is it?” in [Appendix 1](#).

As you read the article, compare your initial opinions with information from the article. In the space under each statement, write a statement from the article that supports or refutes your original ideas. When you are finished, compare notes again with a classmate. Do you agree?

As a class, discuss:

- What kind of health benefits are claimed for chocolate? What is the evidence for these benefits? How were the studies done?
- On the other hand, why might chocolate not be good for you?
- Did reading the article change your views on chocolate? Did you learn something new?

Source: American Association of Chemistry Teachers, “Chocolate: The New Health Food”

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.R.3.3; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4

Analyzing a newspaper article

In small groups or as a class, analyze one of the newspaper articles in [Appendix 7](#) using the following Observe-Reflect-Question analysis guiding questions.

OBSERVE: Identify and note details

Write down your answers to the following questions:

- Who published the article? Who was the audience for this article?
- Who was the audience for this newspaper?
- What type of article is this (eye-witness account, straight news article, feature article, editorial, column, reader contribution)?
- On what page and section does the article appear?
- What are the topics of other articles found on the same page or section?
- Is place relevant to this article? How?
- Are one or more dates listed in the article? Was this article written at or around the same time that the text relates to?
- What information is highlighted by the headline and other text callouts, if present?
- Are there any photos or illustrations? What additional information or explanation do they provide?
- What does the text describe, explain, or provide an opinion on?

Share what you have learned with your class.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.5.C.1.3; ELA.68.C.1.4; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.68.N.1.6

REFLECT: Generate and test hypotheses

Write down your answers to the following questions:

- What is the main idea of the article? List several facts or arguments that support the main idea of the article.
- Is this article a news story or an opinion piece? Is the article trying to inform or persuade? How do you know?
- Are there details that reference other people or events of the time period? What was happening during this time period?
- Why do you think this text was made? What might have been the author's or publisher's purpose? What evidence supports your theory?
- Who do you think was the audience for this article? What evidence supports your conclusion?
- If there was information about the author included, does that information suggest certain biases that person might have had? What do you think those biases were?
- Why do you think the author chose to include these specific details of description or explanation? What information or perspectives might have been left out of the article?
- What source or sources does the author quote or refer to in the article? Do you think these sources are reliable? Why or why not? What evidence supports your conclusion?
- Does this article show clear bias? If so, towards what or whom? What evidence supports your conclusion?
- What do you think the author might have wanted the audience to think or feel? Does the arrangement or presentation of words, illustrations, or both affect how the audience might think or feel? How?
- What do you feel after reading this article?
- If someone wrote this text today, what would be different? What would be the same?
- What did you learn from examining this article? Does any new information you learned contradict or support your prior knowledge about the topic of this article?

Share what you have learned with your class.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.5.C.1.3; ELA.68.C.1.4; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.68.N.1.6

QUESTION: What didn't you learn that you would like to know about?

Write down your answers to the following questions:

- What questions does this article raise?
- What do you wonder about . . .
 - Who?
 - What?
 - When?
 - Where?
 - Why?
 - How?
- Examine the words and phrases the author uses. Does the author's language support a particular perspective? Are different viewpoints presented?
- What sources might you consult to learn more?

Share what you have learned with your class.

Florida Standards: ELA.68.EE.1.1; ELA.68.EE.2.1; ELA.68.EE.3.1; ELA.68.EE.4.1; ELA.68.EE.5.1; ELA.68.EE.6.1; ELA.68.C.1.3; ELA.68.C.1.4; ELA.68.C.2.1; ELA.68.C.3.1; ELA.68.C.4.1; ELA.68.R.2.1; ELA.68.R.2.2; ELA.68.R.2.3; ELA.68.R.2.4; ELA.68.V.1.1; ELA.68.F.2.1; ELA.68.F.2.2; ELA.68.F.2.3; ELA.68.F.2.4; SS.68.A.1.1; SS.68.W.1.3; SC.68.N.1.6

Source: Library of Congress, [Getting Started with Primary Sources](#)

Selected teacher resources

American Heritage Chocolate – Chocolate Educational Resources

<https://www.americanheritagechocolate.com/free-educational-resources/>

Stephen T. Beckett, *The Science of Chocolate*

Sophie D. and Michael D. Coe, *The True History of Chocolate*

Cornell University Library – Online Exhibition CHOCOLATE: Food of the Gods

<https://exhibits.library.cornell.edu/chocolate-food-of-the-gods>

The Exploratorium – Exploring Chocolate

https://annex.exploratorium.edu/exploring/exploring_chocolate/index.html

Louis Evan Grivetti and Howard-Yana Shapiro (eds.), *Chocolate: History, Culture and Heritage*

The Field Museum – Cocoa Connections: From Beans to Bars: a Resource Kit for Educators

<http://archive.fieldmuseum.org/chocolate/education.html>

Hemispheres: The International Outreach Consortium – *Chocolate: From New World Currency to Global Obsession* (a unit of Explorers, Traders Tracking the Cultural and Social Impacts of the Global Commodity Trade & Merchants: A Curriculum Unit for Grades 9 – 12)

<https://utexas.box.com/shared/static/iebfqpwznzw6mafyswgkwlc6z2k158bp4.pdf>

HowStuffWorks – The History of Chocolate

<https://recipes.howstuffworks.com/food-facts/history-of-chocolate5.htm>

National Confectioners Association

<https://candyusa.com/>

Science of Cooking

<https://www.scienceofcooking.com/chocolate/science-of-chocolate.htm>

Tampa Bay Times Newspaper in Education, *History of Chocolate* curriculum supplement and teacher guide

https://nieonline.com/tbtimes/curriculum_social_studies.cfm#chocolate

Appendix 1

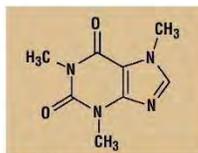
There is a word for you: “chocoholic,” when you *need* chocolate. Nothing else will do. Just thinking about hot fudge drizzling over ice cream raises your spirits. You crave a truffle, a Kit-Kat, a mug of velvety hot cocoa. Few, if any, other foods evoke such passion.

So what is unique about chocolate? Recent scientific findings are providing new evidence that chocolate may be healthier than is usually assumed.

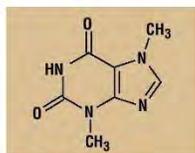
So many good chemicals ...

One of the reasons chocolate is unique is the temperature at which it melts: between 94 °F and 97 °F. A morsel of chocolate slides across your tongue and liquefies into a perfect puddle of taste sensation. The human body, at 98.6 °F is just above the chocolate’s melting temperature. “Melts in your mouth”? Definitely true.

Chocolate contains more than 300 chemicals. Caffeine, a stimulant, is the most well known, but it is present only in small amounts. Another stimulant is theobromine, found in amounts slightly higher than caffeine. The two molecules are identical except for one methyl group (CH₃), but it is not yet clear how they act together in chocolate.



Caffeine

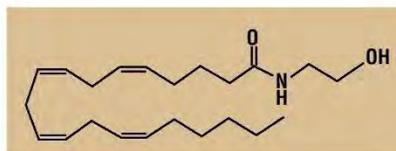


Theobromine

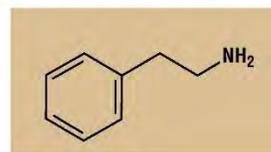


Another chemical known to make us happy when we eat chocolate is anandamide, so named because it means “bliss” in Sanskrit. Not only is it present in chocolate, but it is also produced by the brain and blocks out pain and depression.

But when anandamide is produced by the brain, it is broken down quickly, so its effects don't last. Emmanuelle diTomaso, an assistant biologist at Massachusetts General Hospital, Boston, Mass., and Daniele Piomelli, professor of pharmacology at the University of California-Irvine, have shown that chemicals in chocolate may inhibit this natural breakdown of anandamide. This means that when you eat chocolate, anandamide molecules from chocolate stay in the body longer.



Anandamide



Phenylethylamine



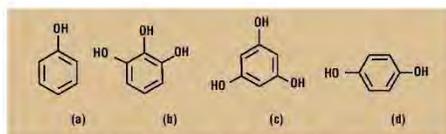
Then, there is phenylethylamine (PEA), a natural brain chemical which stimulates the parts of the brain that keep you alert and mimics the brain chemistry of a person in love.

Is chocolate healthy?

Recent studies have explored chemicals in chocolate called polyphenols, which belong to a larger group of chemicals called antioxidants. These chemicals protect cells against damage from free radicals—atoms, molecules, or ions with unpaired electrons.

Inside cells, free radicals damage DNA and have been associated with Alzheimer's disease, heart disease, and cancer. Antioxidants prevent this damage from happening by blocking the action of free radicals and may therefore reduce the risk of being affected by these diseases.

Antioxidants work by slowing or preventing a chemical reaction called oxidation, which can produce free radicals. Antioxidants terminate this reaction by preventing free radicals from being formed. Examples of antioxidants include thiols, which are organic compounds that contain a functional group composed of a sulfur atom and a hydrogen atom (-SH) and polyphenols, which are organic compounds that contain OH groups attached to six-membered benzene rings.



Phenol (a) and three examples of phenol derivatives: pyrogallol (b), phloroglucinol (c), and hydroquinone (d). These molecules are components of large molecules called polyphenols.

The health benefits of some polyphenols—such as quercetin, which is found in citrus fruit, buckwheat, and onions—are well established, while other polyphenols' health effects are still being investigated. The largest and best studied group of polyphenols are the flavonoids, a group of several thousand compounds present in various fruits, vegetables, and chocolate.

Joe Vinson, professor of chemistry at the University of Scranton, Pa., and his research students have found that polyphenols in chocolate have

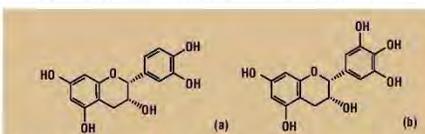
beneficial effects against heart disease. The scientists showed that cocoa polyphenols acted as antioxidants in the body, compared with coconut butter and sugar alone. Also, the scientists discovered that in hamsters, cocoa powder at a dose equivalent to two dark chocolate bars per day significantly inhibited atherosclerosis, a type of heart disease in which fat clogs up arteries, and raised the levels of good cholesterol.

Cocoa is especially rich in chemicals called flavanols, which are flavonoids also found in tea, wine, and nuts. Ian McDonald, professor of metabolic physiology at The University of Nottingham, and colleagues have shown that people who consumed a flavanol-rich cocoa beverage had increased blood flow in their brains. This result suggests that cocoa flavanols could be used to prevent vascular impairments in the brain resulting from, say, a stroke.

Norman Hollenberg, professor of medicine at the Harvard Medical School and Brigham and Women's Hospital, and colleagues have observed that the consumption of a flavanol-rich cocoa beverage also increases the amount of nitric oxide in the blood vessels, allowing them to dilate and stay pliable. This result suggests that cocoa flavanols could also be used to improve heart health.

Also, Juan Carlos Espin de Gea, a senior research scientist at the Spanish Research Council in Murcia, Spain, and colleagues are working on processing the cocoa beans differently to include the flavonoids

usually lost in the processing of the beans. They asked six volunteers to consume a milk beverage made with flavonoid-enriched cocoa and later to drink chocolate milk made from traditional cocoa. When they drank the flavonoid-enriched cocoa, these volunteers had eight times more of



Examples of flavanols: epicatechin (a) and epigallocatechin (b).

antioxidants epicatechin and procyanidin B2 than when they drank regular chocolate milk.

Another piece of good news: You might think that chocolate causes acne, decays teeth, and makes you fat. Not so. No current research connects specific foods to skin problems. Chocolate husks contain chemicals that prevent tooth decay (although they don't offset the added sugar), and too much food causes weight gain.

But how about all this saturated fat, usually blamed for the ills of chocolate? Let's look at how chocolate is made to understand why chocolate is not *totally* healthy.

How chocolate is made

The cacao beans used to make chocolate come from a tree called *Theobroma cacao* (food of the Gods) that is cultivated in the tropics. Tiny flies called midges pollinate the



trees, and each pod contains 20 to 60 seeds in a sweet pulp. The pods are removed from the tree, split with a machete, and the pulp and beans are removed and fermented under banana leaves in the sun.

Then, the sugary pulp breaks down, heating the beans. Many chemical changes take place, affecting flavor, aroma, and color. The rich cocoa aromas develop, and the beans change from purple to chocolate brown. After fermentation, the beans are dried on bamboo mats or wooden floors.

These dried beans are shipped to the manufacturing plants, where they are cleaned, sorted, and roasted. This roasting loosens the bean shells so they can be easily removed. What is left are dark chips called nibs, which are crushed



MIKE GIBBENS

to form a liquid paste called chocolate liquor.

To make dark, semisweet, and bittersweet chocolates, nibs and sugar (and sometimes additional cocoa butter) are mixed together for up to 72 hours to further smooth and blend all particles, creating creamy chocolate.

So here's the bad news: Cocoa butter is essentially all fat. There are three major kinds: a "bad-for-you" saturated fat called palmitic acid; oleic acid, a heart-healthy monounsaturated fat; and stearic acid, part of which later converts to oleic acid in the liver. Overall, one-third of chocolate's fat is known to be unhealthy. All three kinds of fats produce high amounts of calories in the body, although they do not cause an increase in blood cholesterol when consumed in chocolate.

Here's the good news: Chocolate straight from the tree has more beneficial chemicals than possibly any other food, including blueberries, red wine, or green tea. They are not only antioxidant, but anti-inflammatory, anti-allergic, anti-cancerous, and anti-viral.

So why is chocolate often rated junk? It's all in the processing. Processing determines whether chocolate is a healthy food or a high-calorie indulgence. Roasting and fermenting tends to decrease the amount of antioxidants. Food stores sell mainly milk chocolate, with sugar, milk, and extra cocoa butter added because they taste good, but the more noncocoa items are added to cocoa, the more dilute the healthy chemicals become.

Making healthier versions of chocolate

W. Jeffrey Hurst, principal scientist at Hershey Co., Hershey, Penn., and colleagues have compared the amount of antioxidants in cocoa-containing products. The products they considered were natural cocoa, unsweetened baking chocolate, dark chocolate, semisweet baking chips, milk

chocolate, and chocolate syrup. They discovered that natural cocoa contains the most antioxidants, followed by baking chocolates, dark chocolates, baking chips, and finally milk chocolate and syrups, when compared on an equal weight basis. So if you want to consume a lot of chocolate, you may be better off choosing natural cocoa or dark chocolate rather than milk chocolate or chocolate syrup.

Over the past two decades, various candy makers—including The Hershey Co. and Mars, Inc.—have been trying to use this scientific knowledge by making chocolate-based candies that are high in antioxidants and flavanols. The most recent trend is "premium" chocolate, often made of top-quality beans with high cacao content, no milk, and fewer additives.

Scientists may even be able to modify the genes of the cocoa tree in the future. Last June, Mars, Inc., partnered with IBM and the U.S. Department of Agriculture to launch a five-year project to unravel the genome of the cocoa bean. The team of scientists from these three institutions may find ways to make the cocoa tree more resistant to pests and disease and provide healthier, more nutritious, and better-tasting chocolate.

Want the most for your calories? And your dollars? Check out the nutrition information on the labels. The fewer additives, the better. Meanwhile, dark chocolate or chocolate nibs are a healthy alternative to milk chocolate or chocolate syrup.

So, is chocolate a healthy food, a luxury item, or junk? It can be all three, just not all at the same time. The choice is yours. Go easy! Go dark! Go chocolate! ▲

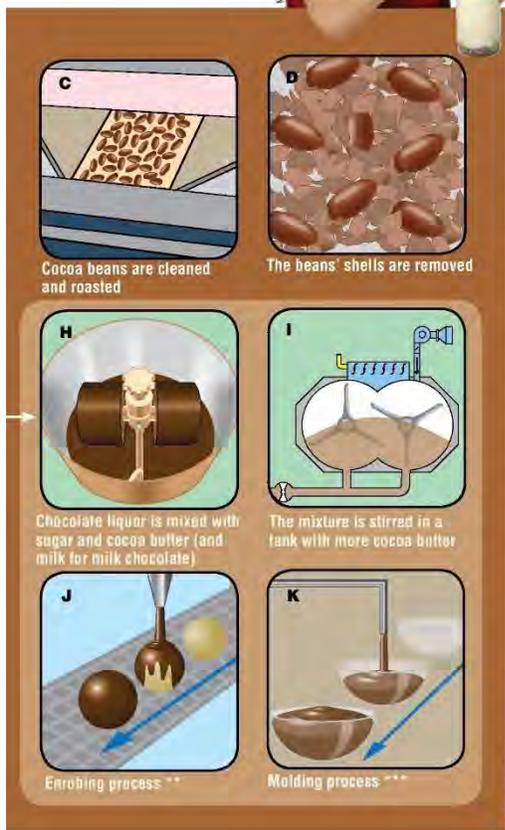


AP/ITERIMAGES

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Gail Kay Haines is a science writer and book author from Olympia, Wash. Her most recent article, "Coffee: Brain Booster to Go?" appeared in the December 2008 issue.



ANTHONY FERRELL/AGE

Appendix 2

Name: _____

Directions: As you read, give examples of specific compounds found in chocolate, along with the benefits or drawbacks of the chemicals.

TYPE OF COMPOUND	EXAMPLES	BENEFITS OR DRAWBACKS
Stimulants		
Polyphenol Components		
Flavanols		
Fats found in cocoa butter		

Appendix 3

Name:

Date:



Source: Can I Trust the Creators?

Find a news story that is interesting to you and that includes information/facts from at least two different individuals. Then use this chart to determine if it is a trustworthy source of information.

News story title:	Date:
Publication:	
Writer(s): (If there are more than one, pick one to research and circle their name.)	

Publication	Writer
Is there an About Page? (circle one): YES / NO If so, summarize the information.	Is there a bio or info page? (circle one): YES / NO If so, summarize the information.
Is there a parent company that owns the publication or another organization that funds it? If so, name it here.	Can you contact the writer via email or social media? (If yes, write their email or handle(s) here.)
What advertisements are on the page? Do any seem linked to suspicious products or services?	Does the writer have an active social media account(s)? How often do they post? Are their posts professional?
Do a search for the publication's name and list two additional facts about it: 1. 2.	Have they written other stories for the same publication or other publications? List two examples of their work: 1. 2.

Name:

Date:



Write one reason to trust this publication, if any.	Write one reason to trust this writer, if any.
Write one reason not to trust this publication, if any.	Write one reason not to trust the writer, if any.

Now that you have determined whether you should trust who produced the story, let's go deeper. Find two sources (people) who provided information for this story.

Source #1 name and description (if unnamed, write anonymous):	Source #2 name and description (if unnamed, write anonymous):
What information did this source provide?	What information did this source provide?
Search for the source's name (if given) to find out: 1. Are they an expert on this topic? 2. Would they have a reason to know the information they provided to the writer?	Search for the source's name (if given) to find out: 3. Are they an expert on this topic? 4. Would they have a reason to know the information they provided to the writer?
If the source is anonymous, why do you think the writer trusted them?	If the source is anonymous, why do you think the writer trusted them?
What else would you like to know about this source to determine how trustworthy they are?	What else would you like to know about this source to determine how trustworthy they are?

On a scale of 1 to 10, where 1 is no trust and 10 is deep trust, rate your overall level of trust in this story: Explain your rating.
--

Appendix 4



Criteria for Evaluating Sources (CRAP Test)

Adapted from the [CSU Chico CRAAP Test](#)

Question	Yes/No	Tips
Currency: The timeliness of the information		
Was the information published or updated recently ?		For a news article, check the date it was published. For a website, check the copyright date or “last updated” date.
Is the information recent enough for your topic?		For topics like current events or new research, it’s important to use up-to-date sources. For other topics, like history, older sources may also work.
If using a website, do the links work ?		A website with broken links might be outdated.
Reliability: The accuracy and truthfulness of the information		
Is the information supported by evidence like data or quotes? Are there references for the evidence?		If the source references a research study, try to find out more about the study. Make sure the study was valid and represented accurately.
Does the source make reasonable claims about what the evidence shows?		Some sources may overgeneralize the results of a study. Check where the study was done, how many individuals it tested, if it used humans or animals, etc. If the study used animals, for example, its results may not apply to humans.
Has the information (or its references) been reviewed ?		Be wary of information from a study that was not published in a peer-reviewed journal.
Can you confirm the information using another source or your own knowledge?		Trust your judgment and be wary of claims that have been shown to be false by a trustworthy source, such as an educational or government website.
Does the language or tone seem unbiased and professional ?		Avoid sources that use opinionated or biased language, or are poorly written with spelling and grammar errors.
Authority: The source of the information		
Is the author, publisher, or sponsor of the information a trustworthy source , such as an educational or government institution?		If you’re using a website, check the domain in the URL. In the United States, websites with the domain .edu are owned by educational institutions, and those with the domain .gov are owned by the government.
Is the author qualified to write on the topic?		Check the author’s credentials/qualifications to see how experienced they are with the topic.
Is the author likely to be unbiased about the topic?		Check the author’s background and organizations they work with to see if they may have biases or conflicts of interest.
Is there any contact information ?		Avoid sources without an email, publisher address, etc.
Purpose: The reason the information exists		
Is the purpose of the information to teach or inform , rather than to sell, entertain, or persuade?		Avoid sources that are just trying to sell products, get more views, or push a personal agenda. If there are any advertisements, they should be clearly marked as such.
Is the information fact , rather than opinion or propaganda?		The information should be objective, meaning that it uses facts instead of personal opinions or emotions.
Does the source’s point of view seem unbiased ?		Be wary of sources that have political, ideological, cultural, religious, institutional, or personal biases.

Appendix 5

NEWSEUM^{ED}
PRESENTS

facebook

E.S.C.A.P.E. JUNK NEWS

Visit
NewsEumED.org
for more
resources!

6 WAYS TO EVALUATE INFORMATION

<h2>E</h2> <p>EVIDENCE</p> <p>DO THE FACTS HOLD UP?</p> <p>Look for information you can verify.</p> <ul style="list-style-type: none"> • Names • Numbers • Places • Documents 	<h2>S</h2> <p>SOURCE</p> <p>WHO MADE THIS, AND CAN I TRUST THEM?</p> <p>Trace who has touched the story.</p> <ul style="list-style-type: none"> • Authors • Publishers • Funders • Aggregators • Social media users 	<h2>C</h2> <p>CONTEXT</p> <p>WHAT'S THE BIG PICTURE?</p> <p>Consider if this is the whole story and weigh other forces surrounding it.</p> <ul style="list-style-type: none"> • Current events • Cultural trends • Political goals • Financial pressures 	<h2>A</h2> <p>AUDIENCE</p> <p>WHO IS THE INTENDED AUDIENCE?</p> <p>Look for attempts to appeal to specific groups or types of people.</p> <ul style="list-style-type: none"> • Image choices • Presentation techniques • Language • Content 	<h2>P</h2> <p>PURPOSE</p> <p>WHY WAS THIS MADE?</p> <p>Look for clues to the motivation.</p> <ul style="list-style-type: none"> • The publisher's mission • Persuasive language or images • Moneymaking tactics • Stated or unstated agendas • Calls to action 	<h2>E</h2> <p>EXECUTION</p> <p>HOW IS THIS INFORMATION PRESENTED?</p> <p>Consider how the way it's made affects the impact.</p> <ul style="list-style-type: none"> • Style • Grammar • Tone • Image choices • Placement and layout
---	--	--	---	---	---

Name:

Date:



E.S.C.A.P.E. Junk News

E → Evidence

Do the facts hold up?

Your news story (title):

Choose three important facts from this story. The facts could be the names and roles of key individuals involved, a specific event that took place, a quote, a photograph or any other type of evidence that backs up the story.

Example fact: Fire Station 106 was closed because of a gas leak in the kitchen.

Example fact: Jennifer Smith was the firefighter who first noticed the problem.

Fact 1:

Fact 2:

Fact 3:

Verify these facts. In other words, find another source that independently reported the same fact (not a story that references the story you already have). List the second source that either confirms or contradicts each fact.

Fact 1: **Confirmed?** YES / NO

Source:

Fact 2: **Confirmed?** YES / NO

Source:

Fact 3: **Confirmed?** YES / NO

Source:

Based on this quick investigation, do you think the facts in this story hold up? YES / NO

Explain:

Name:

Date:



E.S.C.A.P.E. Junk News

S → Source

Who made this, and can I trust them?

Your news story (title):

Track down the following information for your news story:

1. **The publisher** (The site or organization that provided a space for this story; for example, *The Washington Times*)
2. **The author(s)** (The name(s) and profession(s) of the person or people who wrote it; for example, Sally Hawk, technology reporter)
3. **One source of information within the story** (A person, document or other source for the facts used in the story; for example, Juan Ortiz, a computer science professor, or *Tech Times* magazine survey on app usage)

For each element identified above, answer the following based on your overall impression. Using a scale of 1-10, where 1 is not at all and 10 is very strongly, how much do you trust these sources to provide accurate information about the topic of your news story?

1. **The publisher** 1 2 3 4 5 6 7 8 9 10

Explain your rating. (For example: I have never heard of this source and the website looks cheap)

2. **The author(s)** 1 2 3 4 5 6 7 8 9 10

Explain your rating.

3. **The source within the story** 1 2 3 4 5 6 7 8 9 10

Explain your rating.

Overall, do you think the story is a reliable source of information? YES / NO

Explain:

Name:

Date:



E.S.C.A.P.E. Junk News

C → Context

What's the big picture?

Your news story (title):

What is the main issue or event in this story?

Find and read two other stories about the same issue or event.

Story 1 **Title:**
Publication or website:

Story 2 **Title:**
Publication or website:

For each additional story, answer the following question: Did this story provide any new or different information about the event/issue?

Story 1 YES / NO
Explain:

Story 2 YES / NO
Explain:

Based on this quick investigation, do you think this story presents the big picture, or just a piece of the story?

BIG PICTURE / ONLY A PIECE
Explain:

Name:

Date:



E.S.C.A.P.E. Junk News

A → Audience

Who is the intended audience?

Your news story (title):

Publication/website:

Look closely at your news story and its publication/website and answer the following questions:

1. What does the **publication/website name** tell you about the intended audience? (For example, *The Washington Post* is intended in part for people living or interested in Washington, D.C.)
2. What does the **text of the story** tell you about the intended audience? (For example, difficult vocabulary or unusual terms might indicate that an article is intended for a well-educated audience.)
3. What does the **other content on the publication/website** tell you about the intended audience? (For example, is there a theme in the stories they publish? Do they often write about specific groups or interests?)
4. Based on your answers above, describe the type or types of individuals that make up the audience for this story:
5. Do you think the intended audience shaped the content of this story? In other words, did the writer or publisher change, omit or twist anything in the story to appeal to a certain group? YES / NO

Explain:

Name:

Date:



E.S.C.A.P.E. Junk News

P → Purpose Why was this made?

Your news story (title):

Look for the following possible purposes in your news story and explain why you think each one is or is not applicable.

1. Was this story made to **educate or inform** people about an event/issue? (Possible clues: detailed facts and clear sources, complete information about the topic) YES / NO

Explain:

2. Was this story made to **earn money** for the author or publisher? (Possible clues: ads around the story, appeals for money/support) YES / NO

Explain:

3. Was this story made to **influence** how someone feels about this event/issue? (Possible clues: labeled as opinion or perspective, highly emotional language that “tugs the heartstrings,” extreme praise or criticism for key individuals or groups involved in the event or issue) YES / NO

Explain:

Of the three purposes listed above, which do you think is the **main** purpose of this story, and why? (Or, if you think the purpose is something other than the three listed above, explain.)

Based on your answers above about this story's purpose, do you think the story is credible? YES / NO

Explain:

Name:

Date:



E.S.C.A.P.E. Junk News

E → Execution

How is this information presented?

Your news story (title):

On a scale of 1 to 10, where a 1 is very sloppy/poorly done and a 10 is very professional/well done, rate each of the following elements of your story:

1. **Clarity** (the writer's ability to clearly present information)

1 2 3 4 5 6 7 8 9 10

Explain your rating. (For example: I found this story very confusing.)

2. **Style** (the writer's tone and ability to engage a reader)

1 2 3 4 5 6 7 8 9 10

Explain your rating. (For example: I found this story very boring.)

3. **Grammar, typos and spelling** (the writer's technical abilities)

1 2 3 4 5 6 7 8 9 10

Explain your rating. (For example: I found lots of incomplete sentences.)

4. **Layout/format** (the way the story appears)

1 2 3 4 5 6 7 8 9 10

Explain your rating. (For example: The page is well-organized and easy to read.)

Based on this quick evaluation of the execution, do you think this information is reliable? YES / NO

Explain:

Appendix 6

What Do We Know About Chocolate? Worksheet

Me	Text	Statement
		Chocolate contains stimulants similar to those found in coffee.
		A chemical that makes us feel “blissful” and is produced naturally by the brain, is also found in chocolate.
		Scientists have found that antioxidant chemicals in chocolate can protect against heart disease.
		Chocolate causes acne.
		Chocolate comes from seeds that grow underground.
		Cocoa butter is produced from the oils of the cocoa bean.
		The fats in cocoa butter increase blood cholesterol.
		Natural cocoa has fewer antioxidants than chocolate syrup.
		Milk chocolate is healthier than dark chocolate.
		The fewer the additives, the less nutritious the chocolate.
		Beneficial compounds in chocolate are also found in tea, wine and nuts.
		This article may change my views on chocolate.

Chocolate prices are rising as cocoa rots in West Africa

BY MUMBI GITAU, BAUDELAIRE MIEU AND EKOW DONTOH
Bloomberg

The muck from incessant rain sloshes around Nestor N'Guessan's feet as he points to a plot of cocoa trees ravaged by rot on his farm in Ivory Coast, West Africa.

The 52-year-old grower can't save those plants from black pod disease, so he's focusing efforts on quarantining whatever healthy ones he has left. The soakings of recent months mean fewer pods on his trees, with some supporting just a handful of cocoa buds.

"I had to create a boundary to prevent the rest of the plantation from being contaminated," he said while pruning the healthy thicket. "Yields are low. The weather hasn't helped us."

It's a climate crisis playing out across Ivory Coast and Ghana, the heavyweights of cocoa, with consequences for global food inflation and the cost-of-living squeeze. Too much rain is lowering output and delaying harvests, with the resulting shortfall catapulting wholesale prices in New York to their highest in 46 years.

The total precipitation in West Africa since the rainy season started May 1 has been more than double the 30-year average, according to Maxar Technologies Inc. The damage to yields is compounded by growers' long struggle over pay, leaving them little money to pour back into their plots.

This is the main harvest period, and the constant deluge turns dirt roads into impassable swamps, knocks flowers off before they bud



Photos by PAUL NINSON | Bloomberg

A pile of cocoa pods shows signs of black pod disease during a harvest in Kwabeng, Ghana. Ghana's cocoa output is expected to be the lowest in 13 years.

and fosters breeding of a fungal infection that turns rugby-ball-sized pods into black mush.

Ghana's output is expected to be the lowest in 13 years, and Ivory Coast's the smallest in seven, based on totals provided by traders and exporters. Together, the countries produce about 60% of the world's beans, according to the International Cocoa Organization.

The most active futures are trading at the highest since 1977 in New York, soaring past \$4,200 a ton. At that price, you could buy about 50 barrels of oil.

"This is a bull market, and it hasn't peaked yet," said Fuad Mohammed Abubakar, head of government-affiliated Ghana Cocoa Marketing Co. (U.K.) Ltd., which sells and exports premium cocoa. "More risks lie ahead."

With sugar also reaching a decade high, consumers likely will spend more



Workers receive a delivery of cocoa beans at a processing plant in San Pedro, Ivory Coast.

for their chocolate bars, cookies and hot cocoa as Christmas approaches. The U.S. Department of Agriculture forecasts prices for sugar and sweets rising 8.9% this year and another 5.6% next year, outpacing total food inflation.

Citing higher supply costs, Mondelez International Inc., maker of Toble-

rone bars and Oreo cookies, will raise some prices next year, chief executive officer Dirk Van de Put told Bloomberg Television on Nov. 6. Nestle SA, owner of Haagen-Dazs ice cream and Quality Street candies, said it will do the same.

With assistance from Megan Durisin Albery.

Firms find new ways to grow cocoa, keep up with demand

By Amy Taxin
and Terry Chea
Associated Press

WEST SACRAMENTO, Calif. — Climate change is stressing rainforests where the highly sensitive cocoa bean grows, but chocolate lovers need not despair, say companies that are researching other ways to grow cocoa or develop cocoa substitutes.

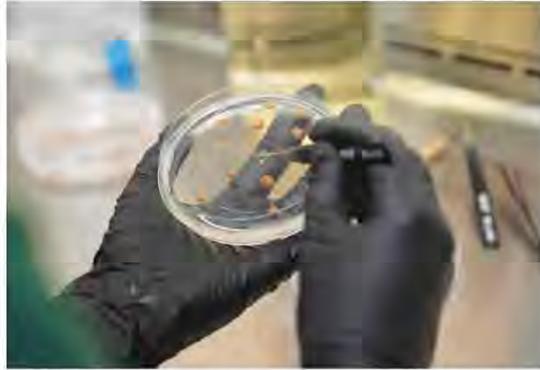
Scientists and entrepreneurs are working on ways to make more cocoa that stretch well beyond the tropics.

California Cultured, a plant cell culture company, is growing cocoa from cell cultures at a facility in West Sacramento, with plans to start selling its products next year. It puts cocoa bean cells in a vat with sugar water so they reproduce quickly and reach maturity in a week rather than the six to eight months a traditional harvest takes, said Alan Perlstein, the company's chief executive.

"We see just the demand of chocolate monstrously outstripping what is going to be available," Perlstein said.

Cocoa trees grow about 20 degrees north and south of the equator in regions with warm weather and abundant rain, including West Africa and South America. Climate change is expected to dry out the land under the additional heat. So scientists, entrepreneurs and chocolate lovers are coming up with ways to grow cocoa and make the crop more resilient and more resistant to pests — as well as craft chocolate-tasting cocoa alternatives to meet demand.

The market for chocolate is massive, with sales in the United States surpassing \$25 billion in 2023, according to the National Confectioners Association. Companies are looking at either bolstering the supply with cell-based cocoa or offering alternatives made from products ranging from oats to carob



California Cultured lab technician Aubrey McKeand works on cell cultures Aug. 28 in the company's lab in West Sacramento, California. **JEFF CHIU/AP**

that are roasted and flavored to produce a chocolaty taste for chips or filling.

The price of cocoa soared this year because of demand and troubles with the crop in West Africa caused by plant disease and changes in weather. The region produces the bulk of the world's cocoa.

The innovation is largely driven by demand for chocolate in the U.S. and Europe, said Carla D. Martin, executive director of the Fine Cacao and Chocolate Institute and a lecturer in African and African American Studies at Harvard University. While three-quarters of the world's cocoa is grown in West and Central Africa, only 4% is consumed there, she said.

The push to produce cocoa indoors in the U.S. comes after other products, such as chicken meat, have already been grown in labs. It also comes as supermarket shelves fill with evolving snack options — something that developers of cocoa alternatives say shows that people are ready to try what looks and tastes like a chocolate chip cookie even if the chip contains a cocoa substitute.

Planet A Foods in Planegg, Germany, contends that the taste of mass-market chocolate is derived largely

from the fermentation and roasting in making it, not the cocoa bean itself. The company's founders tested out ingredients ranging from olives to seaweed and settled on a mix of oats and sunflower seeds as the best tasting chocolate alternative, said Jessica Karch, a company spokesperson.

They called it ChoViva and it can be subbed into baked goods. "The idea is not to replace the high-quality, 80% dark chocolate, but really to have a lot of different products in the mass market," Karch said.

Yet while some are seeking to create alternative cocoa sources and substitutes, others are trying to bolster the supply of cocoa where it naturally grows.

Mars, which makes M&Ms and Snickers, has a research facility at University of California, Davis aimed at making cocoa plants more resilient, said Joanna Hwu, the company's senior director of cocoa plant science. The facility hosts a collection of cocoa trees so scientists can study what makes them disease-resistant to help farmers in producing countries and ensure a stable supply of beans.

"We see it as an opportunity, and our responsibility," Hwu said.

What's missing from your favorite chocolate bar? It may be chocolate

Experts say high cocoa prices have triggered a wave of 'reformulations' to recipes.

By Claire Brown | c. 2025 The New York Times

Almost no one noticed when, sometime over the last few years, the packaging on Almond Joy, Mr. Goodbar and Rolo was updated to remove the words "milk chocolate." The edits were easy to miss: The description on the front of the Mr. Goodbar wrapper changed from "milk chocolate with peanuts" to "chocolate candy with peanuts." Almond Joy is now marketed as a "coconut and almond chocolate candy bar." Rolos are now wrapped in "rich chocolate candy" instead of "milk chocolate."

I realized this earlier this year after eating a disappointing chocolate bar. It wasn't spoiled; it just didn't taste like I remembered. As a reporter who covers the climate, I'd read about global warming contributing to drought in West Africa and sending cocoa prices through the roof, and I knew candy companies had raised prices and shrunk portions.

But could it be that they were also tinkering with the makeup of the candy itself?

Yes, it turns out. Experts say high cocoa prices have triggered a wave of "reformulations," the industry term for recipe changes. Some candy companies are replacing expensive cocoa butter with other fats, a swap that means their products no longer meet the U.S. regulatory definition of milk chocolate and can no longer be called that on packaging.

That's why milk chocolate (a Food and Drug Administration-regulated term) has become chocolate candy. And these are just the most extreme examples. Armed with the latest confectionary techniques, candy scientists work hard to find reformulations that slip below the threshold for a mandatory label change. These might go undetected outside the industry and the tight-knit world of super-taster candy scientists.

Less cocoa

In recent years, longer droughts, extreme heat and irregular rainfall patterns have suppressed cocoa yields in West Africa, the crop's primary growing region. An infection carried by mealybugs has also spread rapidly. Financial speculators, the threat of tariffs, labor issues and other geopolitical factors have compounded the problems.

In February, nonprofit research group Climate Central published a study that found climate change had brought six additional weeks of extreme heat to



A worker prepares cocoa beans for roasting at a chocolatier in Grand-Bassam, Ivory Coast, in 2022. High cocoa prices in 2025 have triggered a wave of "reformulations," the industry term for recipe changes. THE NEW YORK TIMES

most West African growing regions per year over the last decade, suppressing crop productivity.

The result of all the recent upheaval in the cocoa market is that prices have shot upward, reaching a peak of more than \$10,000 per ton at the end of last year, roughly four times the price in 2022, according to the Federal Reserve Bank of St. Louis.

"When climate change bumps into structural problems and disease," said Judy Ganes, a food industry consultant, "then prices go up, and manufacturers are hesitant to pass through price increases and hurt their sales. Either consumers find something else, or they try to reformulate."

Food industry executives have openly acknowledged the trend of cutting down on cocoa ingredients to save money, but when it comes to answering questions about changes in their own recipes, they're far more circumspect.

Asked about reformulations in a February earnings call, Steve Voskuil, Hershey's chief financial officer, said, "It's a

place we look at, we test, and in some parts of our portfolio, over time, we've made some changes," and added that "there's been no consumer impact whatsoever."

The same month, Nestlé told investors it had saved more than \$500 million through recipe reformulations as it shared a slide showing high cocoa and coffee prices. When I asked Nestlé for more detail, a spokesperson said candy made up a small portion of the cost savings and that much of it came from addressing "recipe complexity" and "harmonizing recipes" from different brands.

How can you tell?

So how can you tell when your favorite candy changes? I compared current labels on the packages of Mr. Goodbar, Rolo caramels and Almond Joy with past ingredient lists using the crowdsourced database Open Food Facts, a U.S. Department of Agriculture ingredient database, and data compiled by Richard Hartel, a food science professor at the University of Wisconsin-Madison who each year

writes down ingredients in common chocolate bars for one of his classes.

According to the databases, Rolo and Mr. Goodbar have changed since 2023, and Almond Joy seems to have changed sometime between 2020 and 2022. The Hershey Co., which makes all three candies, declined to comment. (Mr. Goodbar was also not technically milk chocolate for a handful of years starting in 2008, before it apparently switched back.)

But comparing labels can only tell enterprising candy lovers so much. Food scientists say they're trained to tweak recipes in a manner that evades consumer detection.

Michelle Frame, founder of candy development company Victus Ars, was the first person to develop flavored Peeps, an achievement that helped land her in the Candy Hall of Fame.

In the last year or so, Frame has noticed changes creeping into her life outside the laboratory. The milk chocolate coating on a Snickers bar she bought seemed thinner than it used to be. She stopped buying a favor-

ite store-bought chocolate chip cookie after she noticed large chocolate chips had been replaced with a lower-quality substitute. (A Mars spokesperson said Snickers coatings have not changed since 2019, when the candy's coatings were reduced by a small amount.)

Frame said a common approach to reducing cocoa costs was to replace chocolate coating with compound coating, which is made with vegetable fats instead of cocoa butter. Some candy bars, like Butterfinger and Baby Ruth, have been made with compound coatings for years. Others, like Almond Joy, have changed more recently.

For candies without coatings, reformulation can be trickier. Candy makers have begun experimenting with realistic substitutes for cocoa butter. Hartel called this problem "a food scientist's delight" because replicating cocoa butter's precise texture and mouth feel is so complicated. It's also a big business.

One of the most obvious substitutions tells, he added, is the use of the word "chocolatey" on packaging.

Another method is to replace chocolate with existing ingredients like sugar or chunky add-ins. Andrew Moriarty, senior cocoa analyst at Expana, a company that reports agricultural commodity prices, said this had resulted in the reversal of a long-term trend. Companies had been cutting back on added sugars over the last 10 years or so in response to consumer preferences, but sugar content has been quietly ticking upward more recently again as it replaces cocoa.

Elsewhere, a company might thin out a milk chocolate coating and slip a layer of chocolate compound beneath it. Cookie makers might shrink their chocolate chips, or use fewer, or mix in a combination of "real" and compound chocolate

chips, Frame said.

Shoppers rarely notice these sleights of hand, but industry insiders tell a different story.

"We all know each other, and we run around behind the scenes, and we're like, 'Can you believe this stuff?'" said Eric Schmoey, technical innovations director at IRCA Group, a chocolate manufacturer.

Cocoa prices have come down some since their peak last winter, but analysts predict the supply crunch is here to stay as the planet warms. Demand for chocolate continues to increase, and expanding production takes time. Climate change is expected to stress crops with hotter days and shifting rainfall patterns, but new plantings may be limited by regulations prohibiting deforestation, Moriarty said.

In the long run, Hartel predicts, the chocolate market will split further in response to these pressures: High-end chocolate will most likely continue to be made with the same ingredients, and people will continue to pay more and more for it. Companies will continue to look for ways to keep lower-quality chocolates affordable, whether it be through reformulations, shrinking packages or marketing new products that contain less cocoa.

Over the last several years, there have been no shortage of scary headlines about the ways the food system could transform as the world gets warmer, making some key crops less nutritious, triggering severe food shortages and widespread hunger. But there are also subtle shifts that have already landed on our plates, and masking them has become possible and profitable.

The future may taste like my chocolate bar: a little worse in a hard-to-define way, whether it was made with different beans, less cocoa butter or more sugar.

Then again, maybe it was just stale.

Taste test

Lab-grown chocolate?

I should

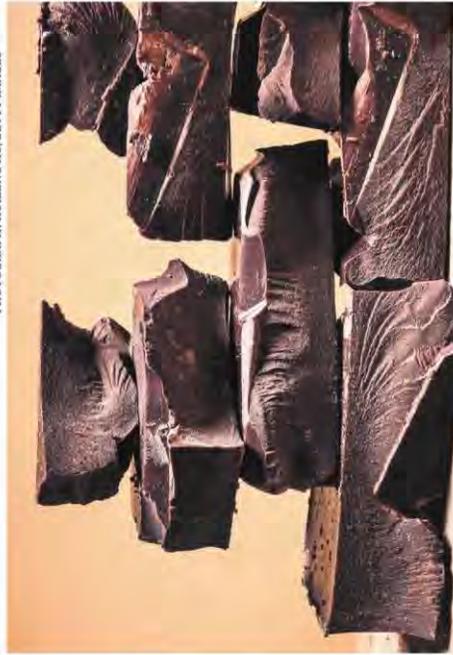
cocoa

Adrienne Matei

Would you eat lab-grown chocolate? I requested a sample from California Cultured, a Sacramento-based company. Its chocolate, not yet commercially available, in the same way as synthetic plant-derived pharmaceuticals. A few days later, it arrives. The morsel, barely bigger than a

▼ *Traditional cacao-derived confectionary could be challenged by a lab-grown replacement*

PHOTOGRAPH: HUIZENG HU/GETTY IMAGES



coffee bean, is supposed to match the flavour of a 70%-80% dark chocolate. I open its packet and a chocolatey aroma escapes – so far, so good. I pop it in my mouth.

Slightly waxy and distinctly bitter, it boasts those bright, fruity dark chocolate notes. I'm no expert, but I enjoyed it – and found it almost indistinguishable from normal dark chocolate.

Globally, chocolate worth \$140bn (£106bn) is eaten per year, and our appetite is only growing.

Yet the chocolate market has grown volatile in recent years. Cacao trees are vulnerable to

drought and disease and the climate crisis has led to production shortfalls in chocolate-producing regions in west Africa.

Chocolate prices hit a historic high of \$12,500 per tonne in 2024 with big confectionery companies such as Mondelez, Mars and Nestlé heavily affected by the increases. Ignacio Canals Polo, a Bloomberg Intelligence market analyst said

companies were “trying to adjust their portfolios to rely less on cocoa” by “shrinkflating” their products; reformulating recipes to use cheaper ingredients, such as vegetable oil instead of cocoa

butter; and promoting chocolate-free spins on classic products – think KitKats covered in flavoured cream coatings.

This volatility represents an opportunity for lab-grown products. Alan Perlestein, California Cultured's CEO said its process started with cacao plant cuttings from which it grows specific cell types, such as those that produce cocoa butter or cocoa flavanols.

Other companies, such as Nukoko and ChoViva, are also developing chocolate alternatives made from ingredients including fermented fava beans or sunflower seeds. Scientists are also experimenting with chocolate made from ground cacao husks typically discarded in conventional chocolate making.

California Cultured is still waiting for US Food and Drug Administration approval to launch its chocolate in the US.

Initially, lab-grown chocolate may be more expensive, but Perlestein hopes the price difference will disappear after three years on the market. But will people buy it?

“I think in certain niche sectors, like tech, it's going to be very cool – you can have more control, you can geek out on the very fine nuances,” said Eragramie Yuh, a former chocolatier and chocolate educator. But according to Yuh “most people

\$140bn

Value of the annual global chocolate market. Sharp price rises are fuelling search for synthetic alternatives

have a visceral response” to the idea of lab-grown food.

Yet Yuh suggests the ability to tweak levels of caffeine and health-supporting polyphenols in the lab product could add “a rational element to what is a largely an emotionally driven product”.

A shift to lab production could also have ecological benefits in regions where cacao cultivation has led to deforestation.

But that could put livelihoods at risk. Sophia Carodenuto, a political geographer at California's University of Victoria said: “The socioeconomic consequences of [lab-grown chocolate] could be huge for the smallholder farmers in west Africa.”

Shirley Temeng-Asomaning, founder and CEO of the Ghana-based confectioners Chocolate Mall, said: “Lab-grown chocolate can't replace the heritage, livelihoods and soul behind real cocoa. My hope is that science will complement and not compete with farmers and that technology helps make chocolate more sustainable, not less human.”

Appendix 8

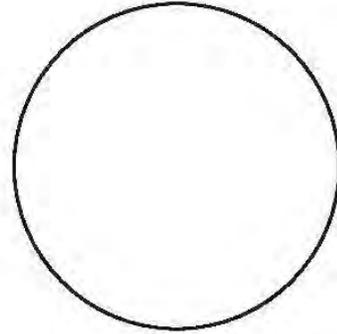
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Class Period: _____

M&M's

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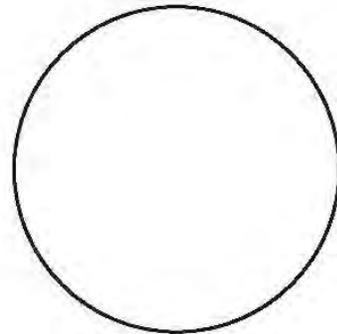
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Skittles

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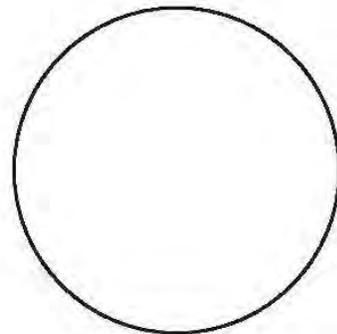
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Yellow		
Green		
Purple		



Smarties

Total number in bag: _____

Color	Number	%
White		
Yellow		
Pink		
Green		
Purple		
Orange		



Are the percentages similar to, or different from, the M&M's?

Worksheet created by Melissa Konkol