Case: Cancer Causing Foods in Cafeterias

Overall Background:

This is the first material students read. For example:

IGRs are attractive candidates for developing less hazardous insecticides. The problem is, which plants contain them? One way to identify sources of them is to look for plants that insects avoid eating. The example we will test today is blue flossflower (*Ageratum houstonianum*), which insects rarely attack.

Goals of Whole Case:

Summarize what students are trying to do without giving away the key points. For example:

During this 2-day case you will learn:

1. How to make a sound logical argument using experimental data.

2. Why the same transcription factor can both turn genes off and on.

Day 1 Handout:

Winston-Salem/Forsyth County School System  
Board of Advisors Regular Meeting

##### Agenda for 3/13/23

*Old Business*

Final vote on changes to Advisors Board bylaws (approved 12/1/22 by Bylaws Subgroup)

*New Business*

Discussion, vote on public petition to amend nutrition and food standards for K-12 school cafeterias during 2015/16 academic year.

***Background***:

A local advocacy group, **Parents for Safe School Food** has submitted a formal petition to change the food standards approved at the 4/1/23 meeting of the WSFC School Board (aka, “current standards”).

Petitioners have submitted evidence to suggest nine (9) foods or food constituents allowed under the current standards pose significant health risks to children.

They have asked the School Board to remove said items from the list of approved school menu foods in 2023/2024. A summary is provided in ***Attachment 1***.

This petition meets minimum requirements for consideration as defined in County Ordinance 97-314§2.11(a). It now moves forward for review and debate by the full School Board.

***Action Required***:

Before the full WSFC School Board can discuss or vote on this petition, it must be reviewed for scientific accuracy by the Board of Advisors.

* Advisors must identify and present the current best evidence on health risks posed to students by each item or category of foods.
* Members of the Advisory Board will vote individually using a secret ballet, either for or against removal of each food category or food item from cafeteria menus in WSFC schools.
* Advisors’ findings and results of the secret ballot will be submitted as this committee’s formal recommendation to the School Board.

Attachment 1

*Parents for Safe School Food* is requesting that the WSFC School Board permanently remove the following 9 items of concern from WSFC Schools cafeterias.

**1. French fries and processed potato nuggets (“tots”).**

Proven by the World Health Organization to contain acrylamide, a known carcinogen.

**2. Conventionally raised chicken and products containing conventionally raised chicken.**

Commercially produced chickens are treated with toxic and carcinogenic arsenic-containing drugs.

**3. Canned tomatoes**

Commercial food cans are lined with plastic to limit metal breakdown and increase shelf life. The plastic contains phthalates including bisphenol A. The acid in tomatoes leaches BPA from the can lining.

**4. Hot dogs, bacon, and other meats processed or cured using sodium nitrate or sodium nitrite**

These compounds convert to nitrosamines, which are known carcinogens. Several studies have linked consuming nitrite-cured meats with cancer in children, pregnant women, and adults.

**5. Commercially prepared milk-based foods, including chocolate milk, processed cheese** **food, puddings, flavored yogurt, and frozen desserts.**

Commercially processed milk and dairy foods contain Additive E171 (titanium dioxide) as a whitening agent. E171 generates oxidative free radicals, and it is a known carcinogen.

**6. Food items containing commercial bread dough, including pizza, deli-style sandwiches, biscuits, and other bread dough-containing meal items.**

Commercial doughs contain azodicarbonamide (ADC), a chemical bleaching agent that strengthens dough. ADC also is used in plastics manufacture, and potentially poses a significant health risk. United Nations risk assessors have said “there are not enough data to evaluate the risk to human health.”

**7. Microwave popcorn, all forms and flavors.**

Bags are lined with perfluorooctanoic acid (PFOA), a toxin found in Teflon that increases risk of kidney, bladder, liver, pancreas and testicular cancers. Most manufacturers use soybean oil (potential a GMO product) and the corn may be a GMO product as well. Conagra Foods stopped using diacetyl because it causes lung disease.

**8. Canned and bottled sodas, all flavors.**

Commercial sodas contain multiple cancer-causing chemicals, most notably, caramel color and its derivative 4-methylimidazole (4-MI), as well as other coloring agents.

**9. Foods with added fructose and/or high fructose corn syrup (HFCS).**

High-fructose corn syrup (HFCS) is ubiquitous in manufactured pies, cookies, sodas, juices, sauces, cereals, and most other popular food items, which explains why both child obesity and cancer rates are on the rise. Refined sugars spike insulin levels, and are preferred by cancer cells, thus promoting their growth. This was established in 1931 by German physician and Nobel laureate Otto Warburg. In order to proliferate, cancer cells prefer feeding on fructose-rich sweeteners like high-fructose corn syrup (HFCS); the reason is that HFCS is being metabolized by cancer cells most quickly and easily.

### Instructions for Today and Next Class Meeting

You will work with your group to:

* Pick 1 of the 9 options to evaluate.
* Decide what the most important facts are to present.
* Create an outline of what you want to present, so you can stay in your allotted time.
* Pick a spokesman for your group. (Remember, your last spokesman cannot go again until everyone has done it once.)
* Decide what your FINAL recommendation will be: keep food in cafeterias, or remove it.

Each group will have 10 minutes: 5 minutes to present their findings, and 5 minutes for questions from the Chair (instructors) and other members of the Advisory Board (other students).

### Follow-Up Homework AFTER Day 2

Once presentations are finished, there will be a closed ballot posted online. You may not abstain from voting on the items presented.

* You will have 5 days to vote either to keep or remove each of the food items presented.   
  (You can vote differently from what a presenting group recommends.)
* For each item you will be asked what your primary reason was for voting as you did. All responses will be collated and passed along anonymously to the School Board. (Yes, you get to see what the final votes were, and whether your arguments were persuasive.)

### Supporting Information For Each Food Item

Once your group has chosen an item to evaluate, the attached links to relevant articles will help you get started. By all means look for other sources too.

**French fries and processed potato nuggets (“tots”).**

* Lay press article(s):

<http://www.naturalnews.com/021808_cancer_prevention.html>;

<http://www.abc.net.au/science/articles/2004/03/26/1074438.htm>

* Empirical data sources:

<http://www.cancer.gov/cancertopics/factsheet/Risk/acrylamide-in-food>

<http://www.ncbi.nlm.nih.gov/pubmed/24875401>

**Conventionally raised chicken and products containing conventionally raised chicken.**

* Lay press article(s):

<http://www.whydontyoutrythis.com/2013/08/fda-finally-admits-chicken-meat-contains-cancer-causing-arsenic.html>

<http://www.bloomberg.com/news/print/2013-10-10/what-was-arsenic-doing-in-our-chicken-anyway-.html>

* Empirical data sources:

<http://www.fda.gov/AnimalVeterinary/SafetyHealth/ProductSafetyInformation/ucm258313.htm>

<http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm258342.htm>

**Canned tomatoes**

* Lay press article(s):

<http://www.prevention.com/food/healthy-eating-tips/7-foods-should-never-cross-your-lips?s=2>

<http://healyeatsreal.com/why-you-should-never-use-canned-tomatoes/>

<http://www.choice.com.au/reviews-and-tests/food-and-health/food-and-drink/safety/bpa-in-canned-foods.aspx>

* Empirical data sources:

<http://dx.doi.org/10.1289/ehp.1206367>

<http://www.fda.gov/cosmetics/productandingredientsafety/selectedcosmeticingredients/ucm128250.htm>

**Hot dogs, bacon, and other processed or cured meats**

* Lay press article(s):

<http://www.organicconsumers.org/foodsafety/processedmeat050305.cfm>

<http://healthychild.org/easy-steps/avoid-nitrates-and-nitrites-in-food/>

<http://www.todaysdietitian.com/newarchives/020612p48.shtml>

<http://www.pronutritionist.net/nitrates-are-beneficial-where-did-i-get-it-wrong/>

* Empirical data sources:

<http://www.ncbi.nlm.nih.gov/pubmed/21102328>

<http://ajcn.nutrition.org/content/90/1/11.full>

**All commercial items containing milk**

* Lay press article(s):

<http://www.wecf.eu/english/articles/2013/09/titaniumdioxide-ngoletter.php>

<http://henrymakow.com/who-titanium-dioxide-in-our.html>

<http://nutritionfacts.org/2013/08/13/is-titanium-dioxide-in-food-harmful/>

<http://pressroom.cancer.org/index.php?s=43&item=256>

* Empirical data sources:

<http://www.oehha.org/prop65/CRNR_notices/admin_listing/intent_to_list/052711LCset12b.html>

<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?fr=73.575>

<http://www.ccohs.ca/headlines/text186.html>

**Microwave popcorn**

* Lay press article(s):

<http://www.drweil.com/drw/u/QAA400701/Microwave-Popcorn-Threat.html>

<http://www.prevention.com/food/healthy-eating-tips/7-foods-should-never-cross-your-lips?s=4>

<http://www.livescience.com/23360-microwave-popcorn-lung.html>

* Empirical data sources:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2669658/>

<http://pubs.acs.org/doi/abs/10.1021/jf500615u>

<http://www.toxipedia.org/display/toxipedia/Diacetyl>

**Pizza, deli-style sandwiches, biscuits, and bread-based items containing commercial bread dough**

* Lay press article(s):

<http://foodbabe.com/subway/>

<http://www.examiner.com/article/azodicarbonamide-another-reason-to-avoid-most-bread>

<http://www.npr.org/blogs/thesalt/2014/02/06/272455631/subway-phasing-out-bread-additive-after-blogger-flags-health-concerns>

* Empirical data sources:

<http://www.ncbi.nlm.nih.gov/pubmed/21786817>

<http://www.who.int/entity/ipcs/publications/cicad/en/cicad16.pdf>

<http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35031>

**All foods containing caramel coloring**

* Lay press article(s):

<http://www.naturalnews.com/031383_caramel_coloring_cola.html>

<http://consumerreports.org/cro/news/2014/01/caramel-color-the-health-risk-that-may-be-in-your-soda/index.htm>

<http://www.cbsnews.com/news/caramel-coloring-chemical-linked-to-cancer-found-in-too-high-levels-in-some-colas/>

<http://www.foodsafetynews.com/2014/01/fda-to-reexamine-caramel-coloring-in-sodas-due-to-impurity/#.VNft98Ysp4s>

<http://www.usatoday.com/story/money/business/2014/01/23/fda-takes-another-look-at-caramel-coloring-in-soda/4800279/>

* Empirical data sources:

<http://www.fda.gov/food/ingredientspackaginglabeling/foodadditivesingredients/ucm364184.htm>

**Foods with added fructose and/or high fructose corn syrup (HFCS)**

* Lay press article(s):

<http://www.naturalnews.com/038071_cancer_sugar_sweets.html>

<http://www.cancercenter.com/discussions/blog/understanding-the-link-between-fructose-and-pancreatic-cancer/>

<http://naturalmedicinejournal.com/journal/2012-10/high-fructose-corn-syrup-and-pancreatic-cancer>

<http://articles.mercola.com/sites/articles/archive/2010/08/27/warning--fructose-feeds-cancer-cells.aspx>

* Empirical data sources:

<http://www.ncbi.nlm.nih.gov/pubmed/23493541>

<http://www.ncbi.nlm.nih.gov/pubmed/24650559>

<http://www.sciencedirect.com/science/article/pii/S0899900714002822>

Case and Instructor Notes: Cancer Causing Foods

### 2023 Addendum:

I last used this nonmajors-level case in 2013. Many of the reference links are no longer active, and some of the controversial foods have been reformulated or shown to not have the negative effects on which the scenario is based. To refresh it, a web search for “common part of life X” that causes “horrible disease or consequence Y” (ex., “foods that cause cancer”) would provide plenty of updated alarm-sounding lay press articles.

I included this case more as a model for how to construct and assess a scenario in which students:

* Research and argue an ethical stance for a controversial medical procedure;
* Present an argument for or against a policy;
* Debate the scientific validity of a controversial legal decision;
* Test the validity of lay press stories against scientific evidence.

### Background

Many in the lay public have a flawed “cause-effect” misconception of cancer that leads to irrational (and unnecessary) fears about food and health risks. Others are jaded from relentless press coverage, and simply ignore legitimate warnings.

In fact there are no foods or consumer goods that unequivocally “cause” cancer. Rather, certain foods, goods, and behaviors cause genomic and cellular damage that, when not repaired, can eventually lead to cancer. The more of these “hits” our cells endure, the more likely it is some of those cells will be altered in ways that can lead to cancer.

This case was designed to help students step back and use empirical evidence to distinguish hype from legitimate cancer risk. It helps them replace a cause-and-effect model with an “aggregate risk” model, where each biochemical hit on our cells raises or lowers the risk of disease or death. The choice we must make is, what to eliminate, mitigate, or accept as part of life.

More general questions to discuss with students are:

* Should public opinion overshadow evidence?
* How much hazard/risk is acceptable? What is the risk of living?

### Case Structure

##### Summary of the Scenario:

A parent advocacy group has proposed eliminating several foods from local school lunches:

* Fried potato products
* Conventionally raised chicken
* Canned tomatoes
* Hot dogs, bacon, and other processed or cured meats
* Commercially prepared foods containing milk
* Bread-based meal items containing commercial dough, including pizza.
* Microwave popcorn.
* All foods containing caramel coloring.
* Foods with added fructose and/or high fructose corn syrup (HFCS).

As members of a fictitious School Board Advisory Group, students must find and examine the evidence for or against each food or additive, then make a case for or against removal. To set the scene, i provide an agenda in a format copied from our local School Board meetings. It is intentionally generic and bland, like most governmental agendas. However the proposed changes would have an enormous impact on food choices and per-student costs.

To create an engaging controversy, I intentionally chose foods for which:

* There are claims in the lay press that the food or additive “causes” cancer.
* Epidemiological & experimental evidence does not suggest they increase cancer risk.

### Class Management

##### Helping Students Get Started:

Students can get off track easily when searching for relevant information. I get them started in the right direction by providing each group with the 2-page agenda to start. Once they have selected their food to assess, I give them a set of web links:

* 1-2 lay press articles focusing on the alarming features.
* If one is available, an article raising questions about strength of evidence.
* 1-2 sources of empirically generated data. Preference is for summary reports that compile multiple studies, or reports meta-analyses, from:
  + US government agencies: EPA, FDA, USDA, CDC
  + International agencies: WHO, IARC
  + Well-respected testing programs: NTP, OSHA/NIOSH

Links to relevant materials are included in *Supporting Information About Each Food Item.* To make this case more challenging, you can opt to not provide any initial sources.

##### In-Class Activities:

I give groups 15 minutes on Day 2 to work together on their case presentation, when I am available to answer questions or clarify data they have found that are unclear

Each group has 5 minutes to present their findings, and 5 minutes for questions from the rest of the class. Encourage brevity and good planning by holding groups to their time limit. Initially students will be reluctant to ask much, and the instructor must ask most of the questions. Once students warm up though, their follow-up questions will easily fill the allotted time.

##### Follow-Up Homework

Once presentations are finished, I post an online survey, with 2 questions for each of items presented. The first is a simple yes/no multiple choice “vote” to keep that food item, or recommend removal from the approved foods list. The second question is an open response that students complete individually.

Students become invested in proving their point. They are anxious to know the outcome of the vote, and which of the arguments they made was rated as the most important. Report back the final results of voting as soon as possible.

### Assessment

Students vote via secret ballot. The ballot actually is an online survey form that tallies the votes. As part of individual assessment, the survey asks each student to identify the most compelling argument.

For this case, I assign scores to individual students based on participation and engagement. What we look for (with relative weights in parentheses):

* Do they contribute substantively to group discussion and planning (0 to 5)?
* Do they vote (0 or 5)?
* How well thought out is their rationale for keeping or removing each item (0 to 5)?

Students receive a shared group score for the overall presentation. What we look for in presentations (with relative weights in parentheses):

* Does the group make a clear recommendation whether or not to keep their item in cafeterias   
  (0 or 2)?
* Is their recommendation based on general knowledge (0), second-hand data (0.5), or empirical evidence (1) from a reputable, cited source (2)?
* Is their argument based on emotions (0), a uniform threat (0.5), or aggregate risk (1)?
* Is the risk a guesstimate (0), or empirically determined (1) and from a reputable, cited source (2)?
* Is their recommendation consistent with prior basic biological knowledge (0 to 2)?

Supporting Information For Each Food Item

Links to relevant starting articles that can be given to students are listed for each item. The text summaries are provided for instructor reference. Students should find most of this information on their own or with their groups.

**French fries and processed potato nuggets (“tots”).**

These products do contain acrylamide that is generated when starch is heated to the point of browning. However dark parts of any starchy item, either baked or fried, will have measurable acrylamide. This is NOT a new occurrence; what brought it into the news was its discovery by Swedish scientists in 2002. It has been part of the human diet as long as we have been browning starchy food.

**Conventionally raised chicken and products containing conventionally raised chicken.** Commercial chicken feed contains antimicrobial compounds intended to improve poultry health. One common additive was roxarsone, an organo-arsenic compound that inhibits coccidial parasites. Coccidiosis is a severe, often fatal disease of poultry, and roxarsone and related anti-parasitic chemicals were added routinely to feed. Inorganic arsenic is very toxic and carcinogenic, but organo-arsenic compounds are about 1/100th as toxic. It was thought that organo-arsenic compounds could not break down to release inorganic arsenic, and posed no health risk, but routine monitoring by commercial producers and FDA turned up evidence that roxarsone did in fact break down and release detectable levels of inorganic arsenic. On the basis of the evidence, in 2011 Purina and Pfizer decided they would eliminate roxarsone and related arsenicals from commercial feed. In this example, the timeline is important. The web exploded with claims of a cover-up, when in fact:

* It was improved methods of routine testing that uncovered the problem
* The problem first was **discovered and reported** by the commercial food and drug manufacturers
* Arsenical drugs were eliminated almost as soon as the problem was discovered

The switch to non-arsenic formulation of chicken feed was completed in 2-3 months in 2011; the “news” of this “horrible threat” did not explode until 2013.

**Canned tomatoes**

Modern food cans are lined with phthalates (including bisphenol A) to limit metal breakdown and increase shelf life. A study published in May of 2013 by the *Proceeding of the National Academy of Sciences* showed that BPA actually affects the way genes work inside the brain of rats. Even the FDA agrees that there is a problem with BPA as it is supporting efforts to either replace or at the very least, to minimize the amounts found in canned foods.

**Hot dogs, bacon, and other processed or cured meats**

Meat processors love sodium nitrite because it stabilizes the red color in cured meat (without nitrite, hot dogs and bacon would look gray) and gives a characteristic flavor. Sodium nitrate is used in dry cured meat, because it slowly breaks down into nitrite. Adding nitrite to food can lead to the formation of small amounts of potent cancer-causing chemicals (nitrosamines), particularly in fried bacon. Nitrite, which also occurs in saliva and forms from nitrate in several vegetables, can undergo the same chemical reaction in the stomach. Companies now add ascorbic acid or erythorbic acid to bacon to inhibit nitrosamine formation, a measure that has greatly reduced the problem. While nitrite and nitrate cause only a small risk, they are still worth avoiding.

Several studies have linked consumption of cured meat and nitrite by children, pregnant women, and adults with various types of cancer. Although those studies have not yet proven that eating nitrite in bacon, sausage, and ham causes cancer in humans, pregnant women would be prudent to avoid those products.

The meat industry justifies its use of nitrite and nitrate by claiming that it prevents the growth of bacteria that cause botulism poisoning. That’s true, but freezing and refrigeration could also do that, and the U.S. Department of Agriculture has developed a safe method using lactic-acid-producing bacteria. The use of nitrite and nitrate has decreased greatly over the decades, because of refrigeration and restrictions on the amounts used. The meat industry could do the public’s health a favor by cutting back even further. Because nitrite is used primarily in fatty, salty foods, consumers have important nutritional reasons for avoiding nitrite-preserved foods.

The labels on some "natural" hot dogs and other cured meats brag about "no added nitrite." Be skeptical. While those products may not contain added sodium nitrite, they sometimes are made with celery powder or celery juice that are naturally high in nitrate. A bacterial culture is used to convert that to nitrite. Indeed in 2011 the New York Times revealed that the "natural" cured meats could have 10 times as much nitrite as conventional products. The bottom line: those products typically are high in salt and sometimes saturated fat, so they'd be worth eating only occasionally or avoiding entirely, but not just because they are “causing” cancer.

**Chocolate milk, processed cheese food, puddings, flavored yogurt, frozen desserts, and other commercial items containing milk**

Commercially prepared, milk-based foods, including chocolate milk, processed cheese food, puddings, flavored yogurt, and frozen desserts regularly contain titanium dioxide/Additive E171. Titanium dioxide is listed by NTP and IARC as a carcinogen, but only when inhaled in quantities associated with industrial production and manufacture. There is no evidence that titanium dioxide is hazardous when ingested. Public preference is for uniformly colored food, which drives its use. Eliminating it from our diet would require massive overhaul of the food industry, because it is used in so many products. Milk products are just the most obvious targets.

**Pizza, deli-style sandwiches, biscuits, and similar bread-based meal items containing commercial bread dough**

This particular example was in the news in late 2013 because a blogger obtained enough signatures to pressure Subway restaurants into removing ADC from their bread doughs. The primary reason was that “ADC is used to make yoga mats, so why is it in my food?”

This example is ideal for showing a false correlation, and how easily an ill-informed smear campaign led to bad publicity and pressured an potentially ill-informed response. Yes, azodicarbonamide (ADC) is used in plastics and chemical manufacturing, but so are soybean oil and citric acid. Chemical feedstocks for plastics can come from any source, so long as the chemical backbone is appropriate.

Most of the concern about ADC relates to two chemicals that form when bread is baked. The first chemical is semicarbazide (SEM), which caused cancers of the lung and blood vessels in mice. It did not cause cancer in rats. In 1976 the International Agency for Research on Cancer considered SEM to be a carcinogen in mice, but in 1987 concluded that the animal data were "limited" and that SEM was "not classifiable" as to its carcinogenicity to humans.

A second breakdown product, urethane, is a recognized carcinogen. ADC used at its maximum allowable level (45 ppm in bread) leads to levels of urethane in bread that pose a small risk to humans. Toasting that bread increases the amount of urethane. However, when used at 20 ppm, which may be the amount used by some commercial bakeries, a 1997 FDA study found "only a slight increase" in urethane. (Some urethane forms in bread not made with azodicarbonamide.)

The overall value of ADC is a more legitimate point to debate. Students should be asking, “WHY it is banned in certain countries? Is it ADC specifically, or a general ban on categories and types of chemicals?” They should look for the underlying rationale, not accept that a ban indicates risk. At present, there is no evidence that ADC is carcinogenic; it is guilt by association with plastics. Evidence suggests ADC is mainly a respiratory sensitizer, but I could not find data to suggest a serious health risk.

Conversely, students rightly should ask, “what is the benefit of ADC in dough? Are there viable alternatives?

**Microwave popcorn**

Diacetyl is one of the many chemicals that give butter its characteristic flavor. Low levels are present in butter (including unsalted butter, to which extra diacetyl is added to prolong its shelf life). Much higher levels have been used in butter-flavored popcorn, margarine, and butter-flavored cooking oils and sprays. The low levels are safe, but workers in factories that produce microwave popcorn learned the hard way that long-term exposure to diacetyl causes obstructive lung disease, which is potentially fatal. Widespread publicity around 2005 to 2007 and several lawsuits persuaded most major American food manufacturers to protect their workers (and restaurant cooks) by switching to supposedly safer ingredients. But more recent studies indicate that one substitute, 2,3-pentanedione, chemically similar to diacetyl (also called 2,3-butanedione), may be just as damaging to the respiratory tract.

**All foods containing caramel coloring**

Caramel coloring is the most widely used (by weight) coloring added to foods and beverages. Caramel coloring is used to simulate the appearance of cocoa in baked goods, make meats and gravies look more attractive, and darken soft drinks and beer. It is made by heating corn syrup with ammonium compounds, acids, or alkalis.

Caramel coloring, when produced with ammonia, contains contaminants, 2-methylimidazole and 4-methylimidazole. In 2007, studies by the U.S. National Toxicology Program found that those two contaminants cause cancer in male and female mice and possibly in female rats. In 2011, the International Agency for Research on Cancer, a division of the World Health Organization, concluded that 2- and 4-methylimidazole are "possibly carcinogenic to humans." Then, the State of California's Environmental Protection Agency listed ammonia-caramel coloring as a carcinogen under the state's Proposition 65. The state lists chemicals when they pose a lifetime risk of at least 1 cancer per 100,000 people. California warned that as of January 7, 2012, widely consumed products, such as soft drinks, that contained more than 29 micrograms of 4-methylimidazole per serving would have to bear a warning notice. In March 2012, when CSPI published the results of a study that found levels up to 150 micrograms per can of Coca-Cola and Pepsi-Cola purchased in Washington, DC, the soft-drink giants announced that they had reduced the contaminant to below California's threshold for action in products distributed in California. They said they would market the less-contaminated products throughout the country, but did not give a timetable for that change.

The FDA has a limit that is 10 times as strict as California's for regulating chemicals that are contaminated with cancer-causing chemicals. CSPI's analysis of a Coca-Cola purchased in 2012 in California found just 4 micrograms of 4-MI per 12 ounces. Even that much lower level might exceed the FDA's threshold for action of 1 cancer per million consumers.

It might be worth avoiding or drinking less colas and other ammonia-caramel- colored beverages not only because of risk from the 4-methylimidazole, but, of course, because the products contain about 10 teaspoons of sugar per 12 ounces and promote obesity and tooth decay. Soy sauces, baked goods, and other foods that contain ammoniated caramel coloring are much less of a problem, because the amounts consumed are small.

**Foods with added fructose and/or high fructose corn syrup (HFCS)**

Fructose is a monosaccharide sugar that is approximately two times sweeter than table sugar. Modest amounts of fructose occur naturally in fruits and vegetables, which also contain other sugars. When table sugar is digested, it breaks down into equal amounts of fructose and glucose (dextrose). Another major source of fructose in the typical diet is high-fructose corn syrup (HFCS), which typically contains about half fructose and half glucose.

The Dietary Guidelines for Americans (America's basic nutrition policy), American Heart Association, and other health authorities recommend that people consume no more than about 3 to 8 percent of calories in the form of refined sugars. That's far less than the current average of 14 percent of calories. The bottom line: the less added sugars—fructose, dextrose, sucrose, or HFCS—one consumes the better (though, again, small amounts are safe).

Our consumption of high-fructose corn syrup (HFCS) has soared since around 1980. That's because it is cheaper and easier for some companies to use than sugar. HFCS has been blamed by a few people for the obesity epidemic, because rates of obesity have climbed right along with HFCS consumption. But that's an urban myth. HFCS and sugar are equally harmful. We're simply consuming way too much.

HFCS starts out as cornstarch. Companies use enzymes or acids to break down most of the starch into its glucose subunits. Then other enzymes convert different proportions of the glucose to fructose. The resulting syrups contain as much as 90 percent fructose, but most HFCS is 42 percent or 55 percent fructose. Because of all the criticism (not fully deserved) of HFCS in recent years, HFCS consumption declined by about 22 percent between 2002 and 2010. Much of that historic decline resulted from declining soft drink consumption (thanks to increased health consciousness and to the popularity of bottled water). Actual consumption (as opposed to production) of caloric sweeteners, according to the U.S. Department of Agriculture, was 79 pounds per person in 2011.