



## **Chemical Footprints: Health Threats of Food Toxins?**

Curriculum Unit 18.05.07, published September 2018

by Patricia Moncrief

“Give us this day our daily bread,” is one sentence from the Lord’s Prayer that is recognized globally. A modern day interpretation of the sentence could now read “Give us this day our daily poison,” signifying the toxic chemicals humans ingest on a daily basis. These chemicals enter our bodies through a variety of avenues – by breathing, eating, or drinking. The majority of toxins ingested wind up residing in the vital organs (heart, lungs, kidneys, brain), or fatty tissues in our body for an extended period of time. Most of these toxins will be excreted but those that are left behind will wreak havoc by altering genes, especially by creating harmful mutations in our DNA.

The importance of finding food sources is of the utmost priority for survival. As humans evolved, so did the search and procurement of adequate food supplies. Hunting for, and gathering food usually insured the food’s safety, and could be consumed without causing too many problems to one’s physiology. Lives were progressing along maintaining a “somewhat” symbiotic relationship with nature until the advancement of the Industrial Revolution. The revolution led to new ways of finding and harvesting food. With the advent of machinery, farming undertook new ways to bring food to the table. For many humans, gone were the needs for plowing the land, planting crops, harvesting food by hand, and knowing exactly what was on, and in the food found on our table. Instead, as time had progressed, we acquired most of our food from markets, and assumed they were safe for human consumption.

Present day life, especially in Silicon Valley, has families eating fast food more so than not. Generally, meals that are pre-packaged, or prepared elsewhere, are what lands on the table. My students are of middle school age and due to “economic reality” there is no one home to fix their meals. Their parents are usually working two to three jobs daily to make ends meet. If for some reason parents don’t work, many have ICE concerns. They do not want to venture out of the home for fear of getting caught and possibly deported. With the very real possibility of eating “processed” meals I want my student to be aware of what lies hidden in their foods that could potentially make them sick, or acquire the possibility of mutationally changing their genetic codes to alter their health.

I feel it imperative to introduce a curricular unit that educates students about the toxic chemicals they eat that threatens their health. They would research whether use of high levels of pesticides, or herbicides are common practices in their region; examine labels on cans of food for listed chemicals and foreign substances they will ingest; and check whether the nutritional value of the food, meets the United States Department of Agriculture (USDA), and the Federal Drug Administration (FDA) standards.

## Background

---

George Shirakawa Sr. Elementary School has an enrollment of 871 students. Enrolled student percentages are broken down into the following groups: Asians 41%, Hispanics 43%, Caucasians 4%, African American 2%, and other ethnicities 10%.

Shirakawa Elementary School is one of twenty-one schools in the Franklin McKinley School District, a Title 1 district, located in the East Side of San Jose, CA. The Shirakawa neighborhood is comprised of families that are generally: Asian and/or Hispanic; single parent households; families with members that have gang affiliations; homes where English is not the native language, nor is it spoken at home; grandparents and/or other guardians raising students (due to parental issues), and a handful of middle-class families.

Shirakawa Elementary is a K-8 campus where older students are role models, and help younger students with their schoolwork. Many siblings attend Shirakawa so teachers get to know the families, and their students' needs more than a traditional elementary school model.

I want to stress topics that are of critical importance to areas of applied knowledge that all 21st century students need to possess. Special Ed, ELL's, ED students will be included and encouraged to participate with general education students throughout the unit. Those students are usually the populations that are overlooked in courses, yet they need to be as informed as all other students when it comes to critical matters facing our world.

In adopting CCSS and NGSS one major criterion is Project Based Learning melding with traditional curricula to facilitate a deeper knowledge and understanding of content. I know in my personal practice, Design Challenges have instilled in the students a means to assimilate specific theories and principles on a much deeper level. In my research, I will find means to teach this unit to accommodate their learning styles.

## Rationale

---

We are living in a world where our environment is becoming more toxic each year. Whether on land, in water, or airborne, the amount of toxins received by the average individual when eating, breathing, or bathing can lead to a toxic buildup within our bodies. While most Americans are aware of how toxins are affecting the environment, they are unaware of the massive number of potential genetic health outcomes these chemicals may trigger.

Most middle school students develop an internal sense they need to become more aware of how they fit into society and what specific major issues will be instrumental in shaping their future, and futures to come. A vast majority of information accessible to them is either dispersed by their friends or received from social media, which for some teenagers serves as their mentor. Media plays a massive role in accessing information that formulates their viewpoints. It is time they take a role in choosing what goes into their bodies, and the ramifications their choices may lead them to. What information they choose to access, and utilize, (not only for dietary purposes) will have potentially long range effects on their lives and their children's. Teenagers now are at a turning point where becoming personally and socially responsible is a necessity.

In order for students to gain an active role in social responsibility and mapping their

“chemical footprint”, they need to recognize where their food is being grown and distributed to, what dangers lie in the processing and packaging of food, what chemicals or extra additives are contained in the food, and the expiration dates placed on the outer packaging. The benefits and controversies aligned with their food choices will now be paramount to their lives, but also become a “womb to tomb” paradigm for future generations (unknown).

## Content

---

Food items contain pesticides, and certain amounts of plastics that seep from the wrappers. It is ironic how plastic wrap keeps the food safe, but what about us? To make matters worse, the meats or other foodstuffs are usually placed on Styrofoam trays (along with the plastic covering). That in itself is yet another toxic hazard! Even liquids have their own dangers. Gone are the glass bottles in favor of the plastic ones. Disposable bottles are not biodegradable so plastic can seep into the ground. A relevant topic teens need to discuss and be aware of is what “chemical footprint” they are creating in themselves due to their choices in food.

Toxins have been discovered to be responsible for weight gain, various cancers, numerous allergies, neurologic disorders, and a multitude of other diseases.<sup>1</sup> Toxins are a threat, which we cannot see. They are invisible which makes it more difficult to pay attention to their dangerous capabilities. People are commonly exposed to thousands of chemicals everyday. Toxins have a way of infiltrating, and blocking enzymes needed to initiate or maintain bodily functions.<sup>2</sup> An extensive study by the Environmental Working Group was conducted on nine adults (none of whom worked in industries that could expose them to high levels of toxins). All were tested for the presence of 201 contaminants. The results showed the presence of 167 of the 201 chemicals with an average of 91 per person.<sup>3</sup> The common chemicals were linked to cancer, and toxic reactions in the endocrine, immune, and neurological systems. Specific toxins will be cited and discussed further in the Content Objective section.

Additives are one of the economic mainstays in the food industry. Their capability to keep foods wholesome, and attractive to consumers while being transported thousands of miles around the world is nothing short of a genius marketing strategy.<sup>4</sup> Additives have the unique capabilities to: have food maintain their consistency, enhance the color and flavor of food (especially seafood); control acid levels to inhibit leavening from occurring; prevent spoilage; and maintain nitrite levels at a safe amount.<sup>5</sup> Americans eat 150 pounds of additives each year. Of the approximately 3,000 additives that are approved, most of these cause little or no controversy.<sup>6</sup>

Throughout history additives have long been used to enhance food. Salt was and is being utilized to cure meats. Vinegar is used to cure pickled vegetables. Soda crackers are placed in sugar bins to keep sugar from lumping. Additives received FDA approval in 1958. Food color was added; however, only 90 of the 200 food colors are listed as safe.<sup>7</sup>

Food additives go through stringent testing and evaluation before being approved. Approved additives have

labels, including information designating what the additive is being used for, the amount of it to be used safely, and the product identification number stated clearly on its label.<sup>8</sup> Specific additives that students come in contact with will be discussed under benefits and controversies in the Content Objectives section.

## **Pesticides**

As we become closer to becoming an integral part of the global community, more and more demands are going to be made on our agriculture output. Pesticides share the common suffix “ides” with herbicides, and fungicides. The suffix “ides” means to kill. Pesticides are composed of chemical compounds that seek and destroy unwanted pests. They protect the crops from bacteria, insects, and other organisms known to destroy crop yields. The use of pesticides has increased crop yield dramatically over the decades making it a mainstay in agricultural domains. There are several pesticides being used by farmers; however the ones most widely administered are the organophosphates. U.S. Department of Agriculture reports that 81% of conventionally grown crops are sprayed with this group of pesticides.<sup>9</sup> They are extremely effective at protecting crops from insects, but it seems that their effectiveness may come as a detriment for humans.<sup>10</sup>

The vast majority of modern insecticides fall into one of two large groups of chemicals. One group, represented by DDT, consists of the chlorinated hydrocarbons. The other group consists of the organic phosphates, and is represented by the reasonably familiar malathion and parathion.<sup>11</sup> All have one thing in common: they are built on a basis of carbon atoms, which are also the indispensable building blocks of life, and thus both groups are classified as “organic.” Carbon is an element whose atoms have an almost infinite capacity for uniting with each other in chains and rings and various other configurations, and for becoming linked with atoms of other substances.<sup>12</sup>

## **Hormones**

Much like puzzle pieces, hormones act by binding to receptors that are produced and housed within the cell. When hormones bind to receptors, the hormone’s specific instructions get carried out either by altering the cell’s existing proteins or turning on the genes that will form new proteins. The “hormone-receptor complex” switches on or off specific biological processes in cells, tissues, and organs.<sup>13</sup>

The endocrine system incorporates the body’s different hormones, into regulating the body’s biological processes throughout our lifetime. The major pillar of the endocrine system is developing the structure and function of: brain / nervous systems; metabolism; blood sugar levels; ovaries / testes; and pituitary, thyroid, and adrenal glands.

Humans, domesticated animals, fish and wildlife have revealed unfavorable health consequences from being exposed to environmental chemicals that negatively interact with the endocrine system.<sup>14</sup>

The majority of beef, and dairy products sitting on dinner tables around America are being consumed on a daily basis possessing something extra in their tissues. Animal growth hormones are given to the animals to increase their weight and grow faster, to produce more resources such as milk, and generally for arriving at the slaughterhouse sooner. Is this a safe practice, or are we being placed in a position to suffer potential ramifications to our health and the health of our progeny? For years, the cattle industry has been using growth hormones to supplement the growth of these animals caused by their own genes. Is this a marketing tool to increase profit line for farmers, or are their public health risks waiting to emerge?

Hormones are formed in the endocrine glands and take specific regulatory controls of body functions. They control simple drives such as hunger, for example, as well as more complex ones for emotions, growth, and reproductive abilities. Ten glands are responsible for hormones and their actions: hypothalamus, parathyroid, thymus, thyroid, adrenal, pituitary, pineal, ovaries, and testes.<sup>15</sup> For decades the cattle, and poultry industries have been using hormones to increase the flesh, weight, and milk products from of their animals. Livestock will grow heavier, and can be slaughtered faster by exploiting synthetic hormones to induce the above reactions. The hormones are administered by placing an implant under the skin, such as behind the ear. The implants are inserted at a young age while their growth rates are highest.<sup>16</sup> The majority of researchers in the beef industry feel the hormones implanted in the animals are similar to the ones found in our bodies, but at a much lower dosage than humans produce.<sup>17</sup>

## **Antibiotics**

One can never escape from bacteria. They were here before us, and will most likely be around after we are gone. We have bacteria on our skin and in our bodies and we co-exist with each other without too many problems. However, there are strains that can and do make one sick. It happens to livestock also. Due to their crowded habitats, and living conditions, on increasingly large sized farms, the incidences of farm animals contracting infectious diseases are quite high. Antibiotics are routinely fed to the animals to compensate for their exposure to unsanitary conditions.<sup>18</sup> Another valid reason animals especially cows are given antibiotics is for the treatment of mastitis. Mastitis is an inflammation in the udder. It can be caused from a variety of incidences – seasonal weather /or extreme weather conditions, age of cow or lactation. The milk from a cow being treated with antibiotics is discarded, documented, and cannot be transported. This procedure goes on for several days to insure that humans are not exposed to tainted milk.<sup>19</sup>

Antibiotics costs, benefits and controversies will be discussed in Content Objectives.

## **Content Objectives**

---

While researching information concerning chemicals my students were consuming either through their snacks or at mealtime, what I thought I knew about those topics was not going to be anywhere near the information I needed to prepare and effectively teach my unit titled “Chemical Footprints”. For one thing I discovered most of the information I had available to access on the pesticide segment was at least from eight years ago or even older. I also found when I wanted to research the effects that hormone diffusors / synthetic estrogens were introducing into genes and their structures, there were few articles I felt I could understand enough to write comfortably about mutations and how they can affect future generations. I went through an intense phase deciding what information to include and / or omit in my unit. I finally decided to base my curricular unit on teaching my students about chemicals that will influence the direction of their health.

A short background addressing genetics and DNA (deoxyribonucleic acid) will start to establish pertinent information influencing benefits and controversies of manipulating biology yields.

## **Heredity and DNA**

The year was 1851 when Gregor Mendel started to notice pea plants could have the characteristics of their

parents however some of the plants were yellow and some were green. His curiosity and years of study and hard work led him to generate the foundation to the science of genetics and heredity. The timeline from 1869-1952 demonstrates specific important scientific discoveries preceding 1953. The following website [www.genomes.gov /pages:/geneticstimeline](http://www.genomes.gov/pages:/geneticstimeline)<sup>20</sup> supplied the following segments: 1869 Frederick Miescher isolates DNA from cells and calls it “nuclein”. In 1909 Wilhelm Johannsen creates the word “gene” to name Mendel’s unit of heredity. He also designated terms genotype and phenotype to differentiate between the genetic traits of individuals and their outward appearance. Going forward to 1911 Thomas Hunt Morgan’s experiments with *Drosophila* (fruit flies) increased scientific understanding of gene coding and genetic linkage. Other major milestone from 1952 - 1953 include Alfred Hershey & Martha Chase showing that only the DNA (and not protein) of a virus needs to enter a bacterium to infect it, providing strong support for the idea that genes are made of DNA.

Surfacing a year later was the detection of structural DNA (the genetic material that transports information across generations, passed from parent to offspring.). Rosalind Franklin, Francis Crick, and James Watson introduced the structure of DNA to the scientific community, and relayed vital information on how DNA replicates itself during cell division.

## **Environmental Toxins**

Bisphenol A (BPA) is a chemical found in hard plastic bottles and in the linings of food and beverage cans. It has been associated with development of brain, breast and prostate cancer in laboratory studies. Phthalates, such as DEHP, are chemicals used to make plastic soft, including plastic food wrap. DEHP has been shown to affect male reproductive development, sperm quality, and male hormone levels in laboratory and human studies.<sup>21</sup>

BPA and phthalates can leach into food and drink from the linings of cans and plastic packaging. It’s not practical to evade packaging materials altogether; however, a good choice would be to choose fresh or frozen foods as much as possible. Studies have shown that people who go out to dinner a lot have higher levels of BPA in their systems.<sup>22</sup> To reduce the BPA levels in your body consider eating more meals at home that contain fresh ingredients. When you do eat out, choose “sustainable” restaurants to dine out. They will guarantee fresh and healthy food choices.

Food and drinks that are stored in plastic can potentially amass chemicals leaked from those containers, especially if the foods are acidic. Storing your leftovers in glass will be a much better option. The rate of chemicals leaching into food is also dependent on temperatures. The warmer it gets the more likely leaching will occur.<sup>23</sup> A recommended alternative is to use heat-resistant glass containers when you microwave. Another way to protect yourself from exposures is to heat your food on top of the stove. When you see a label saying a container is safe for microwaving food in, or to be loaded in the dishwasher the label is designating the container as safe not you. Also when considering safe appliances (non BPA) coffee makers should be looked at with a critical eye. BPA and phthalates may be found in their plastic containers and/ or in the tubing dispensing the water.

Evidence has not been easily attainable. More focus had been given to water and air pollution. Chemical companies have an advantage to using their chemicals to manufacture plastic water bottles, hand sanitizer, food storage containers etc. Anything to make life easier! If only that were true!

## **Food additives**

### **HFCS -**

One hears about high fructose corn syrup and how it has recently been excluded from food sources. What is it, and why is it so serious? Before 1966, high-fructose corn syrup (HFCS) was not considered to be the sweetener of choice in American households. One would find sucrose or table sugar sitting on the tables / counter tops to be used as the prime sugar source.

Mass-produced from cornstarch through a complex manner, HFCS emerged as a formidable alternative to sugar. It was cheaper to manufacture, significantly sweeter than sugar, easily transported, and simple to pour (especially in beverages).<sup>24</sup> In fact, between 1970 and 1990, Americans' intake of HFCS increased more than 10,000 percent -which is far greater than changes in intake for any other food, according to an article in the American Journal of Clinical Nutrition.<sup>25</sup>

HFCS is different than regular corn syrup. It is half glucose, and half fructose. Glucose sets off reactions throughout the body that translates to an energy source. It is an integral component aiding in the production of leptin, (appetite controller). Leptin is increased, and ghrelin, a stomach hormone, is reduced, which erases the hunger feeling.<sup>26</sup> When fructose is present it performs differently than glucose. It does not increase leptin levels, nor does it decrease ghrelin levels. It is not an insulin secretor, and is thought to aid in fat storage.

### **Aspartame**

Aspartame aka Equal or Nutra-sweet is another sweetener that is much sweeter than sugar. It is made from two proteins - aspartic acid and phenylalanine mixed with methanol. Methanol is found naturally in fruit juices, and many other foods.<sup>27</sup> When ingested as a sugar supplement, aspartame functions and is digested just as the aspartame that is found in milk, meat, vegetables, and fruits. Health studies have shown that aspartame always appears to be safe for consumption.<sup>28</sup> As time progresses more adverse information is becoming available though. With the help of social media, and technology, adverse health effects are surfacing. Phenylketonuria is a rare genetic disease. People that have PKU must control their intake of phenylalanine. The list of foods with designated amounts of servings people deemed safe can be found on the International Food Informational Council website. Aspartame is considered a safe sugar substitute for people living with diabetes. Aspartame has been given a clean bill by the Epilepsy Institute and no evidence of promoting seizures has been documented. Not everyone is convinced it is safe, however. There are people and organizations that still believe Aspartame is a threat to health and wellbeing of many Americans. Those individuals have stated that articles concerning the safety of aspartame are biased and the manufacturers only support articles that judge the sweetener safe. Controversial matters have arisen because aspartame should be classified as a drug instead of an additive.<sup>29</sup> A campaign is underway to enlist corporations that produce aspartame to collect data that supports the supposition that serious medical issues are induced by eating the supplement. When the companies are ready and the data is procured, they will petition the FDA to take another look at Aspartame.

### **MSG -**

One of the most contentious food additives in the world today is monosodium glutamate. (MSG). It is the most common form of glutamic acid, a building block of proteins.<sup>30</sup> Glutamic acid in its' natural environment is not detrimental to humans nor does it set out to improve flavor in foods. MSG becomes a problem when

processing plants hydrolyze MSG to generate “free glutamates”.<sup>31</sup> At this point, MSG becomes a flavor enhancer, and can be found in a plethora of foods – Chinese, prepared foods, snacks, salad dressings, canned meats etc. One of the hallmark actions that MSG creates is fooling your brain receptors into thinking that the taste of the food is heartier than it really is.<sup>32</sup> MSG is an appetite suppressor that causes you to feel hungry after eating large amounts of food. Eating Chinese food is a great example of being hungry an hour after you eat it.

MSG can be placed on cheaper cuts of meat, older vegetables, and food that has not spoiled yet to improve the quality of it. It is found worldwide because of its nature to enhance food flavor and potentially increase the supply of foodstuff available to people in developing countries. The savory flavor associated with foods that have MSG in it is called “umami” which has now been widely accepted as the “fifth” taste.<sup>33</sup> Monosodium glutamate continues to inspire controversy among those who link the additive to serious neurological side effects and other undesirable health effects. MSG also has been traced to the increase in brain lesions in animals.<sup>34</sup> Scientists are now developing solid information concerning the adverse reactions people have been experiencing with MSG. The information has been compiled and is available for people to access by going to [www.truthinlabeling.org](http://www.truthinlabeling.org).

### **Pesticides**

An esteemed pioneer ecologist in the early 1960’s was Rachel Carson. Her groundbreaking book *Silent Spring* was instrumental in getting the pesticide DDT banned from commercial usage. She protested the environmental contamination caused by toxic chemicals that accumulate in the tissues of plants, animals and humans. It was not until six years after her death that Congress passed the National Environmental Policy Act establishing the Environmental Protection Agency. The EPA banned the domestic production of DDT.<sup>35</sup> As the unit progresses I plan on having students research Rachel Carson, and her activism towards ecology.

It started out as a fable brilliantly describing an idyllic environment where nature and humans coexisted symbiotically. As the story progressed over a relatively short period of time, the tides started to turn. Carson alluded to the environmental change as, “One Spring an evil blight crept over the entire area and everything began to change”.<sup>36</sup> The story continues to illustrate chickens, cows, sheep and pigs contracting strange disorders and eventually dying from those exposures. The once vibrant habitat bore the brunt of the aforementioned blight. The idyllic setting was reduced to a wasteland. Dirty rivers, trash-laden paths, and filthy air now replaced the vivacious region. The setting Carson wrote about was fictional, however communities across America’s farm belt have confirmed they experienced similar circumstances, and happenings.

“It is only within the moment of time represented by the twentieth century that one species-man-has acquired significant power to alter the nature of his world, and it is only within the past twenty-five years that this power has achieved such magnitude that it endangers the whole earth and its life.<sup>37</sup> The villains turned out to be DDT and other organophosphates. Who knew that her book *Silent Spring* would become the best seller and initiate a movement for the eradication of DDT (and other pesticides) at a time when women had little credibility with male dominated companies? The book led to the formation of the EPA and helped launch the Environmental Movement.

Pesticides are known to be one of the extremely useful and beneficial agents for

preventive loss of crops as well as diseases in humans.<sup>38</sup> A benefit would be for crops to grow successfully in



developing countries and lessen the starvation and hunger rates there.

An essential threat to our existence is our contamination of Earth's environments with materials possessing incredibly harmful substances that accumulate in the tissues of plants and animals, penetrating germ cells, to ultimately splinter genetic materials.<sup>39</sup>

### **Hormones**

Consumer advocates are concerned about growth and sex hormones in the food supply, but it's unclear whether these hormones truly are bad for our health. According to the FDA there has been little research conducted about the health problems of hormones contributing to cancer, early puberty in girls, and to cancer and health problems in humans. For years, consumer advocates and the public have felt that manipulating growth hormones in cows may increase another hormone, insulin-like growth factor, (IGF) which mimics the effects of human growth hormone in harmful ways. In fact, research has found that milk from recombinant bovine growth hormone (rBGH)- treated cows contains up to 10 times more IGF than other milk.<sup>40</sup> The more this information goes public it will challenge the research based articles that state in order for there to be a problem with either IGF, or rBGH one has to drink an inordinate amount of milk to be worried about adverse health effects states the FDA.

### **Antibiotics**

Antibiotics as with hormones will cause animals to grow faster, gain weight and their meat will be leaner. Antibiotics are routinely given to farm animals to compensate for unsanitary conditions in their pens.<sup>41</sup> A major route antibiotics enter the environment is through their waste. Antibiotics are not fully digested and will come in contact with the ground. At that point they will leach and enter ground or well water supplies posing a major health issue for humans.<sup>42</sup> Health care costs has steadily increased yearly, and at the highest count the cost exceeded 4 billion dollars.<sup>43</sup>

The subject of giving antibiotics to farm animals has led people to economically look at ending the practice. Supporters of ending the practice feel it can be profitable for both the farmers and the public. The use of administering antibiotics to animals would be prohibited if the meat is stated and certified organic. Implementing and following the labeling policy would save vast amounts of money. It could also decrease the expense to everyone by reducing drug resistant bacteria.<sup>44</sup>

## **Strategies**

---

I plan on introducing and teaching lessons on environmental toxins and their method of transmission and consumption; the enormous effects toxic buildups have on tissues and body systems; DNA, and genetic involvement; conditions which directly alter cellular DNA sequences. Repeated rounds of DNA replication incorporate the changes permanently.<sup>45</sup> The altering of, or potential mutations to genes occur because of toxins interfering with hormone / protein synthesis needed for normal cell growth. Instruction on common insecticides, herbicides, food additives, common household toxins (cleaning solvents, air fresheners, hand sanitizers etc.), will also be taught.

Students will be provided information about environmental toxins. They will be asked to locate agricultural areas in California, and search for information as to what the area produces, how the foodstuff is grown, look for proof stating products are pesticide free, and seek out if food is organically produced. They will also pursue information pertaining to where the food is being shipped to, and received from. Securing information on the safety of food processing will constitute another research assignment detailing how information on packaging and processing work. Students will be asked to identify the toxic and/or foreign chemicals contained in their favorite snack food, and hygiene products (toothpaste, deodorants etc.), and keep a journal on their findings. Lessons to follow will be concentrating on genetics, DNA replication, genetic sequencing, importance of, and effects that proteins, hormones, and toxins create for tissue function, and complications occurring in genes because of toxic exposure.

Guiding questions will be formed for students to critically think about the project and how they are going to become a member of a bigger 'family' than their own. At the beginning of each lesson, the students will have questions to answer as journal entries.

As time goes on, the students will be developing their own guiding questions and coming up with ecologically sound answers. I stress again this is especially valuable to second language learners. Their teammates will be able to aid their understanding by reciprocal teaching methods. Those being: identify what information the question is really asking about; ask for clarification if not sure of answers; answer any questions that arise in their discussions; and finally generate another question to be asked later. This is a good activity for all students to improve their language skills.

The culminating Chemical Footprint project will be having seventh grade students "buddy up" with 1-2 different primary grade students and form teams of 2-3 (one seventh grader and 1-2 primary students). The seventh graders will inform the little ones on how to eat better, and be healthier. The student teams will develop a healthy eating newsletter and distribute their letter to all classes. They also will develop a PSA to present to the school board on concerning the hidden toxins found in our school environment.

## Activities

---

### Guiding Questions

Guiding questions will be formed for students to critically think about the project and how they are going to become a member of a bigger 'family' than their own. At the beginning of each lesson, the students will have questions to answer as journal entries.

As time goes on, the students will be developing their own guiding questions and coming up with nutritionally sound answers. I stress again this is especially valuable to second language learners. Their teammates will be able to aid their understanding by reciprocal teaching methods. Those being: identify what information the question is really asking about; ask for clarification if not sure of answers; answer any questions that arise in their discussions; and finally generate another question to be asked later. This is a good activity for all students to improve their language skills.

In addition to guiding questions; curricular readings, discussions, and journaling will all be an integral part of the project. Students will be interweaving technology into lessons by visiting and researching websites.

Students will participate in their own generated quests – one being “the intake of”, and “at risk” of being exposed to harmful chemicals activity. They will be creating charts on identifying and calculating chemical /toxin exposure rates, producing Power Point Presentations, and designing their exhibits for culminating public service announcements (PSA). The Power Point Presentations will feature not only the seventh graders, but also younger students who have been selected to work with on them on teams. Participating in writing, directing, and producing monthly nutrition tips will serve as a public service message and will be distributed to all respective grade levels.

## Lessons

---

### **Heredity**

*Guiding Questions:*

1. Which two scientific researches advanced the science of genetics?
2. Would you want to be able to change your DNA?

Students will be grouped in fours. They will read and review primary source documents from this time period. The documents can be obtained on line by accessing various educational websites utilizing the sub topic - Heredity and DNA. Students will discuss with group members and generate a chart depicting elements that were responsible for genetic investigations and their effect on DNA research. The next day they will do a jigsaw activity with each member from the group joining another group. Students will then discuss their findings and choose which elements had the most effect, and create a timeline representing their mutual conclusions. Assessment can be to have the students write a cause and effect essay using the information gained from the timeline.

### **Pesticides**

*Guiding questions:*

1. What are the most common pesticides/ herbicides used in food production?
2. What if any benefits do they offer? What are the consequences of exposure?
3. What do you know about toxins, and how they interact with body systems?
4. How do structure and function within a system potentially harm its well being?

Lessons will have students creating, and exhibiting charts on the highest pesticide / toxin exposures they encounter on a daily basis. After amassing the information, students will be paired up with each other to increase their results by performing class surveys within the middle school. They will be asked to critically inspect the data; record exposure rates to toxins; critique the five highest toxins encountered among the middle school population; and generate power point presentations highlighting their findings. The information will serve as material for future school-wide public service announcements.

## Resources

---

### Student

#### Books

*Thirteen Dangerous Toxins To Avoid In Your Food*

*Toxic Food Nation*

*Food Forensics*

#### Websites

<https://toxicfreefuture.org/>

[www.greenandhealthy.info/chemicalsinfood.html](http://www.greenandhealthy.info/chemicalsinfood.html)

<https://pubs.acs.org/doi/abs/10.1021%2Facs.jchemed.7b00218>

### Teacher Materials

#### Books

*Controversies in Food and Nutrition*

*Good Belly Bad Belly*

*GaMe Over: Why we don't need GMO foods.*

#### Websites

*Lesson Plans, Teacher Guides and Online Environmental Resources for Educators:*

<https://www.epa.gov/students/lesson-plans-teacher-guides-and-online-environmental-r>

[www.teacherplanet.com/content/environment](http://www.teacherplanet.com/content/environment)

<https://www.epa.gov/.../lesson-plans-teacher-guides-and-online-environmental-resource>

[https://www.scholastic.com/teachers/unit-plans/.](https://www.scholastic.com/teachers/unit-plans/)

<https://foodscience.cals.cornell.edu/research>

[www.pbs.org/now/classroom/classroom\\_kids1.ht](http://www.pbs.org/now/classroom/classroom_kids1.ht)

## Endnotes

---

1. Lourie, Bruce, and Rick Smith. *Toxin Toxout: Getting Harmful Chemicals out of Our Bodies and Our World*.
2. Science Explorer: Focus on Life Science. Prentice Hall 2001
3. EWG. EWG. Accessed July 28, 2018. <https://www.ewg.org/>.
4. Jenkins, McKay. *Whats Gotten into Us?: How to Live a Healthy Life in an Increasingly Toxic World*. 2011
5. Goldstein, Myrna Chandler., and Mark Allan. Goldstein. *Controversies in Food and Nutrition*. 2002
6. Goldstein, Myrna Chandler. and Mark Allan. Goldstein. *Controversies in Food and Nutrition*. 2002
7. Goldstein, Myrna Chandler. and Mark Allan. Goldstein. *Controversies in Food and Nutrition*. 2002
8. Food Safety and Applied Nutrition [fns.usda.gov](https://www.fns.usda.gov). Accessed July 11,2018
9. S. Dept. of Agriculture accessed July 10, 2018. [ww.usda.gov](http://www.usda.gov).
10. [usda.gov](http://usda.gov).
11. Carson, Rachel *Silent Spring 1*. The New Yorker June 18, 2017
12. Carson, Rachel *Silent Spring 1*. The New Yorker June 18, 2017
13. [gov](http://gov). Accessed July 14, 2018
14. Landers, Timothy F., Bevin Cohen, Thomas E. Wittum, and Elaine L. Larson. *Public Health Reports*.
15. Science Explorer: *Focus on Life Science*. 2001
16. [beef.org](http://beef.org) Accessed July 15, 2018
17. [beef.org](http://beef.org) Accessed July 15, 2018
18. *Antibiotics and the Food Industry* Accessed July 11,2018 [www.sustainabletable.org/257/antibiotics](http://www.sustainabletable.org/257/antibiotics)
19. Center for Food Safety. Accessed July 22, 2018
20. [genomes.gov](http://genomes.gov) /pages:/geneticstimeline. Accessed July 14, 2018
21. [silentspring.org](http://silentspring.org) Accessed July 14, 2018
22. Boyd, David R. *Dodging the Toxic Bullet How to Protect Yourself from Everyday Environmental Health Hazards*. 2014
23. <https://www.scientificamerican.com/article/plastic-not-fantastic-with-bisphenol>
24. *Stop Using Banned Food Additives That Can Harm Our Kids*. Change.org. Accessed July 13, 2018.
25. American Journal of Clinical Nutrition. [change.org](http://change.org). Accessed July 13, 2018
26. American Journal of Clinical Nutrition. [change.org](http://change.org). Accessed July 13, 2018
27. International Food Informational Website. Accessed July 12, 2018
28. Smith, Rick/ Lourie Bruce. *Slow Death by Rubber Duck: The Secret Danger of Everyday Things*.2011.
29. Goldstein, Myrna Chandler., and Mark Allan. Goldstein. *Controversies in Food and Nutrition*.
30. Goldstein, Myrna Chandler. and Mark Allan, Goldstein. *Controversies in Food and Nutrition*.
31. Cardiff, Emily. *Addictive Ingredients in Fast Food and Their Effect on Your Body*. One Green Planet.
32. [medicalnewstoday.com](http://medicalnewstoday.com). Accessed July 12, 2018
33. Blaylock, Russell L. *Excitotoxins: The Taste That Kills*.
34. Carson, Rachel Louise. *Silent Spring*.
35. Carson, Rachel Louise. *Silent Spring*.
36. Carson, Rachel Louise. *Silent Spring*.
37. Comstock, Gary. *The Case Against BGH* - Researchgate.net.
38. Goldstein, Myrna Chandler., and Mark Allan. Goldstein. *Controversies in Food and Nutrition*
39. *Hormones In Food: Should You Worry?* [health.com](http://health.com) Accessed July 12, 2018.
40. *Antibiotics and the Food Industry* Accessed July 11,2018 [www.sustainabletable.org/257/antibiotics](http://www.sustainabletable.org/257/antibiotics)
41. *Antibiotics and the Food Industry* Accessed July 11,2018 [www.sustainabletable.org/257/antibiotics](http://www.sustainabletable.org/257/antibiotics)
42. Landers, Timothy F., Bevin Cohen, Thomas E. Wittum, and Elaine L. Larson. *Public Health Reports*. 2012.
43. Carolan, Michael. *Cheaponomics - The High Cost of Low Prices* 2014

44. Landers, Timothy F., Bevin Cohen, Thomas E. Wittum, and Elaine L. Larson. Public Health Reports. 2012.
45. World Health Organization: *Genes and Human Diseases*. Accessed July 11, 2018  
<http://www.who.int/genomics/public/geneticdiseases/en/index3.html>

## Bibliography

---

Nature News. Accessed July 28, 2018. <http://www.nature.com/wls/topicpage/environmental-influences-on-gene-expression-536>.

FDA List of Food Additives That Are "Generally Recognized As Safe" (GRAS). Accessed July 28, 2018.

[http://www.roadtohealth.com/am/publish/article\\_102.shtml](http://www.roadtohealth.com/am/publish/article_102.shtml).

Nature News. Accessed July 28, 2018.

<http://www.nature.com/scitable/nated/topicpage/genetically-modified-organisms-gmos-transgenic-crops-nbsp-732>.

Balingasa, Nancy, and Eduardo Balingasa. *The Food Jungle: Your Guide to Healthy Eating: Your Survival Kit*. The Woodlands, TX: (PM) Printed Matters, 1999.

"Big Question: Can Your Environment Change Your DNA?" Duke Magazine. August 08, 2012. Accessed July 28, 2018.

<http://dukemagazine.duke.edu/article/big-question-can-your-environment-change-your-dna>.

Blaylock, Russell L. *Excitotoxins: The Taste That Kills*. Santa Fe, NM: Health Press, 1998.

Bonvie, Linda, Bill Bonvie, and James S. Turner. *Badditives!: The 13 Most Harmful Food Additives in Your Diet -- and How to Avoid Them*. New York: Skyhorse Publishing, 2017.

Booth, Michael, and Jennifer Brown. *Eating Dangerously: Why the Government Cant Keep Your Food Safe ... and How You Can*. Lanham: Rowman & Littlefield, 2015.

Boyd, David R. *Dodging the Toxic Bullet How to Protect Yourself from Everyday Environmental Health Hazards*. Nanoose Bay: Greystone Books, 2014.

Brown, Mary Jane. "Antibiotics in Your Food: Should You Be Concerned?" Healthline. Accessed July 29, 2018.

<https://www.healthline.com/nutrition/antibiotics-in-your-food>.

Cardiff, Emily. "Addictive Ingredients in Fast Food and Their Effect on Your Body." One Green Planet. September 16, 2013. Accessed July 28, 2018. <http://www.onegreenplanet.org/natural-health/addictive-ingredients-in-fast-food-and-their-effect-on-your-body/>.

Carolan, Michael S. *Cheaponomics: The High Cost of Low Prices*. New York: Routledge, 2014.

Carson, Rachel Louise. *Silent Spring*. London: Hamish Hamilton, 1962.

"Choose MyPlate." Choose My Plate. Accessed July 28, 2018. <https://www.choosemyplate.gov/>.

Colburn, Theo. *Our Stolen Future*. London: New English Library, 1997.

Costa, Annie. *The Feel Good Handbook*. LightHouse Press, 1998.

Epstein, Samuel S., Beth Leibson, and Gary Null. *Good Clean Food: Shopping Smart to Avoid GMOs, RBGH, and Products That May Cause Cancer and Other Diseases*. New York: Skyhorse Publishing, 2015.

EWG." EWG. Accessed July 28, 2018. <https://www.ewg.org/>.

*Food Safety*. Food and Nutrition Service. Accessed August 01, 2018. <https://www.fns.usda.gov/ofsf/food-safety>.

Goldstein, Myrna Chandler., and Mark Allan. Goldstein. *Controversies in Food and Nutrition*. Westport, Conn: Greenwood, 2002.

*Hidden Sources of MSG*. History of Use of MSG. Accessed July 28, 2018. <http://www.truthinlabeling.org/hiddensources.html>.

Jenkins, McKay. *What's Gotten into Us?: How to Live a Healthy Life in an Increasingly Toxic World*. New York: Random House, 2011.

Landers, Timothy F., Bevin Cohen, Thomas E. Wittum and Elaine L. Larson. *Public Health Reports*. 2012. Accessed July 29, 2018. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3234384/>.

Lourie, Bruce, and Rick Smith. *Toxin Toxout: Getting Harmful Chemicals out of Our Bodies and Our World*. Strawberry Hills, N.S.W.: Read How You Want, 2015.

McDonald, Libby. *The Toxic Sandbox: The Truth about Environmental Toxins and Our Childrens Health*. New York: Penguin, 2007.

"Silent Spring 1" June 18,2017 .[www.newyorker.com](http://www.newyorker.com)

Report of the FDA Retail Food Program Database of Foodborne Illness Risk Factors. Washington, D.C.?: FDA, 2000.

Robin, Marie-Monique. *Our Daily Poison: From Pesticides to Packaging, How Chemicals Have Contaminated the Food Chain and Are Making Us Sick*. New York: New Press, 2014.

Science Explorer: Focus on Life Science. New Jersey: Prentice Hall, 2001

Smith, Rick/ Lourie Bruce. *Slow Death by Rubber Duck: The Secret Danger of Everyday Things*. Pgw, 2011.

"The Case Against BGH - Researchgate.net. Accessed July 27, 2018.

## Articles

---

1. Can Environment Change Your DNA 2017 Article Nature Education
2. Identically Different - Why We Change Our Genes 2018 Article
3. Modern Nutrition in Health and Disease 2016 Article

## Websites

---

<https://www.epa.gov/environmental-topics/chemicals-and-toxics-topics>

<https://toxtown.nlm.nih.gov/> educators go to for environmental health

<https://www.ecocenter.org/.../toxic-worries-safemarketsorg-website-helps-find-safer-pr>

<https://www.edf.org/health/chemicals/getting-toxics-out-what-we-buy>

## Appendix

---

This curricular unit will address NGSS standards and satisfy district-learning outcomes for Science, Technology, Engineering, and Mathematics. The new NGSS standards are grouped in the grades levels 6-8. Seventh grade standards in all disciplines are being followed. This curricular unit will address NGSS standards and satisfy district-learning *outcome*.

*NGSS Standards:*

*MS-LS-1-5: Molecules to Organisms:*

*Structures and Processes:*

MS-LS-1-5 is based on how environmental and genetic factors stimulate the growth of an organism. Throughout the unit MS-LS-1-5 will be sufficiently covered in all specific topics.

*MS-LS-4-5: Biological Evolution Unity and Diversity:*

MS-LS-4-5 factors in how technology has changed the way humans influence the inheritance of desired genes or traits. MS-LS4-5 flows throughout the unit especially when segments of pesticides and phthalates are focused upon. Another location MS-LS-4-5 will appear, and be addressed is when the activity “What’s on your plate” is completed.

MS-LS3-1:

*Heredity and Variation of Traits:*

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. MS-LS-3-1 will weave its presences throughout the various topics with close attention on hormones and antibiotics.

RST.6-8.1:

*Technical Writing:*



Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.1 will coincide suitably with all of the aforementioned elements. MS-LS3-1 was specifically cited as the standard to address technical writing in science. Students will be journaling, charting and creating research projects throughout the unit. MS-LS-3-1 will indicate students' aptitude levels by students displaying their knowledge of, and practical capabilities executing scientific concepts.

---

<https://teachers.yale.edu>

©2023 by the Yale-New Haven Teachers Institute, Yale University, All Rights Reserved. Yale National Initiative®, Yale-New Haven Teachers Institute®, On Common Ground®, and League of Teachers Institutes® are registered trademarks of Yale University.

For terms of use visit [https://teachers.yale.edu/terms\\_of\\_use](https://teachers.yale.edu/terms_of_use)