Welcome to lecture 14, unusual hazards to the food supply. In this lecture we are going to cover a number of interesting topics that just don’t fit in any of the other lectures.

The objectives for this lecture are as follows. We will describe the dangers associated with food allergies. We will list the chemical and physical hazards to the food supply. Discuss the use of antibiotics for feed animals. Explain the role of growth hormones in growth promotion. Determine the most common food additives and their roles in food safety.

We begin by talking about food allergies. You will also see some descriptions in these slides of other conditions that are often confused with food allergies. For example, intolerance to milk. Food allergy is a hypersensitive response to foods that is mediated mainly as a result of an immunoglobulin E (IgE) mechanism. So this is a true allergy. These usually occur within the first two years of life. Symptoms usually occur within minutes to hours after eating foods. Some of the things you might see with allergic reactions are skin rashes, respiratory difficulties, vomiting, diarrhea, tingling and swelling in the mouth and throat. Unfortunately food allergies can also cause anaphylactic shock.

An interesting question is where do food allergies come from? In all honesty, we don’t know all of the answers to this question and we will return to that later. Sensitization usually occurs in the gastrointestinal tract by ingesting foods containing the allergen. Interestingly, pollen may be inhaled resulting in IgE which cross-reacts with proteins found in fruits and vegetables. Food allergies are usually acquired within the first two years of life. Previously it was thought that delaying the introduction of solid foods to infants would protect against allergies. However, there seem to be some cases in which pollen may be inhaled resulting in IgE which cross-reacts with proteins found in fruits and vegetables. In other words, you inhale the pollen triggering the IgE formation and when you eat the fruits and vegetables an allergic response occurs. Food allergies are usually acquired within the first two years of life. Previously it was thought that delaying the introduction of solid foods to infants would protect against allergies. Actually, the reverse was true. We used to delay introduction of...
foods like cow’s milk but this wasn’t a good idea. The field of nutrition changes very rapidly and this advice to delay foods is no longer true.

| Slide 5 | Let’s talk about the epidemiology of food allergies. About 4-6% of children have food allergies. Less than 4% of adults have allergies. You may be thinking this doesn’t make sense as children grow into adults. However, childhood allergies to milk, egg, wheat, and soy generally disappear during childhood. This is important because if you have a child with food allergies that are not life threatening, you should try to introduce the foods again later in life. However, if the allergy is to peanuts, tree nuts, and shellfish are generally lifelong. Food allergies are increasing for unknown reasons. There are a number of theories for why this may be happening. One of these is the hygiene hypothesis, a controversial idea that some people do not believe exists. Look up the history of polio in the US for more information on the hygiene hypothesis if interested. The hypothesis states that people live in cleaner conditions and the immune system is less likely to tolerate antigens. You may have heard to let your kids eat dirt, let them get dirty, it is good for their immune system. This is probably true. We also know that some of the increase is due to better diagnosis but that can’t explain all of the increase. Laboratory testing is really good now and we can detect more allergies in kids. Another concern is that processing foods increases the concentration of allergens. The idea is that processing is concentrating allergens but we don’t have any data to support this theory. We do know that concentration of allergens does occur with processing. The final theory is that we are being exposed to food proteins from other products. For example, the use of food proteins in skin creams might trigger allergic reactions. |
Slide 6

**Food Allergy Epidemiology**

- The majority of allergies (90%) are caused by 8 foods:
  - Peanut
  - Tree Nuts (Brazil, Cashew, etc.)
  - Soybean
  - Milk
  - Wheat
  - Egg
  - Fish
  - Shellfish

- Peanuts cause more serious reactions than all of the other food allergies combined.

Slide 7

**Food Allergy – Milk Allergy vs. Lactose Intolerance**

- **Milk Allergy**
  - Symptoms can range from mild (hives, most common) to severe (anaphylactic shock, rare).
  - 2.5% of children <3 years old are allergic to milk.
  - Most outgrow this allergy.
  - Caused by an immune response to milk proteins.
  - Prevention is avoiding milk and milk products.

- **Lactose Intolerance**
  - Symptoms involve the GI tract including bloating, nausea, diarrhea.
  - Caused by a lack of the enzyme lactase which breaks down the proteins in milk.
  - Often treated using Lactaid (which contains the enzyme) or probiotics, including yogurt (which contains microorganisms).
  - Does NOT involve the immune system and is NOT a life-threatening condition.

We want to be certain to differentiate milk allergies from lactose intolerance. In the case of milk allergies, symptoms can range from milk, usually hives, to severe such as anaphylactic shock which is rare. However, this class did have a student with a life threatening milk allergy. About 2.5% of children under the age of 3 are allergic to milk and most will outgrow this allergy. Caused by an immune response to milk proteins, almost always cow’s milk. Prevention is avoiding milk and milk products. There are a number of substitutes you can use. Consider the substitutes carefully. Soy milk and almond milk for example are not only highly processed, but both are also allergens. We don’t want to confuse milk allergy, which is rare, with lactose intolerance which is extremely common. Symptoms of lactose intolerance involve the GI tract, in other words, NOT hives. Usually bloating, nausea, and diarrhea. It is caused by lack of the enzyme lactase which breaks down the proteins in milk. You can treat this by using Lactaid which contains the enzyme, or probiotics, or yogurt a type of probiotic which contains microorganisms that will break down the lactose. Lactose intolerance does NOT involve the immune system and is NOT a life-threatening condition.
Lactose Intolerance (continued)

- All infants produce lactase and successfully digest lactose in milk or formula.
- However, lactase production decreases in most children after weaning.
- This drop in lactase production results in lactose intolerance.
- Most people can still tolerate lactose in smaller amounts and therefore it is recommended that dairy consumption is managed, not restricted.
- Dietary management also includes consumption of yogurt, use of probiotics, use of dairy products with hydrolyzed lactase (Lactaid).

You may be asking yourself where is all this lactose intolerance coming from? All infants produce lactase and successfully digest lactose in milk or formula. You may have known of a child who couldn’t digest milk and in all likelihood that child had a milk allergy. However, lactase production decreases in most children after weaning. The drop in lactase production results in lactose intolerance. Thus, most people as they get older develop lactose intolerance. You can probably still tolerate lactose in small amounts and it is recommended that dairy consumption is managed, not restricted. This is because dairy is a good source of vitamin D and calcium and other good stuff you may have learned about in nutrition. It is not recommended therefore to cut out dairy entirely but restricting amounts may be necessary. Again, dietary management includes consumption of yogurt, use of probiotics, etc.

Food Allergy - Wheat

- Allergies to wheat:
  - Symptoms include rashes, hives, swelling.
  - Serious reactions are possible but rare.
- Foods containing wheat are required to be labeled.
- Preventable by avoiding foods containing wheat.
- 10% of the population may be sensitive to wheat, however, fully 30% of the population reports reducing or eliminating wheat from their diets. The possible reasons for this are described on the next slide.

A lot of confusion occurs when we talk about food allergies as they relate to wheat. We are NOT talking about gluten here, but we will. This is food allergy to wheat. Allergies to wheat cause rashes, hives, and swelling. Serious reactions can occur but are rare. Foods containing wheat are required to be labeled because they could cause death. It is preventable by avoiding foods containing wheat. Seems easy, but if you do try to avoid wheat you may already know that this can be difficult. About 10% of the population may be sensitive to wheat, however, fully 30% of the population reports reducing or eliminating wheat from their diets. The possible reasons for this are described on the next slide. [Note added: nearly all of the 10% who are sensitive to wheat are actually sensitive to gluten, they do NOT have wheat allergies].
Gluten-related Disorders

- There are two types of conditions which are often related to wheat but are actually caused by gluten (which is present in wheat).
  - Celiac disease – an autoimmune disease which damages the small intestine.
  - Non-celiac gluten sensitivity – most common symptoms are abdominal pain, bloating, diarrhea, or constipation, without small intestine damage.

- Note: this topic is highly controversial in that many scientists do not believe that non-celiac gluten sensitivity exists. Studies have demonstrated that the symptoms are often the result of lactose, rather than gluten.

I wanted to be sure that we differentiate wheat allergies (last slide) from gluten-related disorders. Gluten is a really hot topic in nutrition and food safety at the moment. The food agencies are beginning to discuss whether foods should be labeled that they contain gluten. Many gluten-free foods have entered the market and some labels are being used. There are two types of conditions which are often related to wheat but are actually caused by gluten (which is present in wheat). Celiac disease is a serious condition. It is an autoimmune disease which damages the small intestine. Celiac disease is the reason it is being discussed to add “contains gluten” labels to foods. Celiac disease affects an estimated 1% of the population. In contrast, non-celiac gluten sensitivity causes abdominal pain, bloating, diarrhea or constipation, and causes no damage to the small intestine. However, a very large number of scientists do not believe that non-celiac gluten sensitivity exists. Studies have demonstrated that what people believe to be gluten sensitivity is actually lactose intolerance. This is problematic because people are removing gluten from their diets and their symptoms are not going away. Many of these people need to cut lactose from their diets, not gluten. Celiacs however must avoid gluten and a list is shown here on the right of what foods are safe and which to avoid.

Biotechnology and Allergy

- Biotechnology can be used to remove plant-derived allergens and reduce toxins from foods. Although these foods have been produced in the laboratory, none are currently available in stores (as of late 2015):
  - Rice
  - Soybean
  - Apple
  - Tomato
  - Peanut
  - Cassava (toxins)
  - Wheat

- Peanuts are responsible for approximately 200 deaths per year. These deaths are preventable using the GM peanut. Please take a minute to think about that. Would you approve the use of GM technology for something like this?
We are going to change gears from allergy to talk about chemical hazards. Chemical hazards are rare as compared to biological hazards but they still occur too many times. Some chemicals may contaminate foods unintentionally. Some of the things that may get into foods include paints and lubricants. If you watch shows like “Food Factory” you have seen the large machinery used in the production of foods. That machinery has paints, lubricants, etc. that can get into foods. What about sanitizers? What you ever been in a restaurant and watched someone spray sanitizers on countertops where they are making foods, or on soda machines? Various cleaners and coatings can get into goods. Metals can get in from inferior metal food contact surfaces. This isn’t talking about pieces of metals (those are physical hazards) but rather leaching from metals. In the case shown at right, a rodenticide containing barium was accidentally used instead of flour. Because of cases like this, it is illegal to store pesticides and cleaners anywhere near where food is being stored.

This is an unusual chemical poisoning that occurred due to Uncle Ben’s rice mix. Uncle Ben’s rice mix was recalled in 2014 because it caused a bunch of symptoms including burning, itching, rashes, and nausea. Niacin had been added to the rice because it is an essential vitamin. Keep in mind we fortify many of our foods. However, adding too much can result in niacin poisoning. It is important to remember that overuse of vitamins can be dangerous. The recall was never officially due to niacin but the product was recalled for the same thing a few months earlier. Food for thought: some vitamins and minerals can be dangerous in high amounts, beware treatments involving “mega-doses” of these.

This brings us to the yucky part of the food safety lectures, the physical hazards in foods. Physical hazards are foreign objects in foods that can cause illness or injury. In the picture at left you can see a mouse baked into the side of a loaf of bread. Pretty gross right! Physical hazards are usually the result of accidental contamination and poor food-handling practices. Physical hazards can enter the food supply anywhere from farm to fork.
I love this slide because it shows you the huge number of physical hazards that could end up in foods unintentionally. You can see there are plant sources of hazards, people can provide hazards, the premises itself can be hazardous. The product might include hazards such as bones or feathers. The packaging could result in hazards. So there are a lot of ways that physical hazards can make their way into your foods. We have to be aware of this when designing food production facilities.

I would be remiss if I didn’t show you pictures of gross stuff found in foods. This is a story done by CNN in which they show gross stuff found in foods. On the far left is lettuce containing a large snail. That snail carries a deadly disease. In the middle on top you can see canned green beans that contained toads. On the top right is most of a latex glove found inside a burrito. On the bottom is someone’s nose ring in a burrito. And finally these are needles found in sandwiches on Delta flights. The needle one was intentional and they never figured out who did this. They were found when people bit into the sandwiches and got stabbed with the needles.

How do we prevent physical hazards in foods? For starters, we don’t hire this guy! Employee vigilance is important. We need to be sure that employees are doing whatever they can to keep foods safe. Raw fruits and vegetables must be washed. Foods that cannot be washed should be visually inspected for hazards. Many producers use X-rays or metal detectors to check for contaminants. Please note that X-rays and all forms of ionizing radiation are prohibited in organic foods. Safe food handling practices at each step should be used to prevent accidental contamination. Workers don’t always do this as you can see in the picture. Workers should not be allowed to wear jewelry although plain wedding bands are often allowed. We don’t want to find someone’s nose ring in a burrito!
You may have heard that all of our foods is full of antibiotics and may be wondering if this is actually true. I want to begin here by telling you why antibiotics might be used in feed animals. Antibiotics are delivered to animals for the following reasons. Then can be given for disease treatment, disease prevention, disease control or for growth promotion/feed efficiency. This last one is the most controversial use of antimicrobials and will be discussed in more detail. If you add antibiotics to animal food or water they gain weight faster or use less food to gain an equal amount of weight.

Why should we oppose antibiotic use in feed animals? The following are the major consumer concerns associated with the use of antibiotics in feed animals. Could a person have an allergic reaction to an antibiotic fed to a feed animal if that person is allergic to that antibiotic? We will address each of these on the next slides. There are also concerns about the development of antibiotic-resistant bacteria. And there are concerns about animal welfare if antibiotics are used for growth. The concern that is most important at the moment is the use of antibiotics to enhance growth. This is a practice aimed entirely at profits and not animal welfare. The FDA is implementing a plan to phase out the use of medically important antibiotics for enhancing food production. Medically important antibiotics are those used to treat, prevent, and control diseases. Note the wording here, this still allows the use of antibiotics that are not used in human medicine. This is still problematic and many scientists, including your instructor, are against the continued use of ANY antibiotics to enhance growth. The FDA guidelines are the result of findings that all uses of antimicrobial drugs in both humans and animals, contribute to the development of antimicrobial resistant. You shouldn’t be using antibiotics you don’t need, and we shouldn’t be given them to animals either.
Why Not Phase Out All Antibiotics in Food?

- Banning the use of all antibiotics on farms would have the following consequences:
  - Unable to treat sick animals.
  - Unable to prevent the spread of diseases.
  - Animal suffering.
  - Animal mortality.
  - Cost – loss of animals would result in a significant profit loss for the farmer.

Why can’t we just ban all antibiotics in foods? Banning the use of antibiotics on farms would have the following consequences; we would be unable to treat sick animals, unable to prevent the spread of diseases, unable to prevent animal suffering, and animals would die. There would be significant costs involved in those animal deaths. USDA Organic certified foods cannot use antibiotics but this does not mean that they do not treat sick animals. The law requires that sick animals be treated on organic farms, but they can no longer be sold as organic products. In many cases, organic brands are owned by large companies who can sell that product as conventional foods.

Are Antibiotics Used in the Production of Organic Foods?

- Antibiotics may not be used in the production of organic foods.
- As shown in the USDA rule at right, antibiotics MUST be used to treat sick animals, which can then no longer be sold as organic.
- Organic animal handling practices minimize the occurrence and spread of diseases.

Here is a look at that legislation. Antibiotics may not be used in the production of organic foods. As shown in the USDA rule at right, antibiotics MUST be used to treat sick animals, which can then no longer be sold as organic. Organic animal handling practices minimize the occurrence and spread of diseases. Because organic farms often do not have a large number of animals in a small space, they do not tend to have the problems with disease spread seen in conventional crops. Something to think about, if an animal is treated with antibiotics, does that antibiotic stay in the animal forever? Do you think that the antibiotics you have taken in your lifetime are still in your body, or have they been processed?

Are we Eating Antibiotics?

- Milk is strictly tested for antibiotics and positive samples cannot be sold to the public.
- Animals who are treated with antibiotics must undergo a holding period to allow the antibiotic to clear the system before entering the food supply.
- Antibiotic residues do exist for a limited time in edible tissues, so the potential for ingestion exists if the producer fails to observe the waiting period or screening fails.

The answer to that is NO! Antibiotics are processed out of your body and out of the bodies of treated animals. There are a lot of ads like the one you see here on the right. Free antibiotics, just eat meat. But is this really true? Let’s start with milk. Milk is strictly tested for antibiotics and positive samples cannot be sold to the public. There is a guideline that says if you treat cows with antibiotics you must wait X number of days before milking and putting the milk on the market. This allows the antibiotic to leave the system. Animals who are treated with antibiotics must undergo a holding period to allow the antibiotic to clear. The resulting products are strictly tested and positive cannot be sold to the public. This is true for milk and it is also true for meat. Antibiotic residues do exist for a limited time in edible tissues, so the potential for ingestion does exist if the producer fails to observe the waiting period or if screening fails. Screening is in place and USDA and FDA
will randomly screen samples. Every once in while you will see a warning letter sent out to a company whose products violate this rule and a recall is ordered.

Let’s go back to those three consumer concerns on antibiotics and see if we can answer them. First is allergic reactions in persons with sensitivity to the antibiotic. Data do not support that this actually occurs. Antibiotic residues are prohibited in meat and milk products. Antibiotics could potentially remain in products after use but those products cannot be sold. Looking at the epidemiology, if antibiotic residues remained in meat and milk, we should be seeing an awful lot of reactions in allergic people, but this just isn’t occurring. Next is development of antibiotic-resistant bacteria. Overuse of antibiotics for both humans and animals results in resistant organisms. Absolutely, antibiotics must be used ONLY when necessary. We know for sure this contributes to resistant and antibiotic use MUST be restricted. What about concerns for animal welfare when antibiotics are used for growth? The FDA is in the process of banning the use of antibiotics for growth promotion. I think you will see more and more of this happening. We are also seeing certain companies come forward and say they refuse to use any animals given growth promoting antibiotics and this is a very good thing.

This brings us to another major consumer concern and that is growth hormones. Growth hormones have been approved for use in the food industry since the 1950s. Hormones are used to promote growth and to increase the leanness of meats. Includes naturally-occurring hormones such as estrogen and testosterone, and synthetic compounds. Note: Hormones are drugs and are therefore subject to FDA testing and approval.
What are the Concerns with Growth Hormones?

There are two main concerns regarding growth hormones:

- Concerns that trace amounts of hormones remaining in meat may lead to early puberty.
- Concerns that trace amounts of hormones remaining in milk may lead to increased production of IGF-1.

IGF-1 has been linked to several human diseases. Note: Despite what you might find posted on the Internet, growth hormones are not approved for use in poultry.

Recall that I warned you that internet conspiracy sites have lots of food misinformation. Here on the right is a sign saying eat this chicken and you could end up with cancer and your daughters will hit puberty at age 6. Because according to this website, there are growth hormones added. However, growth hormones have never been approved for use in poultry in the United States.

The only food approved to growth hormone use is cattle as of late 2014 and still true in late 2015. The use of growth hormone can increase the food yield of a single head of cattle by 10-15%. In other words, used to increase profits. Estimates of the amount of hormone in meat due to treatment are unreliable as the hormones occur naturally. Testing will always be positive. Overall, the hormones are present in extremely low concentrations. If we test untreated versus treated, the amounts are too low to tell a difference. Despite concerns, no health risks have yet been linked to the use of growth hormones in cattle. Note on right the sign on the beef. It has to say no ADDED hormones because they are naturally present. In other words, this meat was not treated with growth hormone but “no growth hormone” is prohibited.
Growth Hormones in Milk

- Recombinant bovine growth hormone (rbGH) is given to dairy cows to increase milk production.
- rbGH use increases the concentration of IGF-1 (insulin-like growth factor 1) in cow's milk.
- Body weight and IGF-1 are present in cow's milk.
- rbGH treatment does not alter concentrations naturally found in humans.
- No studies have demonstrated a link between rbGH milk and adverse human health.
- The following however may be consequences of using rbGH:
  - Higher incidence of mastitis in cows.
  - Requires treatment with antibiotics and therefore contributes to overuse of antibiotics.
- rbGH and IGF-1 are present in cow's milk.
- However, humans do not possess receptors for rbGH.
- IGF-1 is present in concentrations naturally found in humans.
- Humans do not possess receptors for rbGH, so many people will say it doesn't matter if this is present.
- IGF-1 is present in concentrations naturally found in humans. No studies have demonstrated a link between rbGH milk and adverse human health.
- rbGH is so controversial that most milk companies no longer use it. Please check the labels on your milk or at the grocery and see if you find a label that says “rbGH free”. Very little milk on the US market is still using this hormone.
- As a food scientist, I fully support getting rid of growth hormones. Less than 20% of milk producers use it now and it will likely disappear from milk soon and hopefully later from beef products.

Growth Hormones Summary

- Growth hormones are used to increase profits.
- There are no known health effects in humans despite the picture you see at right. Animals may suffer from the use of growth hormones and this contributes to antibiotic overuse. In my humble opinion, growth hormones will be the next target of elimination due to consumer concerns.
- IMHO, growth hormones will be the next target of elimination due to consumer concerns.
- Less than 20% of all milk producers use rbGH due to consumer concerns.
- Check your milk, is it rbGH free?

Food Additives

- Several things may be added to foods:
  - Preservatives – resist spoiling
  - Colors – including artificial
  - Flavors – including artificial
  - Nutrients – fortified foods
  - Sweeteners
  - Others
- NOTE: 1000s of additives are used in the food industry and due to time, only a few can be covered in this lecture.

This brings us to food additives. Food additives are one of the things that people really like to hate! As a food safety person, I do very little work with food additives as this falls on the side of food science rather than food safety. I did include a bit of info here because there is always interest and concerns. We could do an entire lecture on additives but I have chosen to do just a few here. There are several things that may be added to foods. We add preservatives to resist spoiling. We add colors including artificial colors. We add flavors, including artificial flavors. We add nutrients because sometimes we fortify foods. We add sweeteners and lots of other things. As you can see the giant pile of gummy worms which includes artificial colors and artificial flavors.
### Food Additives - Preservatives

- Most food additives are preservatives; they are added to help food resist spoilage.
- Sugar and salt and compounds containing each resist the growth of bacteria by withdrawing water from food.
- These are added sugars and salts which have nutritional consequences which are beyond the scope of this course.

<table>
<thead>
<tr>
<th>List of common preservatives:</th>
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<tbody>
<tr>
<td>Citric acid</td>
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<tr>
<td>Acetic acid</td>
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<tr>
<td>Sodium benzoate</td>
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<tr>
<td>Sodium nitrate</td>
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<tr>
<td>Calcium sulfate</td>
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<tr>
<td>Potassium sorbate</td>
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<td>BHA</td>
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<tr>
<td>BHT</td>
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<tr>
<td>EDSA</td>
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<td>Tocopherols (Vitamin E)</td>
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You may be asking yourself do we really need all of these food additives and I would say the answer depends on what you do in your own kitchen. How frequently do you shop? What sort of products do you buy? The answer is complicated and often depends on the consumer. Preservatives are one of the main things added to foods. We like foods with long shelf-lives. Most of us do not want to buy foods every single day. Most food additives are preservatives, they are added to help food resist spoilage. Sugar and salt and compounds containing each resist the growth of bacteria by withdrawing water from food. Importantly, these are added and sugars and salts which have nutritional consequences which are beyond the scope of this course. You all know the consequences of sugar and salt in terms of heart disease, obesity, etc. In this course, we will assume you are eating these foods in moderation in our discussion of whether these products are safe or not safe. Here is the list of very common preservatives. Citric acid is listed first as it is the most common. It is considered so safe that it is the preservative added to baby foods. You can see a bunch of other preservatives listed as well.

### Preservatives – BHA and BHT

- BHA and BHT are added to foods to prevent rancidity.
- Consumers have raised concerns because studies have predicted that both may be human carcinogens.
- Conversely, some studies suggest they may protect against cancer.
- FDA has approved the use of both at current levels because no health effects are seen at low levels of exposure.

Two of the most contentious preservatives in food right now are BHA and BHT. They are added to prevent rancidity. Check your food packages and see if these are in your food packages. Note that I said packages, most preservatives are used in packaged foods. Very few will be found in fresh fruits, vegetables, and meats. Consumers have raised concerns because studies have predicted that both may be human carcinogens. However, some studies have found that they may protect against cancer. The studies conflict. The FDA says at levels currently approved for use in foods, they have no effect. These have been used in foods for many years and the FDA says they are safe.
One of the other controversial things in foods is color additives. We add colors to foods for a number of reasons. They are added to offset the loss of colors due to light and air exposure. Light exposure causes foods to lose color. Sometimes we use color to change colorless items. For example, all those worms in the previous slide would not have all those interesting colors had we not added them. We also add fun colors, mostly to market to children. Finally, and really the most important use of colors, is to alert the customer to the taste. For example, if you don’t like banana, what color foods will you not eat? You probably associated yellow with banana so colors are a good clue. Very few artificial colors are FDA approved. There is extensive safety testing and use is strictly controlled. Some colors such as beta-carotene are added to deepen existing colors. So when you buy salmon, beta-carotene may have been added to give it that nice pink color. The following are some common food colorings, and this is pretty much the entire list as very few are approved. There is FD&C blues, reds, greens, and yellows. And you see some natural colorings including annatto extract, beta-carotene, and vegetable and fruit juices. Note that FD&C in colors refers to the Federal Food Drug and Cosmetic Act which we will discuss in the fourth module of this class.

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Colors – Yellow 5 and 6 – Mac and Cheese

- Due to consumer concerns, yellow dyes No. 5 and 6 were removed from some Kraft Macaroni and Cheese.
- In Europe foods with these dyes are labeled that they may cause hyperactivity in children.
- The FDA has cited several problems with this conclusion and notes that data does not support a role for these dyes in attention deficit disorders.
- Both dyes continue to be approved for use in the United States.
This brings us to the food additive flavors. Why do we add flavors? We like food that tastes good! Evolutionarily speaking, humans are tuned to like certain flavors. We like sugar and we like salt and we will seek both tastes. Food producers know this and this is why they add sweet and salty to your foods. Many foods will contain both artificial and natural flavors. Flavor enhancers act to improve the taste of flavors already present. Note that colors and flavors are matched to alert the consumer. Again, we know the yellow ones are going to taste like banana. Please note the flavor enhancers, this include MSG (monosodium glutamate), hydrolyzed soy protein (could be an allergen), autolyzed yeast extract (could contain gluten). What do we use for flavors? Natural flavors include spices, herbs, bark, leaf, bud and other plant parts, essential oils, and on and on. Synthetic flavors can also be made in a laboratory using chemicals. [note added: these will be labeled artificial flavors on packaging]. Both of these are derived from chemicals, only the source is different. 1000s of potential flavorings have been tested and none of them have any known health effects. It is important to note that there are laws in place that say that if any adverse health effects occur, additives cannot be used in foods.

I want to talk about one of the food additives which is MSG. Monosodium glutamate is added to foods to enhance their flavor. MSG enhances food’s flavor by triggering a savory response. We like salt, we like sugar, and we like savory. Many people have reported a link between MSG and physiological responses, in particular headaches. However, no clinical studies can demonstrate that this happens. When you do blinded trials, people who ate the foods couldn’t tell which contained MSG and which did not. If you feel you suffer headaches from MSG, you can easily avoid it by reading the food packaging. [Note added: this is more difficult when dining out, ask your server].
We also add a lot of nutrients to foods. Nutrients are added to replace vitamins and minerals that are lost during processing. The role of processed foods in nutrition is beyond the scope of this course. You are probably not surprised to know that many foods are processed to the point where they lose their nutritious value. Sometimes we add these nutrients back, and sometimes we add additional nutrients that are lacking in our diets. For example, we are currently revising guidelines for vitamin D as current levels are too low. Added nutrients include all of the vitamins (and minerals) shown on the right. A note of caution, sometimes these appear on packages with their chemical names. The rule you may have heard “don’t eat it if you can’t pronounce it” maybe isn’t the best rule as you might not be able to pronounce the chemical names of nutrients.

Here we have an added nutrient, vitamin D. Many diseases can be prevented by fortifying foods. In the United States, we fortify a number of foods, especially milk, flour, and cereals, with vitamins such as vitamin D. Check your foods, are they fortified? The UK does not fortify milk and flour and this may be contributing to a resurgence of rickets in that country. That is really quite sad, this is an old disease that should never make a comeback.

We add a lot of sweeteners to our foods. Sometimes these are simply sugars, other times they are non-caloric sweeteners. Sweeteners refers to a number of compounds added to foods to increase sweetness, with or without added calories. Please note that the controversy surrounding high fructose corn syrup is not a safety issue and we will not discuss it in this class. All added sugars have health consequences, it does not matter if it is high fructose corn syrup or sucrose they are all problematic if we eat too much. Look at the list on the right, are you familiar with some of these products such as sucrose, saccharin, and sucralose?
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Food Additives – Sweeteners

Despite repeated testing and reassurance from public health agencies, the public is still bombarded with unsubstantiated claims on the health risks from artificial sweeteners. Some of the big institutes such as the National Cancer Institute have attempted to combat this by placing official statements on their webpages noting that they have found no data to suggest sweeteners cause cancer. We do continue to test these sweeteners. What is more important is the role of sweeteners in nutrition. Despite substituting a lot of calories for non-caloric sweeteners, we still have an obesity epidemic. There is one study that suggests that a particular sweetener may contribute some markers found in people with diabetes. We do continue to discuss sweeteners and their role in metabolic issues. But in small amounts they just don’t seem to have any adverse health effects.

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Food Additives - Others

Other additives are really beyond the scope of this issue but they include things such as fat replacers, emulsifiers (a really hot topic at the moment), stabilizers, pH controllers, and on and on. Be careful when you hear certain claims about foods. When a person tells you that your food is full of chemicals, please be aware that they are being disingenuous. For example, look at the ingredients in an all-natural banana. Can you pronounce all of these words? Do they look like chemicals? Just because your food has many ingredients does NOT mean it is not safe!

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Lecture Summary

I hope you found this topic interesting and we answered some of the concerns you may have had about foods! [Note: if not, please don’t hesitate to stop by your instructor’s office and “talk food!”]. Food allergies affect a significant portion of the population and labeling is required to prevent illnesses. We will talk more about labeling in a later lecture. Physical and chemical hazards to the food supply exist along the entire production line and care must be taken to avoid accidents. Employees must remain vigilant to prevent these issues. Antibiotics have an important role in animal health, but like growth hormones, their role in growth promotion is controversial. Hopefully we will see both banned for growth production. Food additives including colors, flavors, and preservatives are commonly added to foods and are considered safe with no known health effects noted.
| no known health effects noted. In fact, if any adverse events were seen, the law requires removal from foods. |