Protecting Children's Health

Choosing Organic Food to Avoid GMOs and Agricultural Chemicals

CORNUCOPIA
INSTITUTE

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The Cornucopia Institute is dedicated to the fight for economic justice for the family-scale farming community. Through research and education, our goal is to empower farmers and their customers in the good food movement, both politically and through marketplace initiatives.

Cornucopia's Organic Integrity Project acts as a corporate and governmental watchdog assuring that no compromises to the credibility of organic farming methods and the food it produces are made in the pursuit of profit. We actively resist regulatory rollbacks and the weakening of organic standards, to protect and maintain consumer confidence in the organic food label.

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Table of Contents

Executive Summary

CONVENTIONAL FOODS COMMONLY CONTAIN RESIDUES of pesticides that may cause cancer, damage the nervous system and cognitive development, or disrupt hormone functions in humans. Genetically engineered (GE) foods are allowed in our food supply, without labeling, and have been introduced without adequate testing as to their potential harm for human beings or the environment. In addition, conventional processed foods often contain ingredients that were processed with synthetic solvents like hexane, which are neurotoxic.

All these human health hazards can be avoided simply by choosing organic food.

This report explores the scientific data regarding risks associated with conventional foods, and what parents can do to reduce their children's exposure.

PHOTO: ISTOCK

Currently, data and analyses from government agencies, peer-reviewed scientific publications and mainstream expert groups point to the importance of buying foods that have not been treated with toxic pesticides. The only label that assures the food has been third-party certified as grown without toxic pesticides is "organic." The decision to buy organic is science-based, to reduce long-term human health risks.

Scientific publications and expert opinions supporting the decision to buy organic are hiding in plain sight; corporate agribusiness and chemical companies are attempting to politicize or bury science that points squarely to the benefits of organic foods. This report spotlights the scientific evidence for choosing organic, especially for children.

Pesticides are biocides—toxic poisons by design, engineered to kill living organisms. Yet government regulatory agencies, which should protect public health from the effects of toxic pesticides, have been widely criticized as inadequate and outdated, especially for insufficiently protecting children.

The United States Department of Agriculture (USDA) annually tests common foods, both conventional and organic, for pesticide residues. Results show that conventional foods commonly contain pesticide residues, whereas organic foods are generally a safe haven.

Federal law and regulations prohibit the use of toxic synthetic pesticides in organic agriculture; as a result, studies have shown that children who eat primarily organic food have much lower levels of pesticide metabolites (breakdown products) in their bodies than children eating conventional foods.

One class of insecticides commonly used in conventional agriculture—organophosphates—interferes with the enzyme acetylcholinesterase, which is needed for nerve function. Humans share the same biochemical processes as insects and other animals. This means that poisons that disrupt the neurological systems of insects also disrupt the neurological systems of humans.

The Environmental Protection Agency (EPA) states that organophosphate pesticides are "very highly acutely toxic to bees, wildlife and humans."[1]

While it is a well-accepted fact that organophosphates are neurological toxins, based on studies on laboratory animals, little is known about the long-term effects on public health, especially on the health of children.

What we do know is that rates of neurological disorders in children such as autism and attention deficit hyperactivity disorder (ADHD) have risen alongside the increased use of these pesticides in conventional agriculture.

And in 2010, researchers affiliated with the Harvard School of Public Health and the University of Montreal found a correlation between higher levels of specific organophosphate pesticide residues in children's bodies and higher levels of ADHD.

Other common pesticides are classified as probable or known carcinogens. And emerging science on chemicals that disrupt the endocrine system (hormones) suggests that some pesticides, even in minute doses, may affect the reproductive health of future generations.

Agrochemical companies are not just manufacturing pesticides to be sprayed on food crops, they also have genetically engineered common food crops to internally produce the pesticides themselves. Other crops have been genetically engineered to be resistant to specific herbicides, so that weed killers that would normally kill or injure the plant can be sprayed more frequently and at higher doses to kill the competing plants (weeds).

When shopping for food, always look for the USDA Organic seal and for the word "organic" on the front of the package.

Meanwhile, our government's regulatory agencies, which have a congressional mandate to protect public health, have let agrochemical companies off the hook by requiring only rudimentary, inadequate and outdated safety testing for pesticides.

Safety testing for genetically engineered (GE) crops and animals is even less stringent. In fact, it is virtually nonexistent, since the U.S. government considers a genetically engineered crop to be "substantially equivalent" to a naturally bred plant.

While rates of cancer and neurological problems are rising, agrochemical companies claim that no experiment has proven that pesticide residues on foods cause health problems. That statement is true. Although extensive testing has occurred on laboratory animals, clearly illustrating risk, testing on humans, especially testing long-term effects of pesticides on children, is nonexistent as it would be highly unethical. Yet although such testing does not occur in clinical settings, it occurs daily on a massive scale: Our children are the agrochemical companies' human guinea pigs.

Parents and caregivers are fortunate that an alternative exists. We can opt out of this experiment on our children by choosing organic foods. The "organic" label on foods is government-regulated and third-party certified, and organic farmers are strictly prohibited from using most synthetic inputs, including neurologically toxic organophosphate pesticides and genetically engineered seed.

PHOTO: AWA PHOTOGRAPHER MIKE SUAREZ

What Do Experts Say about Pesticides?

PESTICIDES ARE TOXIC TO CHILDREN.

"Depending on dose, some pesticides can cause a range of adverse effects on human health, including cancer, acute and chronic injury to the nervous system, lung damage, reproductive dysfunction, and possibly dysfunction of the endocrine and immune systems."[2]

—National Research Council,
National Academy of Sciences

"There is a growing body of literature that suggests that pesticides may induce chronic health complications in children, including neurodevelopmental or behavioral problems, birth defects, asthma, and cancer."[3]

—American Academy of Pediatrics

CHILDREN ARE ESPECIALLY VULNERABLE TO THE TOXIC EFFECTS OF PESTICIDES.

"Children are at higher risk for cancer and other adverse health effects from pesticide exposures."[4]

—President's Cancer Panel,
National Institutes of Health

FOOD EXPOSES CHILDREN TO PESTICIDES.

"Diet is an important source of exposure to pesticides."[5]

—National Research Council,
National Academy of Sciences

THE MEANING OF "ORGANIC"

Federal law—the Organic Foods Production Act of 1990—ensures that food labeled "organic" was produced in compliance with strict and extensive federal standards.

No other food label is as strictly regulated by the government as the "organic" label.

Federal law and organic standards prohibit the following from organic food production:

- **Synthetic pesticides and "natural" pesticides that are harmful to human health or the environment**
- **Synthetic fertilizers**
- **Antibiotics and synthetic growth hormones in animal agriculture**
- **Artificial ingredients such as artificial colors, flavors and preservatives**
- **Petroleum-based volatile synthetic solvents (commonly used in conventional food processing)**

USDA-accredited certifying agents ensure compliance with the organic standards by inspecting organic farms and food processing operations annually. Certifying agents are also required by law to perform periodic residue testing (e.g., pesticide residues).

PHOTO: THINKSTOCK

UNDERSTANDING ORGANIC LABELS

Federal law stipulates that only certified organic foods may carry the USDA Organic seal and state "organic" on the front of the package.

It is important to understand the difference between the labels "organic" and "made with organic ingredients." Foods that contain at least 95% organic ingredients carry the USDA Organic seal and/or state "organic" on the front of the package.

These foods contain at least 95% organic ingredients, and the remaining 5% are ingredients that have been reviewed and approved for use in organics.

Products that contain at least 70% organic ingredients cannot bear the USDA Organic seal and cannot state "organic" on the front of the package. They may, however, state "made with organic ingredients" (for example, "made with organic wheat and vegetables") and must identify the organic certifier on the back of the package.

Note that foods labeled "made with organic ingredients" without the USDA Organic seal contain up to 30% non-organic ingredients. The ingredients list will tell you which ingredients are organic and conventional. The 30% non-organic ingredients cannot be genetically engineered, irradiated or grown on fields treated with sewage sludge.

EVEN EXPOSURE TO LOW DOSES OF PESTICIDES AFFECTS CHILDREN'S HEALTH.

"New science is showing that the effects of exposure to chemicals at low doses, and in combination, can have an impact on human growth and development."[6]

—National Institute of Environmental Health Science, National Institutes of Health

"Pesticides have a host of toxic effects that range from acute poisonings to subtle subclinical effects from long-term, low-dose exposure."[7]

—American Academy of Pediatrics

HEALTH EFFECTS FROM EXPOSURE TO PESTICIDES CAN BE LONG-TERM.

"Research has shown that chemical exposures during child development may contribute to health problems that arise later in life."[8]

—National Institute of Environmental Health Science, National Institutes of Health

ORGANIC FOODS PROTECT CHILDREN FROM PESTICIDE EXPOSURE.

"Organic produce contains fewer pesticide residues than does conventional produce, and consuming a diet of organic produce reduces human exposure to pesticides."[9]

—American Academy of Pediatrics

"Exposure to pesticides can be decreased by choosing, to the extent possible, food grown without pesticides or chemical fertilizers."[10]

—President's Cancer Panel, National Institutes of Health

Section I

Organic Diets Protect Children from Pesticide Exposure

ORGANIC FOODS ARE ESPECIALLY IMPORTANT for young children. As pointed out in a 1993 report by the National Research Council, babies and young children eat and drink more per unit of body weight than adults and are therefore likely to receive greater exposure to pesticides in food relative to their body size.[11]

According to the American Academy of Pediatrics (AAP), long-term effects of exposure to pesticides include increased risk of cancer, abnormal neurodevelopment, asthma and endocrine-mimicking effects on development. For certain classes of pesticides, including the widely used organophosphates, the AAP writes that food represents the most important source of children's exposure. (Other sources of exposure include pesticides used in the home, on lawns and gardens, and in drinking water.)[12]

PHOTO: THINKSTOCK

Peer-reviewed, published research has demonstrated that organic diets markedly decrease exposure to pesticide residues in children. In 2001, researchers at the University of Washington studying children's dietary pesticide exposure found that all but one of the 110 children in their research group had measurable levels of pesticide residues in their urine. The pesticides they found to be traveling through the children's bodies were organophosphates, a toxic class of insecticides developed from World War II–era nerve gas and designed to be toxic to the neurological system.

When the researchers questioned the parents of the one child whose urine contained no organophosphate pesticide residues, they discovered that the parents exclusively purchased organic produce.[13]

Two years later, the researchers published a study[14] showing that consumption of organic fruits, vegetables, and juice reduces children's pesticide exposure levels from above to below the U.S. Environmental Protection Agency's current guidelines for acceptable pesticide residues.

The researchers found that pesticide concentrations in urine samples were approximately six times higher in the children consuming non-organic diets than the children on organic diets. They wrote that organic produce and juice could "shift exposures from a range of uncertain risk to a range of negligible risk."

The researchers' conclusion: "Consumption of organic produce appears to provide a relatively simple way for parents to reduce their children's exposure to organophosphate pesticides."

Another team of researchers, at Emory University, found similar

"I recommend that pregnant women and parents of young children feed them organic whenever possible. Children are uniquely sensitive to environmental chemicals including pesticides for several reasons:

- **Their neurological system is still developing.**
- **Their immune system is not fully developed, limiting its ability to protect itself.**
- **Their detoxification systems have not fully matured, so they are less able to metabolize and excrete chemicals.**
- **Organic foods are the best way to protect your child from these chemicals."**

—Victoria Maizes, MD, executive director, Arizona Center for Integrative Medicine; professor of Clinical Medicine, Family Medicine, and Public Health; author, *Be Fruitful: The Essential Guide to Maximizing Your Fertility and Giving Birth to a Healthy Child*

TIPS FOR IDENTIFYING ORGANIC FOODS

- **Look for the USDA Organic seal.**
- **Certain companies or farms choose not to use the USDA Organic seal even though they are certified organic. Their products will state "organic" on the front of the package.**
- **When purchasing produce, the sticker's five-digit code starting with the number 9 signifies that the fruit or vegetable is certified organic. A four number code signifies the produce is conventional.**

results.[15] Median concentrations of metabolites for two toxic organophosphate class pesticides, malathion and chlorpyrifos, decreased to "nondetectable" levels immediately after the 23 children in their research group switched to organic diets.

Levels of these organophosphate metabolites remained nondetectable until the children switched back from an organic diet to a conventional one.

The researchers wrote: "We were able to demonstrate that an organic diet provides a dramatic and immediate protective effect against exposures to organophosphorus pesticides that are commonly used in agricultural production."

Researchers at the University of California at Davis studied 207 preschoolers and 107 school-age children's exposure to dangerous toxins, and concluded:

> "Based on dietary data we collected for different age groups, potential exposure to environmental toxins through the food consumption route is a real and significant concern particularly for children in their preschool and primary school years, with a high proportion of this age group estimated to exceed benchmark levels for a number of contaminants with known effects on health."[16]

The scientists found that children's greatest exposure to pesticides included dairy, fruits including apples, pears, peaches, grapes and strawberries, and vegetables including spinach, bell peppers, green beans and celery. Their findings show that exposure to contaminants often exceeds established benchmarks for safe levels of exposure. The scientists recommended consuming organically produced dairy, fruits and vegetables as a way to reduce children's exposure to toxic compounds.

In its technical paper "Pesticide exposure in children," the American Academy of Pediatrics writes, "Dietary modifications can help reduce pesticide exposure," and points out that "consuming organic produce has shown a reduced amount of urinary pesticide levels in comparison with a conventional diet."[17]

Ample scientific evidence exists to support the positive role of organic foods in reducing children's exposure to toxic pesticides.

Section II

Governmental Failures in Protecting Children

PARENTS AND CAREGIVERS MAY ASSUME that government agencies adequately regulate the safety of pesticides, and that acceptable "maximum levels" of residues on foods are established to protect children from harmful effects. This, unfortunately, is not the case.

Prominent pediatricians, including Dr. Philip Landrigan at the Mount Sinai School of Medicine and Dr. Philippe Grandjean at the Harvard School of Public Health, have repeatedly warned that neurotoxic chemicals, including agricultural pesticides, are not adequately tested for safety and are not regulated to protect children.[18]

PHOTO: DOLLAR PHOTO CLUB

The Environmental Protection Agency (EPA) regulates the use of pesticides, and residues of pesticides on foods, under several laws. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) requires all pesticides to be registered by the EPA.[19] The Federal Food, Drug and Cosmetic Act (FFDCA) sets tolerances for foods, and considers the risks to children and infants. Children's protection from pesticide exposure received a boost by the Food Quality Protection Act (FQPA) of 1996, which added a tenfold safety factor and considered risk from aggregate exposures when setting tolerance levels for pesticide residues on food. But concerns continue to exist.

The EPA, when it reviews and registers pesticides, relies on the pesticide manufacturer's own testing data to determine the safety of a pesticide. Moreover, the types of tests that they rely on are outdated and do not consider either long-term effects or the wide spectrum of pesticides' potentially harmful effects.

So how do we know which levels of neurotoxic pesticides are safe for young children? We don't.

Public health scientists like Dr. Theo Colborn have criticized the EPA for using tests with "crude end points," such as how much of a particular pesticide will kill a rat. Such tests reveal little, if anything, about how consistent exposure to low doses of pesticides on foods affects children's health. According to Dr. Colborn, this system fails in its duty to regulate pesticides with public health in mind, since these tests do not consider effects such as delayed developmental or functional damage.

When a pesticide acts as a neurological toxin, its effects

may not be immediately apparent. A fetus exposed to harmful levels of a neurotoxic pesticide during pregnancy may not be born with visible and detectable birth defects, since effects are neurological, not physical. Effects may not be expressed until years later, when cognitive delays or behavioral problems become apparent.

Damage to the neurological system is expressed in behavior or functions, and these functional deficits can show up years in the future and can vary in severity. Therefore, when symptoms do appear, such as autism or ADHD, it will be difficult, if not impossible, to link this neurological damage to exposure to specific neurotoxic pesticides in pregnancy, infancy, or early childhood.

Moreover, pesticides like the neurotoxic organophosphates may affect the human brain in ways that have not yet been adequately identified and understood. The toxicity to humans of the organophosphate pesticide chlorpyrifos may not be due to the mechanisms that render it toxic to insects. Rather, Dr. Colborn explains that its toxicity may be the result "of other newly discovered mechanisms that alter the development and function of a number of regions of the brain and central nervous system."[20]

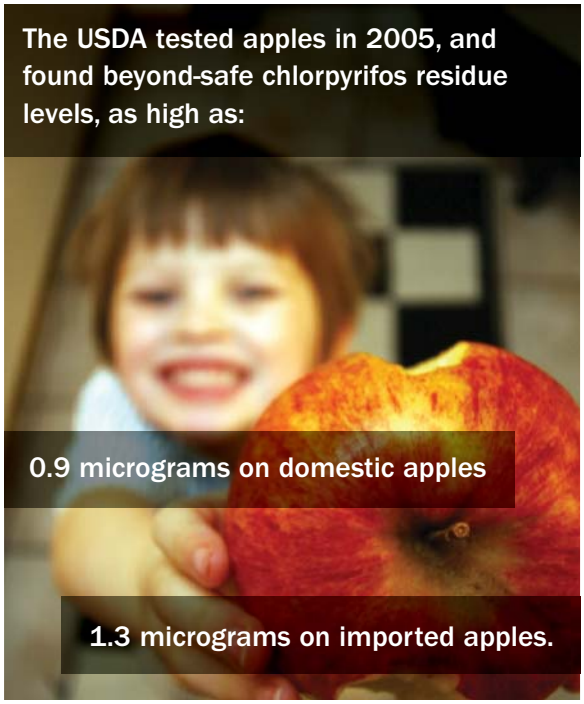


PHOTO: SEAN DREILINGER, FLICKR.COM

USDA tests found conventional apples that contained 90 times the EPA's safe limit for a child's chronic exposure to the neurotoxic pesticide chlorpyrifos, and five times the safe level for an acute exposure. Organic apples contained no chlorpyrifos residues.

Even though chlorpyrifos may not have a high acute toxicity in laboratory animals, Dr. Colborn suggests that "it may have other toxic strategies that are far more egregious."

If the mechanisms by which these pesticides are toxic to humans are not yet adequately understood by scientists, can we assume that it is safe to feed them to children? And more importantly, how can the EPA accept the results of safety tests when scientists have an incomplete and inadequate understanding of how these pesticides affect the development of children?

When maximum residue levels are set, there is no guarantee that foods will comply with these (already questionable) safety levels. The United States Department of Agriculture (USDA) tested samples of prepackaged apples in 1999, and found the neurotoxic pesticide chlorpyrifos on 30% of domestically produced conventional apples and 80% of imported conventional apples (single-serve apples have not been tested by the USDA since 1999). The EPA's "Population Adjusted Dose" for children's exposure to chlorpyrifos is set at 0.6 micrograms for chronic exposure and 10 micrograms for acute exposure. The highest level found on a single conventional apple was 54 micrograms—that's 90 times the EPA's limit that is considered safe for a child's chronic exposure, and more than five times the safe level for an acute exposure.

The USDA tested apples in 2005, and found found maximum chlorpyrifos residue levels of 0.9 micrograms on domestic apples, and 1.3 micrograms on imported apples.

Another serious shortcoming of the EPA's regulation under FIFRA is that it only measures risk based on exposures of individual contaminants. The agency's tolerance limits are based on results of safety tests that are designed to examine the effects of a single pesticide, not complex mixtures of pesticides that may interact with each other in unpredictable ways.

Safety testing therefore does not capture the actual effects of pesticide exposure as it occurs in a setting outside the laboratory. Many conventional foods contain more than one pesticide residue, and children eat multiple different foods each day, each potentially containing different pesticide residues. The interaction of multiple pesticides may have unique effects, yet safety tests are routinely performed using exposure to just one pesticide.

These problems and shortcomings of the EPA's system of regulating residues on foods underscore the main concern shared by many parents who opt for organic foods: Our children should not be guinea pigs for pesticides that are inadequately tested for safety in laboratory animals.

Section III

Pesticides as Neurotoxins

ORGANOPHOSPHATES (OP) BECAME A POPULAR REPLACEMENT for the toxic and carcinogenic pesticide DDT after its use was banned in the United States in 1972. OP pesticides kill insects by interfering with their neurotransmitters (chemicals that transmit signals from nerves to cells). These same neurotransmitters are found in the human body.

Because their brains are developing rapidly, babies and children are especially susceptible to the potential neurotoxic effects of pesticides.[21]

While rates of neurological disorders like autism and ADHD are rising, scientists have been unable to point to a single cause for this increase. It is likely that many sources contribute; after all, more than 200 chemicals that are known neurotoxins are present in our environment, food and drinking water.

Some scientists have identified mechanisms by which pesticides may increase the risk of autism,[22] while others have demonstrated that neurological toxins in food production may play a role, especially for populations and people with a genetic vulnerability.[23]

Research has shown that non-dietary exposure to organophosphate pesticides like malathion and chlorpyrifos, heavily used in American agriculture, negatively affect the developing neurological systems of fetuses, babies, and young children.

Columbia University researchers, in partnership with the Centers for Disease Control and Prevention, published a 2006 study in the journal Pediatrics showing that organophosphate pesticide exposure during pregnancy is associated with delays in mental development at 2 to 3 years of age.[24]

A similar study, from the University of California – Berkeley, found that exposure to common organophosphate pesticides, both during pregnancy and infancy, is associated with risk of pervasive development disorders including lower scores on tests of mental development at age 2.[25]

Several other studies also found that organophosphate exposure negatively affects development, including increased rates of behavioral problems, poorer short-term memory and motor skills, and longer reaction times in children.[26] [27] [28]

In 2010, researchers at the University of Montreal and Harvard published a seminal study — the first one to confidently link dietary organophosphate exposure in children and attention deficit hyperactivity disorder (ADHD).[29]

> The researchers analyzed the levels of pesticide residues in the urine of more than 1,139 children ages 8 to 15, and found that "children with higher urinary levels of organophosphate metabolites were more likely to meet the diagnostic criteria for ADHD."

"My son was diagnosed at age ten with a condition known as PANDAS/PANS/PITAND, similar to autism spectrum. We consulted with an MD who recommended a gluten-free diet with organic ingredients, because the immune system is already taxed from the illness and further assault from pesticides, hormones, and GMOs will not allow for the child's system to heal. People in the community tell me how healthy my son looks now. We can address his behavior issues and are having far more success than before."

—Jacqueline Van Nes, Salinas, CA

PHOTO: THINKSTOCK

HOW MANY PESTICIDES?

Nearly 1,400 pesticides are registered with the EPA. When the USDA tests foods for pesticide residues, one of the most striking findings is the variety of different pesticide residues found. For example, the USDA reported 52 different pesticides on blueberries, 34 different pesticides on grapes, 26 different pesticides on raisins, and 14 different pesticides on single-serve apples.

Safety tests rarely look at the effects of two or more toxic pesticide residues consumed together. Moreover, since children consume various foods throughout the day, they likely consume various pesticides if they consume conventional foods.

For each tenfold increase in organophosphate metabolite levels, the risk of ADHD increased 55% to 72%, depending on the criteria used for case identification.

"It is prudent for parents to try to reduce their children's exposure to pesticides," said Dr. Maryse Bouchard, a professor at the University of Montreal and fellow at the Harvard School of Public Health and the lead researcher of the study that linked pesticides to ADHD.[30] The study's findings were also reported in The Journal of the American Medical Association.[31]

With rates of neurological disorders in children rising, and billions of pounds of neurological toxins sprayed on our food annually, parents can opt out of this uncontrolled experiment on our children by choosing organic foods. On conventional foods, 22 different neurotoxic pesticide residues are commonly found.[32] None of these are allowed in organic production, where residues are found only in rare cases.

Section IV

Pesticides as Carcinogens

MANY WIDELY USED PESTICIDES IN CONVENTIONAL agriculture are classified as "possibly carcinogenic" or "likely to be carcinogenic to humans" by the EPA. Prominent physician-scientists who authored the 2009 President's Cancer Panel Report found that "approximately 40 chemicals classified by the International Agency for Research on Cancer (IARC) as known, probable, or possible human carcinogens are used in EPA-registered pesticides now on the market."

The President's Cancer Panel Report noted that "exposure to these chemicals has been linked to brain/central nervous system (CNS), breast, colon, lung, ovarian, pancreatic, kidney, testicular, and stomach cancers, as well as Hodgkin and non-Hodgkin lymphoma, multiple myeloma, and soft tissue sarcoma."

The American Academy of Pediatrics (AAP) reviewed the scientific body of literature on pesticides and childhood cancers. They noted that many widely used pesticides are categorized as "possible" or "likely" carcinogens, and that "a substantial amount of observational epidemiological data demonstrate a link between pesticide exposure and childhood cancers."[33]

The AAP also notes: "Overall, the most comprehensive reviews of the existing literature implicate an association of pesticides with leukemia and brain tumors."[34]

The authors of the President's Cancer Panel advise Americans to decrease exposure to pesticides by choosing food grown without pesticides or chemical fertilizers. Organic farmers are prohibited from using carcinogenic synthetic pesticides or chemical fertilizers, and residue testing indicates that organic food is demonstrably lower in agrichemical residues.

"My home-based daycare has been evolving for 27 years. I have long been using as much whole, fresh and organic foods to cook for the children as I can buy. I feel it is my job to help them to grow in the healthiest way possible. In addition I feel that by supporting local farmers I am safeguarding clean food supplies. Hopefully the families who see their children eating a variety of organic fresh foods will carry the habit to their own tables."

—Sonia Liskoski, Kennedy Township, PA

PHOTO: THINKSTOCK

WHAT'S IN CONVENTIONAL "ANTS ON A LOG"?

All three ingredients of "ants on a log," a popular snack food for young children made with conventional celery, peanut butter and raisins, contained residues of carcinogenic pesticides on a percentage of the samples.

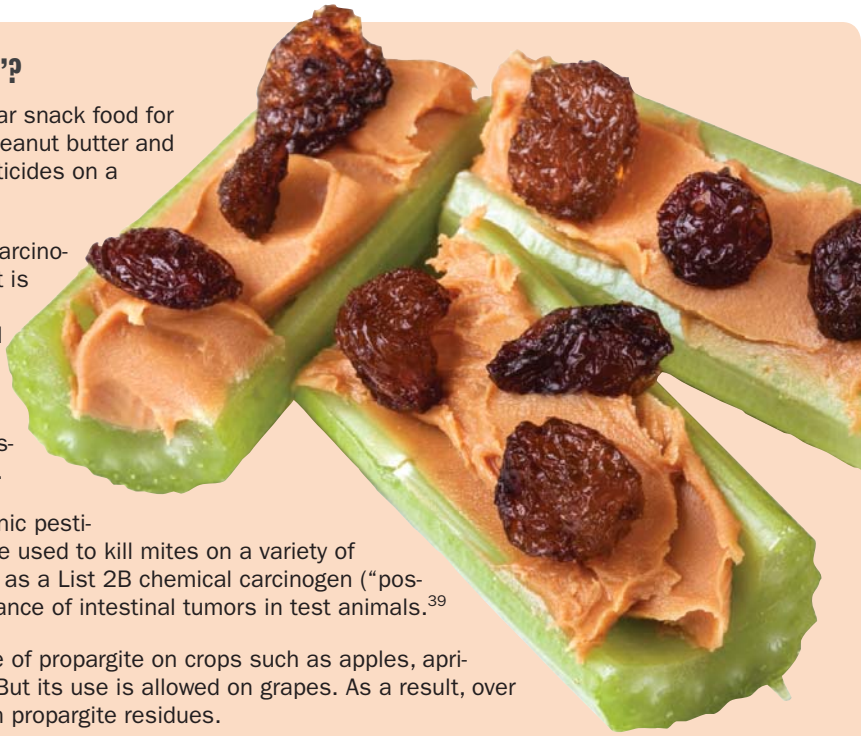


PHOTO: ISTOCKPHOTO.COM

CELERY: CHLOROTHALONIL is one of several carcinogenic pesticides found by the USDA on celery. It is a broad-spectrum fungicide[35] and a List 2B carcinogen[36] ("possible human carcinogen") based on the occurrence of tumors in test animals.[37]

The USDA detected residues on approximately one-third of conventional celery samples. No residues were detected on organic celery samples.

RAISINS: PROPARGITE is one of the carcinogenic pesticides found on raisins. It is a chemical pesticide used to kill mites on a variety of field, fruit and vegetable crops.[38] It is classified as a List 2B chemical carcinogen ("possible human carcinogen") based on the appearance of intestinal tumors in test animals.[39]

Due to its cancer risk, the EPA prohibits the use of propargite on crops such as apples, apricots, peaches, strawberries, pears and plums. But its use is allowed on grapes. As a result, over one-third of conventional raisin samples contain propargite residues.

A smaller percentage of organic raisins also contain propargite residues, possibly as a result of pesticide drift from neighboring conventional farms. Since organic grapes cannot by law be sprayed with propargite, the levels of residues on organic raisins are considerably lower—the average level is 13 times lower on organic than conventional, and the maximum level found on an organic sample is 118 times lower than the maximum level found on conventional.

PEANUT BUTTER: PIPERONYL BUTOXIDE (PBO) was found on 26% of the samples studied by the USDA. PBO is a pesticide synergist used in a number of insecticide products.

Section V

Pesticides as Endocrine Disruptors

IN ADDITION TO DAMAGING NEUROLOGICAL SYSTEMS and increasing cancer risk, many pesticides are endocrine disruptors. According to research by the European Union and endocrine expert Dr. Theo Colborn, 56 different pesticides are endocrine disruptors.[40]

Endocrine disruptors are substances that mimic or interfere with the function of hormones in the body. They may turn on, shut off, or modify signals that hormones carry, thereby affecting normal functioning of tissues and organs in the body. Since hormones act at very low doses in the body, endocrine disruptors are thought to do harm at low doses.

Harmful effects of endocrine disruptors

Endocrine disruptors have been linked with developmental, reproductive, neural, immune, and other problems in wildlife and laboratory animals.[41]

Endocrine disruptors have been linked with:

- ➔ Reductions in male fertility and declines in the numbers of males born;
- ➔ Abnormalities in male reproductive organs;
- ➔ Female reproductive health issues, including fertility problems, early puberty, and early reproductive senescence;
- ➔ Increases in mammary, ovarian, and prostate cancers;
- ➔ Increases in immune and autoimmune diseases, and some neurodegenerative diseases;
- ➔ Increased incidence of obesity.

Research, including by the National Institute for Environmental Health Sciences (NIEHS) and the National Toxicology Program (NTP), shows that exposure to endocrine-disrupting chemicals, often used in conventional agriculture, can adversely affect human health in ways similar to what has been found in laboratory animals and wildlife.

Effects on human health from exposure to endocrine disruptors may include reduced fertility, increased incidence of obesity, and increased incidences or more rapid progression of some diseases, including diabetes, endometriosis, and some cancers.[42]

"I have one son who is now 26 years old. When he was born, it became most important to me that he have clean water and healthy food. I got a good water filter for my kitchen sink and started buying as close to all-organic as I could. Starting with our youngest, we must convince daycare centers, preschools, and elementary schools to do the right thing: serve only healthy, nutritious food to our precious, vulnerable children. Buy organic or grow your own!"

—Julie R. Harris, RN, Berkeley, CA

PERCENTAGE OF SAMPLES CONTAINING IPRODIONE RESIDUES

FRUIT	CONVENTIONAL
Nectarines	99.5% (imported)
Plums	93.8% (imported)
Peaches	99.5% (imported)
Frozen Strawberries	50%
Grapes	28.7% (imported)
Blueberries	34.1% (imported)

Iprodione is a suspected endocrine disruptor. A 2007 study found iprodione disrupted the sexual development of male rats.

ENDOCRINE DISRUPTING PESTICIDES

The table below shows pesticides that have been linked in one or more published, peer-reviewed studies to effects on the endocrine system, and foods where they appear, according to USDA test results.

PESTICIDE	CONTAMINATED FOODS
Acephate	Canned pears, canned peaches, apples, strawberries, blueberries, watermelon, green beans, celery, bell peppers, etc.
Carbaryl	Strawberries, peaches, cherries, pears, canned pears, pear juice, grapes, grape juice, blueberries, apples, apple sauce, apple juice, raisins, etc.
Diazinon	Apples, apple sauce, peaches, pears, etc.
Dimethoate	Apples, oranges, peaches, strawberries, blueberries, pear juice, peaches, canned tomatoes, cherries, spinach, celery, green beans, cantaloupe, lettuce, kale, sweet peas, watermelon, broccoli, cauliflower,
Endosulfan	Apples, peaches, strawberries, plums, pears, tomatoes, etc.
Iprodione	Nectarines, peaches, plums, grapes, strawberries, blueberries, carrots, cherries, pears, raisins, spinach, etc.
Malathion	Wheat grain (used to make bread, cereal, crackers, etc.) Corn grain (used to make corn cereal, tortilla chips, etc.) Strawberries, blueberries, pears, cherries, broccoli, peanut butter, grape juice, apples, spinach, celery.
Triadimefon	Pineapples, grapes, cantaloupe, peaches, spinach, etc.

When the American Academy of Pediatrics examined health effects of pesticides, they agreed that "there is compelling basic scientific evidence for endocrine- mimicking effects of several pesticide chemicals that is sound and scientifically plausible."[43]

With endocrine disruptors, low doses do most harm

What is especially alarming is that harm caused by endocrine disruptors occurs at low doses. The EPA has regulated pesticides with the understanding that higher doses do more harm than low doses; as a result, many pesticides are approved for use because regulators assume that consumers will be exposed to low doses of residues. Traditional safety testing, which generally exposes laboratory animals to intentionally high doses for a portion of the animals' lifespan, is inadequate for protecting consumers from endocrine disruptors.

Research shows that the assumption that low doses do less harm than high doses is incorrect and cannot be used to regulate endocrine disruptors. The NIEHS explains why low doses do more harm than high doses:

> The body's own normal endocrine signaling involves very small changes in hormone levels, yet we know these changes can have significant biological effects. This leads scientists to think that chemical exposures, even at low doses, can disrupt the body's delicate endocrine system and lead to disease.

An independent panel of experts convened by the NIEHS in partnership with the NTP found that "there was 'credible evidence' that some hormone-like chemicals can affect test animals' bodily functions at very low levels—well below the 'no effect' levels determined by traditional testing."

Endocrine disruptors have long-term effects

Another concern with endocrine disruptors is that the effects are often long-term. In research using laboratory animals, the effects of early exposure to endocrine-disrupting chemicals include reduced fertility and cancer, which were not apparent until much later in life. This underscores the importance of protecting babies and young children from endocrine-disrupting chemicals, to protect them from effects that may not manifest until the children are grown.

To complicate matters even further, research suggests that the effects of endocrine disruptors may not only be long-term within the individual's own lifespan, but may even be multi-generational. New research funded by the NIEHS found that endocrine disruptors may affect not just the offspring of mothers exposed during pregnancy, but future offspring as well.[44]

Section VI

Pesticides and Food Allergies

FOOD ALLERGIES ARE ON THE RISE. As with other increasingly common conditions affecting children, scientists have not been able to definitively pinpoint a cause, but they suspect that pesticides may be partially responsible.

A recent study found that study participants with high levels of the pesticide dichlorophenol in their bodies were more likely to have allergies than those with low levels.

Dr. Elina Jerschow, one of the study's authors and a professor at the Albert Einstein College of Medicine at Yeshiva University, stated: "Previous studies have shown that both food allergies and environmental pollution are increasing in the United States. The results of our study suggest these two trends might be linked, and that increased use of pesticides and other chemicals is associated with a higher prevalence of food allergies."

According to Dr. Jerschow, pesticide-treated fruits and vegetables are a source of dichlorophenol, and "may play a greater role in causing food allergy" than other sources of the pesticides, such as drinking water.

These are preliminary findings, and more research is needed. But these initial findings serve as a reminder to parents and caregivers that there is much we do not know about potential harmful effects of agrichemicals. Organic foods can protect our children not only from the harmful effects that scientists have already identified, like ADHD, but from potential harm that scientists are in the early stages of discovering and identifying.

Dr. Kenneth Spaeth, director of the Occupational and Environmental Medicine Center at North Shore University Hospital in Manhasset, N.Y., stated, after reviewing the study published in the *Annals of Allergy, Asthma and Immunology*, that "it is plausible that exposure to these pesticides during this development could alter the immune system in ways that could increase the risk of allergies." Among his tips for avoiding exposure to pesticides: choose organic foods.

PHOTO: MICHELE MOLINARI, FLICKR.COM

"The landscape of children's health has changed. With the escalating rates of diabetes, allergies, autism, obesity and cancers, our children have earned the title 'Generation Rx' and are the first generation expected to have a shorter lifespan than their parents. This has to change. Thankfully, reports from the President's Cancer Panel, the American Academy of Pediatrics and now The Cornucopia Institute highlight steps that parents can take to protect the health of our children. Because while our children are only 30% of today's population, they are 100% of our future."

—Robyn O'Brien, founder of AllergyKids, author, *The Unhealthy Truth: One Mother's Shocking Investigation into the Dangers of America's Food Supply*

DON'T BE FOOLED! LOOK FOR THE ORGANIC SEAL AND LABEL

- **Trust the organic seal, not the store. Not all foods sold at "organic" stores are organic. Stores such as Whole Foods offer many organic options, but many of the foods sold there are conventional. Just because blueberries were sold at a natural food store does not mean they were not sprayed with pesticides—unless they are certified organic.**
- **Trust the organic seal, not the brand. Some prominent companies offer both organic and conventional products under the same brand name. Examples of brands that are not necessarily organic include Kashi (Kellogg), Annie's and Earth's Best (Hain Celestial).**
- **Trust the organic seal, not the brand name. Newman's Own Organics products are not always eligible to label their products as "organic." But because "Organics" appears in their brand name, consumers may mistakenly assume all their products are certified organic.**

Section VII

Genetically Engineered Foods

IT'S ONE THING TO DOUSE FOOD CROPS IN PESTICIDES, but another thing entirely to insert foreign DNA from bacteria, viruses or fungi into plants to enable them to manufacture their own pesticides. Other crops have been genetically engineered to resist herbicides, so that ever greater amounts of chemicals may be sprayed on the land that grows those crops so as to kill the plant's competitors.

Genetic engineering is commonly a process of manipulating the genetic material of an organism by inserting genes, through recombinant DNA gene splicing, from a different species into the genetic makeup of the organism.

In the United States today, the USDA reports that 88% of corn and 93% of soybeans are genetically engineered to either resist herbicide applications, produce their own toxins, or both.[46] These novel life forms are patented for profit, and produced by a handful of biotechnology and agrichemical corporations, including Monsanto Corporation of St. Louis, Missouri, and Dow Agrosciences of Indianapolis, Indiana.

Since foods containing genetically engineered (GE) ingredients, also known as GMOs (genetically modified organisms), are not required to be labeled in the U.S., there is no way to know if the food you are buying is genetically engineered. Conventional processed foods containing corn, soy, sugar beet or rapeseed (canola) likely contain genetically engineered ingredients. Given the wide range of ingredients that are derived from corn, sugar beets, canola or soybeans (e.g., maltodextrin, ascorbic acid, textured vegetable protein), even foods without the words "corn," "sugar beet," "canola" and "soybean" in the ingredients list may contain GMOs.

Organic foods provide a safe haven from genetically engineered food, because the USDA strictly prohibits the use of genetically engineered seed in organic farming.[47]

PHOTO: LYNDSAY STRADTNER LIFEINMOTIONPHOTOGRAPHY.COM

Two common GE traits

In their marketing and public relations materials, chemical and biotechnology companies tend to imply that genetic engineering of food crops is helpful in producing higher yields and "feeding the world."[48] What they don't tell people is that the two most common GE traits have nothing to do with increasing yields. In fact, a report by the Union of Concerned Scientists showed that yields have not increased significantly with GE crops, especially compared with the yield increases accomplished using traditional breeding techniques.[49]

Rather than "feeding the world," biotechnology companies have focused on creating crops that resist or produce patented agricultural chemicals.

The herbicide-tolerant GE varieties allow farmers to spray weed killers on crops that would naturally destroy the crops as well as the weeds. But the crops resist the herbicides because they have been genetically engineered, using techniques that introduce foreign genes of other species, including bacteria and viruses, into the DNA sequence of the crop.

This allows the pesticide manufacturers—the same corporations that are genetically engineering crops (such as Monsanto or Dow Agrosciences)—to sell seeds and pesticides as a package, and continue to profit from the sale of their branded agricultural chemicals even after their patent expires.

A Washington State University researcher, Charles Benbrook, calculated the impact of genetically engineered crops on pesticide use, and found a 7% increase in pesticide use on genetically engineered crops between 1996 and 2011.[50] This research, which calculated that an additional 404 million pounds of pesticides were applied to farm fields with genetically engineered crops, counters claims by the biotechnology industry that their genetically engineered crops reduce the use of pesticides.

Another common GE variety contains genes of a bacterial insecticide. The genes from the soil bacterium *Bacillus thuringiensis* (Bt) that are responsible for producing proteins toxic to certain insects, such as the European corn borer, are inserted into the DNA of the corn crop. The crop is the pesticide, and the pesticide is the crop—the two have been genetically merged. Every bite of the food, therefore, means a dose of the pesticide.

Concerns with genetically engineered foods

Serious questions regarding the safety of genetically engineered foods exist.

First, genetically engineered foods have not been adequately tested to ensure safety, because the FDA uses the concept of "substantial equivalence" in regulating GE foods. Because it considers GE plants to be "substantially equivalent" to traditionally bred plants, the agency requires minimal safety testing before allowing GE foods to appear, unlabeled, on market shelves.

The idea to use the concept of "substantial equivalence" to regulate GE crops was first introduced in 1993 by the Organization for Economic Cooperation and Development (OECD).[51] The OECD's mission is to "promote policies that will improve the economic and social well-being of people around the world";[52] its primary aim is to stimulate world trade,[53] not protect public health.

The concept of "substantial equivalence" means that a genetically engineered food is characterized as equivalent

PHOTO: KAYOSSUS, FLICKR.COM

to its natural counterpart. Since it is assumed to be "substantially equivalent," the assumption is that it poses no new health risks.

In 1999, three British scientists criticized the idea of "substantial equivalence" in a commentary published in the prominent scientific journal *Nature*, stating: "Showing that a genetically modified food is chemically similar to its natural counterpart is not adequate evidence that it is safe for human consumption." They pointed out that the term has never been properly defined, and that its vagueness only serves the interest of the biotechnology corporations, rather than public health.[54]

In an Earth Open Source report titled "GMO Myths and Truths," the basic flaw with "substantial equivalence" is elucidated with the following analogy:

A useful analogy is that of a BSE-infected ["mad cow disease"] cow and a healthy cow. They are substantially equivalent to one another, in that their chemical composition is the same. The only difference is in the shape of a minor component of a protein (prion), a difference that would not be picked up by a substantial equivalence assessment. Yet few would claim that eating a BSE-infected cow is as safe as eating a healthy cow.[55]

Second, government agencies base their decisions regarding the safety of GE foods on tests performed by the biotechnology corporation that developed the novel organism. The FDA does not perform its own safety testing, nor does the agency require results from safety tests performed by independent, third-party scientists without a financial interest in the outcome of the tests.

Two published reviews have shed light on the validity of the concerns that safety tests performed by scientists affiliated with biotechnology corporations are less likely to be questioned.

A 2011 review published in *Environment International*[56] found roughly an equal split between the number of peer-reviewed studies that conclude there are no risks, and those

that conclude there are health risks. The vast majority of studies finding no risks were sponsored by the biotech industry or associates.

The other review, published in *Food Policy*, also in 2011, found a significant correlation between researchers' affiliation to industry and the study's outcome—not surprisingly, casting genetically engineered foods in a positive light.[57]

Shortcomings of GMO safety testing

One of the many shortcomings of current safety testing is the use of 90-day feeding trials. According to scientists concerned with consumer health, "the 90-day-long tests are insufficient to evaluate chronic toxicity."[58] These scientists noted early signs of disease in the kidneys and livers of test animals in 90-day studies. A 90-day-old rat is the equivalent of a 10-year-old human, based on a two-year natural lifespan for a rat and an 80-year natural lifespan for a human.

The scientists suggested that early signs of adverse effects, often seen in 90-day trials, could signify the onset of chronic diseases."[59] They note that no regulatory agency requires the use of two-year safety trials. This, they claim, "is socially unacceptable in terms of consumer health protection."

Third, safety testing by independent scientists has been hindered by the biotechnology industry. In 2009, *The New York Times* reported that 29 scientists studying corn insects sent a statement to the Environmental Protection Agency articulating their concern that biotechnology corporations prohibit scientists from performing research on genetically engineered plants.[60] They stated:

> Technology/stewardship agreements required for the purchase of genetically modified seed explicitly prohibit research. These agreements inhibit public scientists from pursuing their mandated role on behalf of the public good unless the research is approved by industry.
>
> As a result of restricted access, no truly independent research can be legally conducted on many critical questions regarding the technology, its performance, its management implications, IRM, and its interactions with insect biology. Consequently, data flowing to an EPA Scientific Advisory Panel from the public sector is unduly limited."[61]

In response, biotechnology corporations, including Monsanto, reached an agreement with the USDA allowing the agency's scientists access to its seed for research purposes. Monsanto also reached limited agreements with some universities.[62] This, however, is not enough, according to some public-interest scientists.

Doug Gurian-Sherman, director of sustainable agriculture and food scientist at the Center for Food Safety, explains that scientists and research institutions that are not party to the agreement are "still out in the cold." More importantly, the agreements cover only certain types of research, and research into the health risks of genetically engineered crops are not included.[63]

Findings of safety testing

When safety testing has been performed, primarily in Europe, study results have raised serious safety concerns. A 1999 study published in the prestigious medical journal *The Lancet* reported that genetically modified potatoes negatively affected the gastrointestinal system of laboratory rats.[64]

Italian scientists conducted several studies and published the results between 2002 and 2004. They noted signs of disturbed liver, pancreas[65] and testes[66] function in mice fed genetically engineered soy.

In 2008, the same set of scientists published a long-term study[67] that affirmed their earlier concerns with the effects of genetically engineered foods on liver function. The authors concluded:

> This study demonstrates that genetically modified soybean intake can influence some liver features during ageing and, although the mechanisms remain unknown, underlines the importance to investigate the long-term consequences of genetically modified diets and the potential synergistic effects with ageing, xenobiotics and/or stress conditions.

In a 2006 study, researchers at the University of Naples in Italy reported finding differences in enzyme function in the heart and kidneys of rabbits fed genetically engineered soy.[68]

A 2007 study by Danish researchers found higher rates of coliform bacteria in the guts of rats fed genetically engineered rice than in the control group. The researchers also measured differences in the weights of certain organs, the adrenals, testes and uterus, in the two groups.[69]

In separate studies, the same Danish researchers also reported that rats fed genetically engineered rice had a higher water intake than rats on a control diet, and the rats on the genetically engineered diet showed differences in blood biochemistry, immune response, gut bacteria, and organ weight (females only). The authors concluded that the study "did not enable us to conclude on the safety of the GM food"[70]

In a 2008 study commissioned by the Austrian health ministry, researchers found that mice fed genetically engineered corn had fewer litters, fewer total offspring, and more females with no offspring than mice fed conventional corn.[71]

A study published in the *Journal of Agricultural and Food Chemistry* in 2008 reported changes in the peripheral immune systems of weaning and old rats fed genetically engineered corn (Monsanto's MON 810). Given the differences in response to genetically engineered feed in various age groups, with the very young and old rats responding differently, the authors suggest that the age of the consumer should be considered in the safety evaluation of genetically engineered foods.[72]

To explore the effects of GE corn over the entire lifespan of test rats, researchers at the University of Caen in France conducted a full two-year trial. In 2009, they published a study in the *International Journal of Biological Sciences*, which found several genetically engineered varieties of corn damaged the kidneys and liver of test animals.[73] Their more recent 2012 study, based on a two-year trial, was published in the peer-reviewed journal *Food and Chemical Toxicology*, and made international headlines.[74]

In the groups of female rats, those given GE feed died more frequently and more rapidly than the rats in the control (non-GE) group. The researchers observed higher levels of tumors, kidney disease and liver disease in the rats given the GMO diet. Females on the GE diet had significantly higher rates of mammary tumors (breast cancer) than the control group, and males given GE feed presented four times more large palpable tumors than controls.[75]

An important detail of the study is that the tumors in the study rats did not start appearing until four months into the trial, and most tumors were not detected until after 18 months. Again, comparing this to a human lifespan, 18 months for a rat is the equivalent of age 60 for a human. The authors wrote: "The first large detectable tumors occurred at 4 and 7 months into the study in males and females respectively, underlining the inadequacy of the standard 90-day feeding trials for evaluating GM crop and food toxicity."[76]

Scientists have also performed literature reviews of studies examining the safety of genetically engineered foods. A 2009 review by two Greek researchers published in *Critical Reviews in Food Science and Nutrition* found that "animal toxicity studies with certain genetically engineered foods have shown that they may toxically affect several organs and systems."

The authors also wrote: "Most studies with genetically engineered foods indicate that they may cause hepatic, pancreatic, renal, and reproductive effects and may alter haematological [blood], biochemical, and immunologic parameters, the significance of which remains to be solved with chronic toxicity studies."[77]

A 2011 review of the scientific literature on the safety of GE foods concluded:

> A review of 19 studies (including industry's own studies submitted to regulators in support of applications to commercialise GM crops) on mammals fed with commercialised GM soy and maize that are already in our food and feed chain found consistent toxic effects on the liver and kidneys.
>
> Such effects may be markers of the onset of chronic disease, but long-term studies, in contrast to these reported short- and medium-term studies, would be required to assess this more thoroughly. Unfortunately, such long-term feeding trials on GMOs are not required by regulators anywhere in the world.

In 2012, Earth Open Source published a comprehensive and science-based review of studies pointing to negative health effects from consuming genetically engineered foods, titled *GMO Myths and Truths: An evidence-based examination of the claims made for the safety and efficacy of genetically modified crops*. Authored by three scientists, the report presents evidence that genetically engineered foods can be toxic, allergenic and less nutritious than their natural counterparts. The authors also note that genetically engineered crops are not adequately regulated to ensure safety.[78]

When it comes to safety of genetically engineered foods, consumers are essentially acting as the lab rats in a large, long-term, unsupervised study. For parents wishing to opt out of this huge uncontrolled experiment, organics offers a safe haven.

Breakfast cereal and GE crops

People are exposed to genetically modified organisms (GMOs) in their food in many unexpected ways, in part because corn and soybeans provide the starting material for so many ingredients in processed foods. But the foods that are most likely to lead to high doses of GMOs in a young child's diet include corn-based dry cereals, like corn flakes or corn puffs, in addition to a myriad of snack foods that are corn-based.

In 2011, Cornucopia sent samples of "natural" and organic cereal, containing corn and soy ingredients, to an accredited GMO testing laboratory. The results revealed that many leading "natural," non-organic cereals commonly contained high levels of GMOs. At times, as much as 100% of the food's DNA was genetically engineered DNA.

Brands that were found to contain GMOs included Kix, Barbara's Bakery, Kashi and Bear Naked and Whole Foods' 365 (Whole Foods has since changed its cornflakes to be certified organic). Cornucopia did not test conventional cereals like General Mills, Post and Kellogg's brands, or store-label brands, but with 88% of corn and 92% of soybeans grown in the U.S. genetically engineered, these brands undoubtedly contain GMOs and should be avoided.

Cornucopia's GMO test results were announced in a comprehensive report comparing "natural" and organic brands of cereal: *Cereal Crimes: How Natural Claims Deceive Consumers and Undermine the Organic Label—A Look Down the Cereal and Granola Aisle*.

A scorecard of cereal brands, which ranks cereal brands by their commitment to organic, non-GMO production, and the report are available on the Cornucopia website (www.cornucopia.org).

Milk and GE crops

In 2011, scientists at the University of Sherbrooke in Canada published results of a study showing that toxins produced by GE plants are not broken down in the body, as the biotech industry had claimed, but are in fact absorbed into the bloodstream of people who consume genetically engineered foods.[79] The researchers even found Bt toxins, which are genetically engineered into food crops like corn, in the blood of fetuses of pregnant women enrolled in the study.

The fact that these toxins, present in corn and soybeans, are not broken down in the body, raises the question of whether milk and meat from cows fed GE corn and soybeans contain these toxins as well (as well as food from other livestock species). Conventional dairy cows eat a diet of conventional corn and soybeans, which are, again, 88% and 92% likely to be genetically engineered, respectively. Do toxins from GE feed eaten by cows appear in their milk?

Studies have found conflicting results. One study that looked into this question concluded that "it could be demonstrated that a specific DNA transfer from feeds into milk was not detectable."[80] Another study did find "biotech genes" in milk from dairy cows on GE feed diet. The results: "screening of 60 samples of 12 different milk brands demonstrated the presence of GE maize sequences in 15 (25%) and of GE soybean sequences in 7 samples (11.7%)."[81]

Genetically engineered growth hormones

Another reason to buy organic milk is the assurance that no genetically engineered growth hormones (rBGH) were used in the milk's production. The genetically engineered growth hormones were developed by Monsanto, a biotechnology corporation, to inject in dairy cows for the purpose of increasing milk production.

In 2007, the Cancer Prevention Coalition, chaired by a University of Illinois cancer expert, Dr. Samuel Epstein, filed a petition[82] with the FDA, requesting the prohibition of genetically engineered growth hormones in milk production.

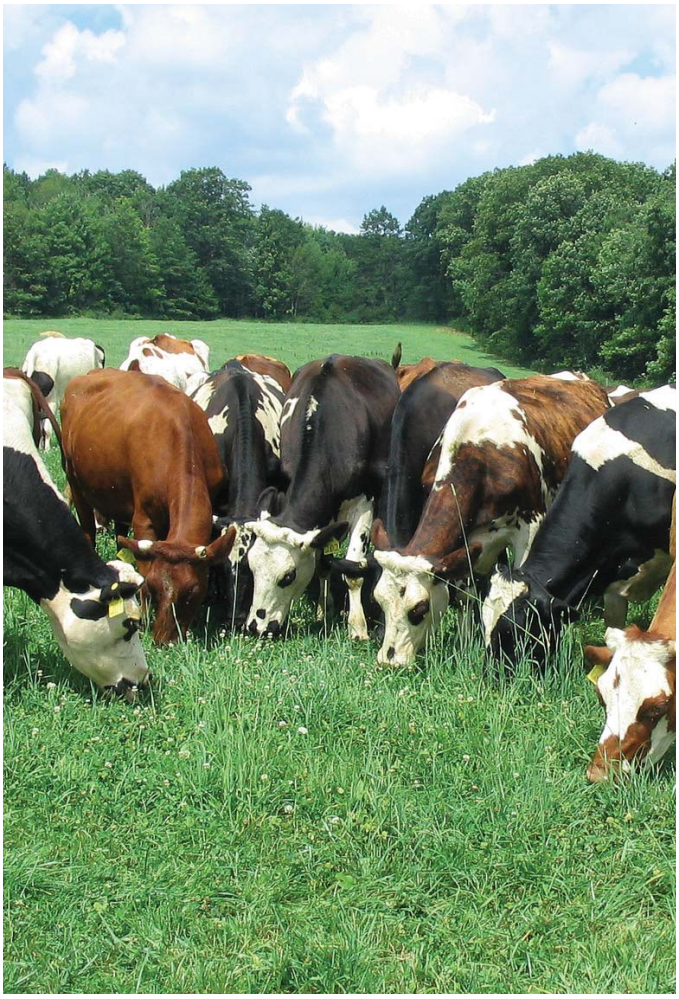


PHOTO: COURTESY OF MOORE FARMS, NICHOLS, NY

The petition cited numerous studies indicating that milk from cows treated with synthetic growth hormones has higher levels of the hormone IGF-1. According to studies cited in the petition, IGF-1 is readily absorbed from the intestines into the bloodstream, and has been shown to increase the risk of breast cancer in 19 scientific publications, risk of colon cancer in 10 publications, and risk of prostate cancer in seven publications.[83]

Studies have also indicated that injecting cows with rBGH increases the rates of clinical mastitis by 25%.[86] This raises the concern that increased rates of mastitis require ever-increasing therapy with antibiotics in dairy herds.

While the FDA has not acted to protect public health, many retailers, including Wal-Mart, have made a commitment to source milk from cows that were not treated with growth hormones for its private-label brands.[84] However, these claims are not verified by a third party unless the dairy farm is certified organic. Injecting dairy cows with growth hormones is explicitly banned in organic production.[85] Certified organic remains the best assurance that milk was produced without the use of genetically engineered synthetic growth hormones.

NATURAL V. ORGANIC

It may be tempting for parents to compromise and choose "natural" foods—organic foods do, after all, frequently cost more than their conventional counterparts. But in protecting young children from pesticide exposure, "natural" foods are no better than conventional foods.

In terms of avoiding pesticide residues and genetically engineered ingredients, the "natural" label is largely meaningless.

"Natural" foods can be legally grown with the same pesticides used on other conventional foods and may contain genetically engineered ingredients.

Only the organic label is regulated by the United States Department of Agriculture to a strict set of standards that include the prohibition against toxic synthetic pesticides, genetically engineered ingredients, most antibiotics, hormones and other drugs, synthetic solvents and other harmful inputs.

Section VIII

Hexane and Other Synthetic Neurotoxic Solvents

CONVENTIONAL COOKING OILS are nearly universally processed with volatile synthetic solvents. The most commonly used solvent to process oil is hexane, a byproduct of gasoline refining. Hexane is classified as a neurotoxin by the Centers for Disease Control and Prevention (CDC).[87]

Crops, like soybeans, canola, corn, cotton and sunflower seeds, are usually bathed in hexane or other solvents to extract the oil.[88] Food ingredients like soy protein isolate or soy flour are byproducts of soy oil production, and are also nearly universally processed with hexane.

PHOTO: ISTOCKPHOTO.COM

In addition to being considered a neurotoxin, hexane is classified as a hazardous air pollutant with the EPA[89] because it contributes to the formation of ground-level ozone (O_3), which is the primary constituent of smog. While ozone is essential in the upper atmosphere, excess ozone at ground level is a pollutant—hazardous to human health, with children especially at risk.[90]

High levels of surface ozone harm human health by causing respiratory symptoms. According to the EPA:

> Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. "Bad" ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue.[91]

The FDA does not set a maximum residue level for hexane, and does not require that food manufacturers test for residues. The European Union, on the other hand, has adopted a directive setting maximum limits of solvent residues in foods.[92]

While some conventional "cold pressed" oil is available on the market, the best way to avoid foods processed with hexane is by choosing organic, since the USDA strictly prohibits the use of synthetic solvents like hexane for processing oil and other grain-based ingredients like soy flour.

Section IX

The Herbicide Glyphosate

FOR THOUSANDS OF YEARS, children ate the same food their parents ate when they were children. In the United States today, this is no longer the case. The food eaten by children attending preschool today, born in the 2010s, differs in important ways from that which was eaten by their parents born in the 1980s, and from food eaten by previous generations.

In this section we discuss just one change in our nation's food supply: the dramatic increase in the use of the herbicide glyphosate. Its proliferation has in effect subjected children to a large-scale science experiment.

Glyphosate is often portrayed by the manufacturers as safe for human exposure while being deadly to weeds. Homeowners can purchase it to spray on their lawns and gardens. Yet scientific research indicates that glyphosate is not as harmless as it has been portrayed.

A recent study in the journal *Entropy* reviewed the published science and analyzed the biochemical reactions that are affected by glyphosate, with particular emphasis on its effect on the microbiome of the human intestinal tract.[93] The researchers concluded: "Contrary to the current widely held misconception that glyphosate is relatively harmless to humans, the available evidence shows that glyphosate may rather be the most important factor in the development of multiple chronic diseases and conditions that have become prevalent in Westernized societies."[94]

In concordance with many scientific findings, in March 2015 the World Health Organization's International Agency for Research on Cancer (IARC), part of the United Nations, classified glyphosate as "probably carcinogenic to humans" (category 2A).[95] This reclassification was based on multiple scientific studies[96],[97] including a meta-analysis published in 2014 that linked an increased risk of non-Hodgkin lymphoma to workers exposed to glyphosate formulations.[98]

In September 2015, the California Environmental Protection Agency announced its intent to list glyphosate, along with three other agrichemicals, as a carcinogen under the state's Proposition 65 law.

The U.S. Environmental Protection Agency (EPA) currently does not consider glyphosate a carcinogen but is conducting a formal review of the safety of glyphosate based on the IARC's findings.[99],[100]

PHOTO: TIM MCCABE, NRCS

In March 2015, the World Health Organization's International Agency for Research on Cancer classified glyphosate as "probably carcinogenic to humans."

Two generations, two diets

Children born today are repeatedly exposed to genetically engineered (GE) foods, as discussed in Section VII. Dangers from GE foods include both the unknown effects of novel DNA and the known effects of high doses of herbicide.

Many GE crops, often branded as "Roundup-Ready" because the herbicide glyphosate was originally marketed under the trade name Roundup, have been designed to tolerate repeated applications of the herbicide glyphosate.

Glyphosate is a systemic herbicide, meaning that it is absorbed by the plant and translocated to the growing points to kill the plant. The Roundup-Ready GE plants absorb glyphosate, but they do not die; rather, they produce a crop for food and livestock feed. Current glyphosate-resistant GE crops include soybeans, corn, canola, alfalfa, and cotton, with wheat under development.

Corn is a favorite vegetable with children. Most of the corn grown in the U.S. today is genetically engineered for either insect resistance, herbicide resistance or both. GE corn finds its way into many processed foods, unless they are certified organic. Beverages, candy, baked beans, and many other products are sweetened with corn syrup or sugar from GE sugar beets. Salad dressings, crackers, and chips are made with canola oil, corn oil, or soybean oil, and unless certified organic, all are likely GE.

PHOTO: THINKSTOCK

Nearly 90% of corn grown in the U.S. is treated with glyphosate.

This was not the case in the 1980s. Glyphosate, developed by Monsanto and marketed under the trade name Roundup, was brought to market in the 1970s, but its use was primarily limited to killing weeds, because glyphosate kills actively growing plants, be they weeds or crops. Children in the 1980s were exposed only to trace amounts of glyphosate because it could not be sprayed on crops without the crop dying. However, children today are exposed to much higher doses, because crops have been genetically engineered to tolerate repeated applications of the herbicide glyphosate.

Rapid increase in glyphosate use

GE crops were first commercialized in the late 1990s and became common by 2010. Since the Roundup-Ready trait for glyphosate resistance is the most common GE trait, the increase in GE has caused an increase in the levels of glyphosate in food.

Glyphosate use has been increasing exponentially. From 2001 to 2007, glyphosate use doubled, reaching 180 to 185 million pounds in the U.S. in 2007.[101] From 2005 to 2010, the use of glyphosate on corn increased by 12.9%.[102]

The USDA's Economic Research Service confirmed the increase in use: "Herbicide use on GMO corn increased from around 1.5 pounds per planted acre in 2001 to more than 2.0 pounds per planted acre in 2010. Herbicide use on non-GMO corn has remained relatively level during that same time frame...".[103]

Herbicide use is also increasing on crops grown for food. Glyphosate can now be sprayed over the GE crop itself, whereas previously only the weeds were sprayed. Additionally, herbicides are now sprayed as a dessicant on non-GE crops to kill the foliage just before harvest, particularly on potatoes, beans, wheat and barley. These practices increase not only the amount of herbicide sprayed into the environment, but also the amount directly absorbed by the plants eaten by humans and livestock.

In response to this scenario, the agrichemical industry requested an increase in the tolerance levels for glyphosate, that is, the glyphosate residues allowed in food and feed. In 2013, the U.S. EPA complied, raising the tolerance levels of glyphosate residue in many crops. For example, the levels for soybean have been doubled, from 20 parts per million (ppm) to 40 ppm.[104]

This means that the genetically engineered Roundup-Ready crops will have higher levels of glyphosate, even as scientists learn more about the insidious long-term effects of ingesting it.

The claim of "substantial equivalence"

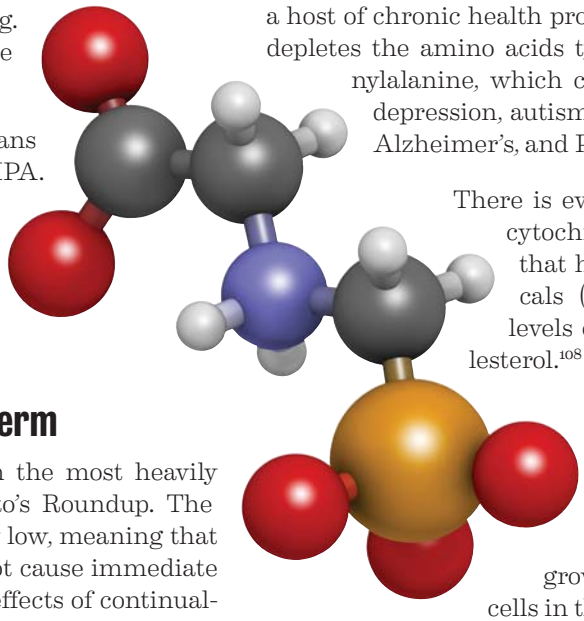
The USDA has permitted the farming and consumption of GE crops based on "substantial equivalence," the concept that GE crops are as safe as the traditional crops they are replacing. Unfortunately, early studies did not measure the differences in pesticide residues between GE and non-GE

PHOTO: THINKSTOCK

crops. This is particularly important for glyphosate-resistant crops, due to their ability to absorb the herbicide.

A 2014 study looked at the herbicide residues and nutritional profile of soybeans grown under three different cultivation regimes: glyphosate-tolerant GE, non-GE conventional, and organic.[105] As expected, the GE soy contained high levels of both glyphosate and its principal breakdown product, AMPA (aminomethylphosponic acid), on average a total of 9.0 mg/kg. Clearly, glyphosate accumulates in the plants that people eat.

In contrast, none of the organic soybeans had any residues of glyphosate or AMPA. The organic soy was more nutritious than conventional, with significantly more total protein, more zinc, less saturated fat, and lower amounts of omega-6 fatty acids.



Glyphosate effects are long-term

Glyphosate is the active ingredient in the most heavily used herbicide in the world: Monsanto's Roundup. The acute toxicity of glyphosate is relatively low, meaning that ingesting a small amount will likely not cause immediate harm. However, chronic toxicity—the effects of continually ingesting glyphosate residues in food—is cause for concern.

Glyphosate interferes with fundamental biochemical reactions and may predispose humans to numerous health problems. The industry claims that Roundup is quite safe, but authors of a recent article in the journal Entropy reach a very different conclusion: "An insidious issue with glyphosate is that its toxic effects on mammals take considerable time to be overtly manifested."[106]

It's easy to overlook these effects. Toxicity studies on laboratory animals are typically short term, often only a few months. They also do not distinguish between effects that may occur in young animals (or human children) and adult animals (or humans). The harm from low-level, chronic exposure can only be seen after a long period of time, often years or even decades. The real "guinea pigs" in this case are humans.

From a scientific perspective, it is nearly impossible to prove that a chemical ingested on food can harm a person's health decades later. However, it is possible to study the specific biochemical action of the pesticide, and then examine the diseases that have been related to malfunction of that biochemical pathway.

Roundup kills plants by interfering with a biochemical pathway involved with synthesis of amino acids, called the shikimate pathway. This pathway is not found in humans; therefore, it was assumed that glyphosate does not harm humans. The pathway is found in bacteria, however, and humans depend on bacteria in the gastrointestinal (GI) tract to synthesize the essential amino acids.

In a scientific article with 286 references, researchers described the many ways that glyphosate may affect the health of humans.[107] By interfering with the biochemistry of bacteria in our GI tract, consumption of glyphosate depletes essential amino acids and predisposes humans to a host of chronic health problems. Specifically, glyphosate depletes the amino acids tyrosine, tryptophan, and phenylalanine, which can then contribute to obesity, depression, autism, inflammatory bowel disease, Alzheimer's, and Parkinson's.

There is evidence that Roundup inhibits cytochrome P450 (CYP) enzymes that help to detoxify foreign chemicals (such as pesticides), regulate levels of vitamin D, and control cholesterol.[108]

Other studies indicate that glyphosate is an endocrine disruptor, even at low concentrations,[109] because glyphosate induced the growth of human breast cancer cells in the laboratory.

PHOTO: THINKSTOCK

Glyphosate harms helpful bacteria

A study examining the effect of glyphosate on bacteria that grow in the GI tract of chickens found that beneficial bacteria were susceptible, and harmful bacteria were resistant, to glyphosate. The growth of four types of beneficial bacteria—Lactobacillus, Bacillus, Bifidobacterium, and Enterococcus—was reduced at low concentrations of glyphosate.[110] The same types of beneficial bacteria inhabit the human GI tract, and they are sold over the counter as probiotic supplements. Some strains are also found in yogurt.

When exposed to the same levels of glyphosate that

harmed the beneficial bacteria, several harmful bacteria, including Salmonella, grew successfully. The authors concluded that ingestion of glyphosate can disturb the normal microbial community and predispose chickens to carrying high levels of Salmonella or other harmful bacteria.

A similar study found that glyphosate was toxic to beneficial bacteria in cattle. The study hypothesized that glyphosate residues on cattle feed may predispose cattle to infection by Clostridium botulinum, the bacterium that causes botulism.[111]

Glyphosate detected in humans and animals

Glyphosate may be applied several times to crops, each time being absorbed and stored in the tissues. The residues cannot be removed by washing, and they are not broken down by processing, such as freezing or drying.[112] When humans or animals eat the herbicide-treated foods, they ingest the herbicide.

PHOTO: THINKSTOCK

Glyphosate is absorbed through a plant's foliage and roots. The residue cannot be washed off.

A study found that people who eat conventional foods have significantly more glyphosate in their urine than people who eat predominately organic foods.[113] The same study found glyphosate residues in the liver, muscles, spleen, kidney, and intestines of conventionally fed cows. This suggests that humans, as well, are accumulating glyphosate residues from GE foods.

Monsanto's Roundup was found to be 125 times more toxic than glyphosate.

Roundup is more toxic than glyphosate

The combination of ingredients in Roundup may be even more toxic than glyphosate alone.[114] The surfactants in Roundup make it an effective herbicide but also increase its toxicity to animal cells[115] and bacteria.[116]

Tests conducted to determine toxicity of a pesticide are typically conducted using only the active ingredient. In practice, pesticides and herbicides are sold as a formulation, including the active ingredient, such as glyphosate, along with other ingredients not disclosed to the consumer. These are labeled "inert ingredients," "other ingredients," or "adjuvants," and their toxicological properties are not tested in long-term experiments on animals or in combination with the active ingredient. Adjuvants may be used for several purposes. One common function is to increase the ability of the herbicide to penetrate into the plant cell.

When researchers tested the formulated product, Roundup, and compared its effect to the active ingredient, glyphosate, they found that the formulation was significantly more toxic to human cells than glyphosate alone.[117] Eight other formulated pesticides tested were more toxic to human cells than their active ingredients alone, due to their adjuvants. This suggests that formulated herbicides and pesticides, in general, are likely more toxic than previous research indicated.

The article concluded: "It is commonly believed that Roundup is among the safest pesticides. ...However, Roundup was found in this experiment to be 125 times more toxic than glyphosate. Moreover, despite its reputation, Roundup was by far the most toxic among the herbicides and insecticides tested."

In summary, feeding herbicide-tolerant GE corn and soy to children gives them a dose of glyphosate with every bite. As the number of herbicide-resistant crops increases, so too does the use of glyphosate. As a result, the amount of glyphosate in our food and in our environment continues to rise.

There is a great need for additional studies to verify the effects of glyphosate consumption over a human life span, in particular its effects on bacteria in the GI tract, especially when fed to young children. Harmful effects on young children may affect them for the rest of their lives.

Section X

Organic Foods and Healthy Nutrients

ORGANIC FOODS REDUCE CHILDREN'S EXPOSURE to toxic pesticides, but there's more to organic foods than just reducing exposure to harmful materials: Nutritional benefits of organic foods have been thoroughly studied and are well documented.

Milk

Cows producing conventional milk are typically confined to buildings and feedlots and are commonly fed rations containing mostly corn and soybeans, which leads to milk that has an unfavorable balance of unhealthy to nutritionally beneficial fats. When cows eat their natural diet of grasses—out in the sunshine grazing on pasture—their milk has a much more favorable ratio of fats, with higher levels of beneficial omega-3 fats and conjugated linoleic acid (CLA).

Dairy cows on conventional farms generally never graze on pasture. The organic standards require that organic dairy cows be on pasture during the grazing season, and obtain at least 30% of their nutrition from pasture. Cows on many grass-based organic farms obtain much more than 30%, and as much as 100%, of their caloric intake from fresh grass and stored forages. Compared with dairy cows raised in conventional dairy operations, organic dairy cows eat much better, and this affects the nutritional composition of the milk they produce.

Two 2012 meta-analysis studies found higher levels of beneficial fats, including CLA, in organic dairy.[118] Scientists at the University of Massachusetts – Amherst write: "CLA reduces body fat, cardiovascular diseases and cancer, and modulates immune and inflammatory responses as well as improves bone mass."[119] [120] [121] [122]

For toddlers who drink whole milk, organic milk from grass-fed cows is especially important.

Other nutrients are found in higher levels in organic milk compared with conventional. Two studies evaluated the lutein and zeaxanthin content of milk and found significantly higher levels of both antioxidants in organic than conventional milk. [123] [124]

To find organic milk brands that purchase from family farmers who graze their cows at high rates, consult The Cornucopia Institute's Organic Dairy Scorecard.

Fruits and vegetables

According to an in-depth analysis of published literature by scientists at The Organic Center, the average serving of organic plant-based food contains

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"Our school community had the foresight to purchase a farm in the 1990s. Children from age 3 up visit with their families or their classes. The hands-on experience with fresh whole foods creates a personal connection to the land. Children are thrilled to eat the broccoli, carrots, popcorn, sunflowers and soups. They know where food comes from—the earth and in this case their Land School. The result is not only better health habits, but a lasting commitment to quality food and caring for the land."

—Donna Goodlaxson, co-manager of the Land School at Lake Country School, Minneapolis, MN

PHOTO: DOLLAR PHOTO CLUB

about 25% more nutrients than a comparable-sized serving of the same food produced by conventional farming methods.[125]

A 2011 meta-analysis by researchers at the University of Newcastle found 12% higher levels of secondary metabolites, which are believed to be responsible for the cancer-reducing and heart-health-promoting effects of fruits and vegetables, in organic produce compared with conventional.

When examining specific nutrients, the differences for certain nutrients were not statistically significant between organic and conventional foods. But for some of the most important essential nutrients, differences were well worth the extra cost of buying organic. The researchers found a 16% higher content for defense-related biologically active compounds in organic fruits and vegetables (believed to be responsible for the benefits in reducing cancer and other disease), and a 6% higher content for vitamin C.[126]

Conclusion

AN EVER-GROWING BODY OF SCIENTIFIC LITERATURE points to harmful effects from exposure to a myriad of agrichemicals. Reputable groups like the American Academy of Pediatrics and the National Institutes of Health's President's Cancer Panel have analyzed scientific data, and recommend foods produced without pesticides.

Fortunately, federal law and regulations make it easy for consumers to find foods produced without toxic pesticides, GE ingredients and other toxic inputs. The Organic Foods Production Act of 1990 and accompanying regulations by the United States Department of Agriculture prohibit the use of toxic synthetic chemicals in organic agriculture and food processing.

Any food labeled "organic" and carrying the "USDA Organic" seal has been third-party inspected and certified to be produced without prohibited synthetic pesticides, genetically engineered seed or ingredients, synthetic solvents, and other harmful synthetic inputs that are common in conventional food production.

Lax regulations regarding the use of toxic pesticides in conventional food production are facing increasing scrutiny from respected pediatricians and scientists for their failure to protect children's health. Scientific data points squarely to the importance of buying organic.

In protecting children, the logical choice concerning known and unknown dangers in the conventional food supply is to operate under the precautionary principle, and err on the side of caution by purchasing organic food.

PHOTO: ISTOCK

Appendix

Toxic Pesticide Residues on Conventional Foods

DATA FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE show that pesticide residues regularly appear on conventional fruits and vegetables, and rarely on organic foods. In fact, toxic pesticide residues on foods that are particularly popular with babies and young children frequently exceed the levels that are considered safe for children by the EPA. And that does not take into consideration the copious quantities of some of these foods consumed by children relative to their weight, nor multiple cross-exposures from different foods contaminated with the same chemicals.

Apples

Whether cooked into applesauce, squeezed into apple juice, or cut into apple slices, apples are popular foods with infants and children.

The pesticides that have been found to harm developing neurological systems of infants and children—including organophosphates like chlorpyrifos—have been detected, sometimes at very high levels, on conventional apples.

In fact, every one of the 14 different pesticides found on single-serve apples is neurotoxic.

APPLESAUCE

The USDA tested applesauce in 2006. In conventional applesauce, residues of 28 different pesticides were detected.

The suspected endocrine disruptor carbendazim was found in 83.5% of samples of conventional applesauce, and in 12.5% of samples of organic applesauce. The neurotoxic carbaryl was found in 22.4% of conventional samples and in 18.2% of organic samples.

And 6.6% of conventional applesauce samples contained residues of the suspected endocrine disruptor pyrimethanil, which was found in 0% of organic samples.

Another 3.2% of conventional samples contained residues of the suspected endocrine disruptor diflubenzuron, found in 0% of organic samples.

6.6% of conventional applesauce samples contained residues of the suspected endocrine disruptor pyrimethanil, which was found in 0% of organic samples.

Another 3.2% of conventional samples contained residues of the suspected endocrine disruptor diflubenzuron, found in 0% of organic samples.

APPLES—SINGLE SERVINGS

The USDA tested "apples, single servings" in 1999.

A total of 77.7% of samples contained residues of the neurotoxic pesticide azinphos methyl.

The neurotoxic pesticide chlorpyrifos was detected on 30.7% of domestically produced conventional samples and 80.6% of the samples of imported conventional apples.

OTHER FOODS WITH CHLORPYRIFOS RESIDUES

Other fruits and vegetables on which the USDA found levels of chlorpyrifos higher than the 0.6 micrograms limit for safe chronic exposure for children.

FOODS	AVERAGE LEVEL (MICROGRAMS PER 100 GRAMS)	HIGHEST LEVEL (MICROGRAMS PER 100 GRAMS)
Apples – single serving Domestic	1.1	54.0
Apples – single serving Imported	2.4	18.0
Sweet Bell Pepper – Imported	3.0	47.0
Cranberries	0.6	9.3
Kale	0.6	110.0
Grapes – Imported	0.7	19.0
Peaches – single servings Imported	0.4	10.0
Peaches – Imported	0.7	11.0
Plums – Imported	0.5	18.0
Nectarines - Imported	0.3	3.9
Pears – single serving Domestic	0.09	23.0
Cantaloupe	0.5	1.6
Oranges	0.03	1.7
Pears - Imported	0.1	2.4
Tomatoes - Imported	0.07	5.2
Blueberries	0.1	3.8
Carrots	0.06	4.4
Strawberries	0.007	1.4
Bananas	0.003	0.6
Grapefruit	0.002	0.7

	PERCENTAGE OF SAMPLES CONTAINING RESIDUES	AVERAGE LEVEL (MICROGRAMS PER 100 GRAMS)	MAXIMUM LEVEL (MICROGRAMS PER 100 GRAMS)
Wheat Flour	49.5%	0.9	68.5

Wheat flour and malathion

It's not only fruits and vegetables that are sprayed with toxic pesticides—grain and wheat crops are also food for insects and therefore commonly doused with insecticides, with sprays in the field and with fumigants in storage.

Nearly half of wheat flour samples tested by the USDA in 2004 contained malathion residues. Malathion, like chlorpyrifos, is an organophosphate pesticide and a neurological toxin. Wheat flour is used to make crackers, cereal, and bread—all popular foods with young children.

Nectarines and formetanate hydrochloride

Tests in 2008 revealed that 71.5% of domestic, conventional nectarines contained residues of formetanate hydrochloride, another neurotoxin. While the percentage is lower for imported conventional nectarines, 18.7%, the highest residue levels found on imported was 74.3 micrograms per 100 grams, which is more than five times higher than the 13 micrograms Population Adjusted Dose for children. While some residues were found on organic nectarines (11.1%), the average residue (0.002) and highest level (0.02) are dramatically lower than the levels found on conventional.

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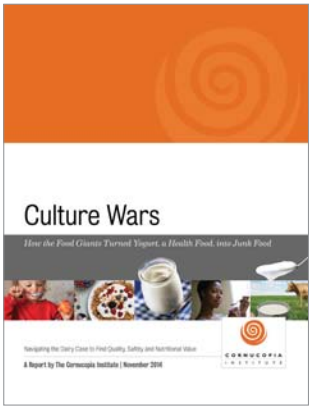

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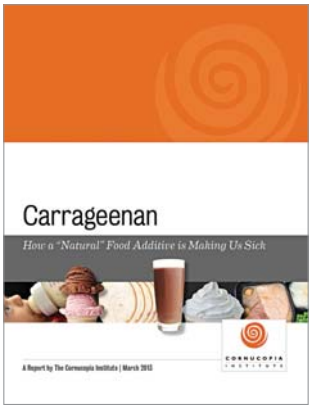

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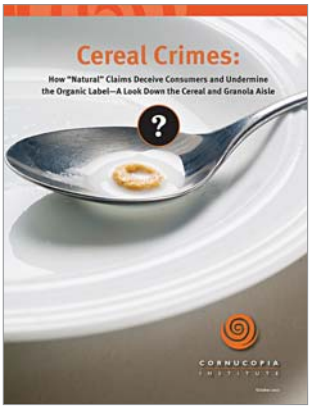

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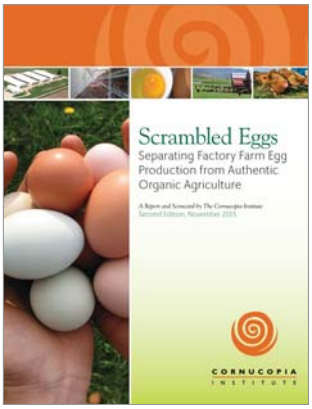

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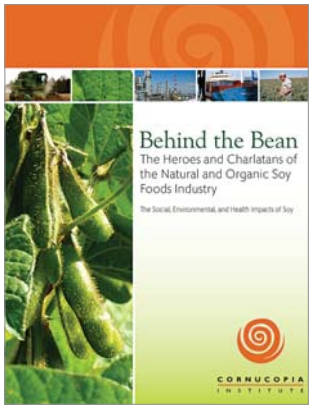

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