

## Cloning

Yuval Hariri, in his book, *Sapiens*, has raised important issues relating to cloning in agriculture. For example, if a farmer has a perfect cow, he can clone that cow and breed the clones and keep their offspring. By doing this, the farmer can introduce the natural positive characteristics into the herd quickly, whereas conventional breeding would take years to achieve the same result. Farmers clone animals to produce more uniform quality meat.

Livestock have been cloned since 1996. In 2001, the Food and Drug Administration Center for Veterinary Medicine asked that food from clones be voluntarily kept out of the food chain and began an intense research project. Clones are born just like other animals and are similar to identical twins. Cloning provides complete control over the offspring, unlike breeding where farmers cannot predict the traits that will be inherited.

Scientists have successfully cloned cattle, swine, sheep and goats. Poultry has not been cloned. Most clones that are healthy at birth become as strong and healthy as other animals. Cloning is particularly valuable to farmers to produce breeding stock, not food. The cloned animals are then used for conventional breeding and the offspring become food-producing animals. Advantages to cloning include creating livestock that are resistant to disease, suitable to climate, body type, fertility and market preference. According to the FDA, food eaten from clones is as safe to eat as conventionally raised cattle, swine and goats.

However, cloning has raised objections from interest groups claiming that it interferes with the natural process of animal and plant creation. It is an expensive process, is the least reliable reproductive method, and is often unsuccessful. It may require serious intervention, inhibit diversity among the species, and may result in unexpected health consequences. Hariri predicts that as technologies improve, animal cloning is a process that could lead to human cloning. He also postulates that the ultimate end of such an intelligent design process may be a process of replicating ourselves, in direct conflict with the teaching of Darwinian evolution in schools and with the view that there must be a Creator who thought out all biological details in advance.

## **Food Labeling**

Food product labels are important, both practically and ethically. Labels inform customers about what they are buying.

Nutritional information, required by federal law, is always displayed in the same orderly fashion and explains how many calories are in a serving and also information about the nutrients. However, it does not indicate the amount of added sugars and trans fats since they go by several names. The amount of sugar is hidden since it has many terms. Trans fats are also hidden since they are part of the ingredients.

Labels include what the product maker wants to brag about and what consumers insist on knowing. What is and should be on labels is hotly debated. For example, it may be important to know whether a food product has been genetically modified. A recent report released by Oceana, an ocean conservation group, found that a high proportion of the fish sold in the United States is not the species indicated on the label.

Currently, the United States government allows companies to self-regulate the labeling of their food products in any way they choose except for nutritional information. For example, producers use the word milk to refer to liquid juice products such as cashew milk or oat milk that are derived from plants. A company can label soy milk or almond milk as “milk.” Cellular protein meats that are created in the lab by culturing muscle tissue or cells are labeled as “meat.” There is also uncertainty with respect to the date when the food becomes unsafe to eat. The terms “Best by”, “Sell by” and “Enjoy by” are confusing. The United States Food and Drug Administration recommends using the term “Best if used by,” but this is not mandatory.

Ten large companies own most of the food products that are found in the grocery store. Companies seek to maximize profits for themselves and for their shareholders. Robert Reich, professor of economics at the University of California Berkeley, recently stated: “Companies are not interested in the public good. It is not their responsibility to be good. If we want them to play differently we have to change the rules.”

## **Genetically Modified and Gene-Edited Foods**

Companies such as Beyond Meat have developed plant-based ground beef and burger patties that are designed to mimic the texture and taste of traditional meat. They use proteins from peas and beans. They are planning to invest in manufacturing facilities, research and development, sales and marketing. Most corn and soybeans grown in the United States are herbicide tolerant GMOs. Proteins are also being genetically modified to grow faster.

Unlike traditional Genetically Modified Organisms (GMOs), which are made by injecting DNA from other organisms, gene-editing adds or takes out genes made in the laboratory. Calyxt, a Minnesota-based company, has used gene-editing to develop soybean oil that contains less saturated fat, no dangerous trans fats, and has a longer shelf life than other soybean oils. Crops that are being explored for gene-editing include mushrooms that don't brown, wheat with more fiber, better-producing tomatoes, herbicide-tolerant canola and rice that does not absorb soil pollution.

Other examples of gene-editing include products such as Intrexon Corporation's development of a genetically modified apple known as the "arctic apple" that will not brown over time. Nestle will offer food choices that are made in the laboratory and will soon market them to restaurants and stores throughout the world. Crispr-Cas9, a new gene-editing tool, makes it much easier to change the genomics of plants and animals. All of these products will begin reaching markets soon, and within a few years they could be filling grocery shelves. They are changing the very nature of the food that we eat.

These advancements could upend traditional agriculture by boosting shelf-life, eliminating the need for pesticides, and providing off-season availability and transportability of fruits and vegetables, according to Haven Baker, chief business officer of Pairwise, a North Carolina startup that uses Crispr technology to edit large scale crops like corn, soy and specialty crops such as berries.

Although the scientific challenges of GMOs and gene-edited crops have been largely settled, the political and social aspects of gene-editing are subject to vigorous debate. United States regulators have agreed that gene-edited crops do not require special oversight. However, the European Union is regulating these products due to health and safety concerns.

## **GenX and its Impact on Water Systems in North Carolina**

The *Raleigh News & Observer* has reported that North Carolina's leading university science researchers are studying the issue of whether the state's water supplies are being contaminated with toxic compounds. These compounds include the controversial GenX, an unregulated chemical discovered in the Cape Fear River. The contaminate water directly impacts drinking water and the water used by farmers to irrigate their fields.

Every municipality in North Carolina will have its water tested in the near future, and each municipality will also pick one well that supplies public drinking water for testing. These studies will determine long-term monitoring for water quality. Environmental regulators are also seeking information about the chemical GenX, which is used to make nonstick cookware and other products. Investigators are focusing on the Chemours chemical company, which discharges GenX from its factory near Fayetteville. A federal class action lawsuit alleges that Chemours knew that the chemical was dangerous, but secretly dumped it into the water. GenX may cause cancer as well as liver and thyroid disease. The North Carolina Legislature has committed more than five million dollars for a study of drinking wells and chemical compound removal and its impact on water quality. The studies are the first of its kind in any state in the United States. Professors from North Carolina State University, Duke University, UNC-Chapel Hill, UNC-Wilmington, East Carolina University and UNC-Charlotte will comprise the research teams. Industrial chemicals also have been found in Jordan Lake, two feeder streams, and in Cary's tap water.

The United States Environmental Protection Agency (EPA) recently announced a plan to study GenX, but Governor Roy Cooper criticized it as lacking detail and ignoring the urgency of the problem. The EPA, where decreased funding from the federal government has resulted in fewer employees, says that it is moving as quickly as it can. The EPA is considering labeling GenX as a hazardous substance and says that it will issue groundwater cleanup recommendations. Issues of water quality in Flint, Michigan several years ago resulted in significant water pollution that caused death and disease. Fifteen state and local government officials were charged criminally for their inaction, in addition to being sued in numerous civil lawsuits.

## “Got Milk?”

In the 1990s, the federal government, prompted by the American Dairy Association, embarked on a massive advertising campaign to encourage Americans to drink more milk. A classic advertisement of the campaign showed Donna Shalala, Secretary of the Department of Health and Human Services, with a white mustache exclaiming “Got Milk?” in an effort to boost dairy consumption. Today, twenty-five years later, grocery stores stock many different varieties of milk in the dairy section, which has raised issues as to which products are “milk” and which are not “milk.”

More plant-based food companies are marketing their products as milk. There are goat, soy, almond, cashew, lactose-free and chocolate “milks.” There are organic brands and hemp, flax, coconut and rice varieties.

The Good Food Institute in Washington, DC recently submitted a petition for the Food and Drug Administration (FDA) to issue regulations that define the term “milk.” The Farm Bureau is requesting the FDA to take immediate action on the mislabeling of imitation dairy products. The debate involves whether plant-based milks can use the term “milk” to market their products. The dairy industry thinks that plant-based milk should not be considered milk at all.

Consumers and dairy farmers are totally confused about what constitutes milk. The Department of Agriculture says that the use of the term “milk” for plant-based milk is a violation of the definition of milk. Nut and plant-based beverages are not held to the same standards of identity. The president of the National Milk Producers Federation recently told Congress that “In the many years since we first raised concerns about misbranding of these products, we’ve seen an explosion of imitators attaching the word “milk” to everything from hemp to peas to algae.” Commentators suggest that the surge of interest in milk alternatives began as a result of many people seeking to limit fat into their diet.

Dairy companies have filed lawsuits against plant-based companies over the use of the term “milk.” In October 1973, the FDA acknowledged that chocolate milk would be allowed because it did not purport to be or represent itself as conventional milk. Plant-based groups argue that they are entitled to use the term “milk” in their products on First Amendment constitutional grounds. The dairy industry has drafted legislation, “The Dairy Pride Act,” that requires that non-dairy products made from nuts, seeds, plants, and algae no longer be labeled with dairy terms.

## Immigration

United States farmers need about two million hired workers to harvest delicate berries and produce. Between 50-70% of these workers are undocumented immigrants since few United States workers are willing to fill these jobs.

Undocumented farm workers often leave their countries to seek a better life. The North American Free Trade Agreement (NAFTA), enacted in 1994, resulted in United States government-subsidized corn that was cheaply produced in the United States and sent to Mexico. Many Mexican workers have come to the United States looking for work. These undocumented immigrants are marginalized and even criminalized since Federal and state laws increasingly impose criminal penalties or deportation. A pathway to citizenship is almost impossible under the present laws.

Historically, immigrants have been important part of the United States economy. Immigrants came to the United States in the late 1800s and early 1900s to build the nation's infrastructure. From the 1920s until the 1960s, no immigration was permitted. Today, immigration is a major political issue. Immigrant rights' groups say that the economy needs to have a steady stream of immigrants. Others say that immigrants must follow the law. Under current laws and policies, undocumented immigrants are being deported and told to wait in line to become citizens.

Some farmers use the H-2A visa program, which makes it difficult to hire and maintain employees, and it provides less than 4% of the workers needed. Farmers must provide transportation to migrants from the border to their farms, which is a problem for North Carolina farmers. Some companies are creating robots with sensitive hands that can harvest berries and beans safely.

The flow of undocumented immigrants has slowed because of tighter enforcement policies adopted by Presidents Bush, Obama and Trump. North Carolina farmers have been affected because they have too few workers. A bipartisan group in the United States Congress has presented a compromise plan, but many other members of Congress have refused to pass legislation.

## **Medical Uses of Hemp**

The issue of the legalization of marijuana and hemp has been controversial for many years. Cannabis plants include the variety called marijuana (which can have a psychoactive effect) and hemp (which generally doesn't and contains CBD oil). The federal government prohibits the production, use and distribution of marijuana. Hemp is legal because of the passage of the Farm Bill in 2018. Hemp is no longer considered a controlled substance by the Drug Enforcement Administration; however, comparatively little research has been done on it. In the past several years, some states have enacted laws that provide for the legalization of marijuana and/or hemp, many with strict guidelines.

Eleven states and the District of Columbia, which contain more than 25% of all Americans, permit recreational use of marijuana. An additional twenty-three states have legalized hemp for medical purposes. Marijuana is illegal in North Carolina, but hemp is legal for very limited purposes. Farmers have told Food and Drug Administration officials that they need to add hemp as a cash crop to compete with China and other big agricultural nations. They predict that hemp farming will result in tens of thousands of new jobs.

The CBD oil in hemp soothes pain and promotes better sleep. It is now in hundreds of products from bath salts to coffee drinks. More than a quarter of the people in the United States have tried CBD for many mental and physical reasons and 15% say that they use it every day. Forty percent of people between 20-30 years of age and 15% of those over 60 have tried CBD oil. Most say that it was effective and allowed them to eliminate prescription medication, including opioids. It is sold in pill form, oils, tinctures, lotions, and even in bottled water, coffee, beer and cosmetics.

Some scientists, doctors and public health officials question the benefits and risks of marijuana and CBD oil, and have concerns about its safety. They are particularly concerned about impaired driving and mental health issues.

North Carolina currently allows the use of CBD oil to be given to children with epilepsy. Proposed bipartisan North Carolina legislation would expand the use of CBD oil by allowing it for people experiencing autism, multiple sclerosis, Crohn's disease and mitochondrial disease. North Carolina legislators state that their goal is to take a slow approach and to consult with medical providers.

## **Roundup**

Much has been written about the ongoing legal battles involving the use of the herbicide known as “Roundup.” Roundup is manufactured by Monsanto Corporation, which is owned by Bayer AG. It is the most widely used weed killer in the world.

Roundup is used on the vast majority of corn, soybean and cotton acres planted in the United States. Farmers are enthusiastic about it because of its low cost and effectiveness.

A United States District Court jury in San Francisco has found that exposure to Roundup, a glyphosate herbicide, caused a man’s cancer after years of spraying weeds on his rural property, resulting in a very large monetary award. Bayer AG faces more than 11,000 similar lawsuits filed by farmers, landscapers and gardeners.

Bayer AG argues that science confirms that glyphosate-based herbicides do not cause cancer. Bayer asserts that 800 studies and regulatory decisions around the world state that the chemical is safe and not carcinogenic. Regulators in the United States have continued to approve its use. The United States Environmental Protection Agency has concluded that glyphosate is unlikely to cause cancer in humans. However, in some countries such as France, Roundup has been banned.

The plaintiffs in the lawsuits involving Roundup have argued that Monsanto has actively manipulated the science regarding glyphosate’s carcinogenic nature. There has been an increase in scientific research into whether glyphosate is carcinogenic. Scientists, who are paid by corporations to study this issue, often conclude that glyphosate is not harmful to humans.



## **Salmon Farming**

Salmon has become America's second favorite seafood, after shrimp. It has many nutrients, is stocked with antioxidants, and is one of the healthiest foods that we can eat. For many years, salmon meant "wild salmon" which was harvested in Alaska, Washington, or in Scandinavian countries. Since 1989, consumption of farmed salmon has risen from less than 130,000 metric tons to more than 300,000 metric tons annually. Today, however, 70% of the salmon that we eat comes from salmon farms. Salmon farming has expanded rapidly during the past thirty years.

Most of the wild salmon caught today are used to feed the farmed salmon in caged farms and ponds. Farmed salmon need fishmeal and fish oil to grow. These ingredients come from wild caught anchovies, sardines and other small species, all of which are taken from the ocean. To increase profits, fish are placed into pens at high densities. To avoid the transmittal of parasites and diseases, farmers administer antibiotics and pesticides that result in a layer of toxic material on the seabed under the farm. Salmon farmers use genetic engineering to accelerate growth and inject hormones into the fish. Large farms can be as large as 400 yards and contain more than 1,000,000 fish.

Advocates of salmon farming argue that it is environmentally friendly. Fish farms try to introduce more good Omega-3 fatty acids into salmon by cultivating algae and worms. However, farmed salmon fishing practices differ from country to country, and there are no regulations in the United States to ensure the humane treatment of fish. Salmon farming advocates also point out that increased fishing for wild salmon will result in overfishing and low harvests in the future.

## Tariffs

The US-Mexico-Canada trade agreement, which is the renegotiated successor to the North American Free Trade Agreement (NAFTA), is being presented as having more agricultural benefits through new commitments in customs, digital trade and intellectual property that could result in more jobs, higher wages and greater productivity in the United States. A major argument for the negotiation of a trade agreement with China is that the Chinese have stolen United States intellectual property for many years. Another argument is that China has benefited from forced technology transfer.

The United States has used tariffs to enhance its negotiating position; however, affected countries have imposed retaliatory tariffs that target American farmers. Some have argued that these retaliatory tariffs lowered the price of United States pork, and soybean prices plunged more than 90% in 2018. United States farmers have suffered large monetary losses and have taken on more debt in the wake of retaliatory tariffs. Bankruptcies are rising in the agriculture sector of the economy.

Agriculture has long been the most subsidized industry in the United States and President Trump has stated that the federal government will help those farmers who are most affected. Farmers have also responded to the retaliatory tariffs by diversifying crops, introducing new technologies and generating income from their land through conservation and recreation.