

Foods: Chapter 2

Our Diets Have Changed but Our Genes Have Changed Much Less

Modern humans are all 99.9% genetically identical and appeared on Earth some 50,000 to 100,000 years ago in Africa. For millions of years before that time, there were pre-humans called *hominids*. Those pre-human vegetarians who lacked the ability to eat meat did not win the evolutionary struggle, and man developed into an omnivore – that is, we eat meat and plant foods. We have canine teeth in the front of the mouth to shred meats and grinding molars in the back to crush cereals. Eating both small and large land animals and sea creatures provided a distinct nutritional advantage in a world where avoiding starvation was paramount. Animals concentrated the minerals and vitamins from the plant foods they ate, and provided a source supplemental fish oils (or omega-3 fatty acids) as well as high-quality protein that stimulated the growth of the brain and the body. However, the base of the diet remained largely composed of plant foods for most early humans. When eating plants, humans not only got vitamins and minerals, but a huge variety of plant substances that provided key health benefits that will be discussed later in this text. These are variously called phytochemicals (phyto, meaning plant), phytonutrients, or bioactive substances. The nutritional science community has been slow to accept the contribution of these substances to the diet, since they do not provide calories. As with fibers, there are some scientists who still consider these as non-nutrient substances. This is important when it comes to the issuance of dietary guidelines and recommended dietary allowances, where the goal of meeting vitamin and nutrient deficiencies has remained paramount. There has been little recognition to date of the importance of returning to a diet based on plant foods and ocean-caught fish rather than industrialized meat and refined carbohydrates.

Our bodies reflect our evolution, resulting in the ability to digest both animal and plant foods. In addition to our omnivore-adapted teeth, our intestines are longer than carnivores but shorter than those found in vegetarian animals. Our 22 feet of small intestine can adapt to diets as different as an all-animal diet and a purely vegetarian diet by changing the amounts and types of enzymes – specialized proteins that help us digest our foods – found on the huge surface area of the small intestine. The surface area of the intestines is increased through millions of tiny folds on the surface of the intestines called *villi*.

Over the millennia, incorporating many features from closely related primates who preceded us on earth, our bodies and our genetics evolved slowly and so they cannot change rapidly with the inherent mutation rate of DNA being 0.5 percent per million years. Some changes did occur in our genes due to changes in the diet and environment. The ability to digest milk developed about 5,000 years ago. The lighter skin color in humans who migrated north from Africa to Europe maximized ultraviolet light to produce vitamin D, while preserving the orange pigment beta-carotene so that it could protect the skin from the damaging effects of the sun's rays. A number of diseases such as sickle cell anemia and cystic fibrosis are due to single gene mutations, which developed in response to disease threats such as malaria and epidemic respiratory diseases. In these situations, one normal and one abnormal gene resulted in an adaptive advantage, but when two abnormal genes were inherited, the result was severe and life-threatening diseases. It is important to realize that genetic changes only occur when they confer a survival advantage before reproductive age. Nature has no mechanisms to guarantee your longevity beyond the age of reproduction. The average lifespan in the Roman Empire was around 20 years of age, while as recently as 1,900, the average lifespan was 50 years of age. Today, average lifespan in many countries for men is in the late 70s, while in women it is in the 80s. About 70 percent of how you age is determined by your lifestyle and environment, and only 30 percent is determined by your genes – so the message is that much of your quality of life is in your hands to optimize through a balanced diet and healthy active lifestyle.

The Discovery of Agriculture Modifies our Food Supply

About 10,000 years ago, the planet emerged from a 120,000 year long Ice Age for unknown reasons. There was an increase in the average temperature of the Earth. As a result of the increase in temperature, it is believed that a spontaneous mutation in wheat occurred at this time, causing the wheat to hold onto its seed, rather than scatter it to the wind. This development enabled man to imitate rodents and store grains for the winter. Since grains have up to 20 to 30 times the calories per bite of fruits and vegetables, the discovery of agriculture made it possible to develop cities organized around an agricultural lifestyle. Agriculture gave mankind the leisure time to develop civilization with all its positive and negative aspects. Crops were domesticated as well. Over time, domesticated crops and animals were introduced to new areas, and in each new area, additional species were domesticated.

The next agricultural phase in Europe was the cultivation of trees that must be grown by grafting, such as apples, pears, plums, and cherries. At around the same time, wild plants that initially established themselves as weeds were domesticated, such as radishes, rye, turnips, beets, leeks and lettuce. By the time of the Roman Empire, many of today's leading crops were domesticated.

After 1,500, the vast fertile plains of the New World brought great enrichment to the world's food supply. The domestication of crops and livestock sprang up independently in some parts of the world. This suggests that, given enough time, humans would have eventually domesticated plants and animals in many areas of the world even if the practice had not migrated from one land to the next. For example, there is evidence that in China, rice, millet and pigs were domesticated independently around 6,500 B.C. In about 3,500 B.C., South Americans domesticated potatoes, manioc, guinea pigs and llamas. In Mesoamerica, independent of developments in South America, corn, beans, squash and turkey were domesticated about 3,500 B.C. Native Americans in the Eastern United States domesticated sunflowers and goosefoot plants, but not animals, about 2,500 B.C. The corn, beans, squash and turkey found by explorers landing in North America were brought there from Mesoamerica. In tropical West Africa, African yams and oil palm were domesticated about 3,000 B.C.

Cultural Evolution Moved Quickly to Change our Diets and Lifestyle

Cultural evolution, including advances in agriculture and the industrialized production of foods in the last 100 years, has resulted in a distortion of our diets. Our genes still make us crave sweet and fat tastes, but the foods we find in our modern environment have little or no similarity to the foods on which mankind evolved.

The Modern Epidemic of Obesity Developed in the Last 20 Years

By the 1980s, the American Diet was the best modern man could devise to match our American tastes, as articulated by Madison Avenue. Food was inexpensive compared to the cost in other countries, but these advantages proved to be less than optimal for our health. Furthermore, the automobile, suburbanization with long commutes, the television, the computer, and the disappearance of physically active work lives, have contributed to a daily decrease in energy burning estimated to be about 800

Calories per day. Diets with more fat, sugar, and calories, combined with less energy burning, have led to a modern epidemic of obesity.

Humans are well adapted to starvation since getting food was the main road to survival until the industrial revolution. The adaptation to starvation, which was once so critical to man's survival, is now maladaptive, leading to the prominence of obesity as the most prevalent nutritional disorder in the United States. According to the Surgeon General, two-thirds of the population is either overweight or obese. These are estimates based on population surveys, and the pattern is being repeated throughout the world. It is estimated that worldwide obesity will double in the next 30 years.

Understanding Gene-Nutrient Interactions

Our genes developed to enable us to survive both starvation and infection in a world where sanitation and predictable nutrition were unknown. The human body has evolved many levels of backup and fail-safe systems. Among these, the ability to interconvert protein, carbohydrates, and fats in certain ways enabled humans to survive in many different food environments. Nature is of no help in enabling you to customize your food intake to extend lifespan and improve quality of life. The way that nature distributes calories and interconverts elements of one food into another is largely based on adapting to starvation and food scarcity. There was no way our bodies could have anticipated the modern era of fast food with high calories, high fat, high sugar, the imbalance of healthy and unhealthy fats, and too little of the needed phytonutrients to optimize our health.