INTRODUCTION
From Foraging to Farming

"We will now discuss in a little more detail the Struggle for Existence" said Charles Darwin in his 1859 Origin of the Species *– a struggle which Thomas Malthus had earlier called "The perpetual struggle for room and food."*

On Populations (1798)

PLANT LEAVES absorb the sun's energy and construct nutrients through photosynthesis. These are passed along to animals that swallow them when they eat the plants; to animals that eat animals that eat plants; and to other animals, including humans, who eat both plants and animals. Because such nutrients are basic to human survival, finding or producing food has been the most important historical preoccupation of humans and their ancestral species in an evolutionary journey to the top of the food chain.

The pages that follow look at the thousands of years of food finding and food producing that have carried us to the brink of food globalization – the latter a process of homogenization whereby the cuisines of the world have been increasingly untied from regional food production, and one that promises to make the foods of the world available to everyone in the world. Food globalization has grabbed headlines as cultures have circled wagons against the imperialism of multinational companies such as McDonald's and Coca Cola. But such standardized food production in which "McDonaldization" has become synonymous with food globalization is a distortion of the concept that has been going on for some 10,000 years since humans first began to control the reproduction of plants and animals;[1] since the first wild rye was brought under cultivation in one place, wheat in another, and maize in another; since the jungle fowl of southeast Asia was transformed into the chicken of Europe and the wild boar, first domesticated in the eastern Mediterranean, became the pig during its long eastward dispersal (with many more domestications) toward Indonesia, before sailing off with the human pioneers who spread out across the Pacific.[2]

Yet food globalization means much more than simply food diffusion. Animal and plant domestication fostered sedentism, and sedentism in turn nurtured deadly diseases that became globalized. It also caused populations to swell, inviting famine to shrink them again and impelling humans further and further afield to occupy less desirable portions of the world's surface. Out of sedentism sprang organized religion, and religious wars; states, and wars between them; nationalism, trade, and wars for empire, all of which brings up another theme – the often-negative impact on human life and health wrought by technological advances.[3]

The Neolithic Revolution(s) was and remains the most momentous of all such technological advances, and in a very real sense today's food biotechnology can be regarded as just the latest chapter in those revolutions set in motion millennia ago. Collectively they have constituted an ongoing, often uncontrolled, revolution, laden with unforeseen and unknowable consequences for humankind's ecological relationship with the planet's flora and fauna, as well as for the planet itself.[4]

But this is a mega- – almost metaphysical – example and historical hindsight can spy smaller technological examples that are easier to grasp. One might be the quick dissemination of the newly discovered New World plants around the globe because the Spanish and the Portuguese had developed technologies that permitted them to stay at sea for long periods of time – long enough for their seamen to develop scurvy, a nutritional deficiency disease that killed at least a million and probably closer to two million sailors before it was understood that vitamin C deprivation was the cause.[5]

Another, more recent, example could be the late–nineteenth-century and early–twentieth-century steam mills that polished rice. The mills represented technological progress; but by efficiently stripping away the thiamine-rich outer layers of the kernels they triggered epidemic beriberi that killed thousands of Asians.[6] And finally, in a very recent (and more complex) example, the Green Revolution was supposed to end world hunger with genetically engineered plants, and in the long run it may do just that if population growth can be curtailed. However its most apparent short-run impact, ironically, has been to encourage population explosions in the "revolutionized" countries so that every one of them is an importer of the staple foods they had expected to produce in abundance.[7]

These are but a few illustrations of the unintended consequences of new technologies on the food front. Countless others can be found in recorded history and doubtless many more took place in a prehistory that we know little about. As of today, humans have spent less than one-tenth of one percent of their time on earth as sedentary agriculturalists and, consequently, much less than one-tenth of one percent of that time in the light of recorded history – which brings up a third theme.

For 99.9 percent of humankind's stay on the planet (and around 90 percent of that of *Homo sapiens*) our ancestors made a living by hunting and gathering, which means that millions of years of our food and nutritional history will forever remain obscure (recent molecular phylogeny indicates that the hominid species split from the ancestral chimpanzee line between 6 million and 8 million years ago). Nonetheless, it makes considerable sense that it was during those millions of years and not the past 10,000 that most of our nutritional requirements were shaped – shaped even before *Homo sapiens* emerged as the sole survivor of a succession of several dozen hominid models launched on, as it turned out, unsuccessful evolutionary journeys.[8]

There are numerous methods employed by bio-anthropological investigators to determine the diet (the foods consumed) and the nutritional status (how those foods were utilized) of our ancient forebears.[9] Plants and animal remains unearthed in archaeological sites across the globe, along with human remains including coprolites (dried feces), bones, teeth, and, occasionally, soft tissue, have been scrutinized using techniques of radiocarbon (14C) dating, chemical analysis, and microscopy; and all have something to say about prehistoric diets.[10] Moreover, the study of the diets and nutritional status of modern-day hunter-gatherers has helped in understanding and interpreting these findings.[11] To be sure, plenty of room still exists for bio-anthropological dispute (and there is plenty of it), but agreement has increasingly jelled that ancient hunter-gatherers did quite well for themselves in matters of diet and nutrition, and considerably better than the sedentary agriculturalists who followed them.[12]

Such a consensus may seem blatantly heretical in light of the Western teleological spin given to the history of human progress. Yet it would seem that the lives of our hunter-gatherer ancestors, living in a state of nature, were not "poor, nasty, brutish, and short" as Thomas Hobbes pithily put it in his *Leviathan*.[13] Instead they were a relatively healthy lot – at least those that managed to survive a rigorous selection process. Life only entered the nasty and brutish stage with the invention of agriculture, according to what is present in, as well as what is missing from, humankind's archeological record.

For example, rickets (caused by vitamin D deficiency) and scurvy (occasioned by vitamin C deficiency) are diseases documented in literary and archival sources from Greek and Roman times onward but there is little evidence of such ailments in prehistoric populations.[14] Or again, the incidence of anemia increased steadily from Neolithic times through the Bronze Age so that the lesions of porotic hyperostosis and cribra orbitalia (a pitting and expansion of cranial bones that are signals of iron deficiency anemia) found in the skeletal remains of Fertile Crescent farmers living from 6500 to 2000 BCE indicate that about half of them were anemic.[15] By contrast, only 2 percent of the skeletal remains of hunter-gatherers dating from 15,000–8000 BCE) show evidence of anemia, which seems testimony to an iron-rich meat diet.[16] In addition hunter-gatherers had far fewer dental caries, knobby joints, and abscesses. And finally, as a rule, hunter-gatherers were significantly taller than the village agrarians who followed them, indicating a much better intake of whole protein.[17]

In fact, among some foraging groups meat may have constituted as much as 80 percent of the diet and for most it was at least 50 percent – but this was an intake that decreased precipitously after foragers became farmers.[18] Hunter-gatherers also ate an amazing variety of wild fruits and vegetables and, in fact, still do. Modern-day hunter-gatherers like the Kung! San of the Kalahari Desert region of southern Africa utilize more than 100 plant species and more than 60 animal species in their diet, and it has been estimated that our ancient ancestors knew the natural history of several thousand plants and several hundred animals.[19]

The diet of latter-day hunter-gatherers during the last 100,000 years or so of the Paleolithic (nearly modern human skulls recently unearthed in Ethiopia were dated at around 160,000 years ago) was apparently even more varied than that of the Kung! San. It was high in meat, vitamin C, and calcium, and low in simple carbohydrates. It offered much fiber in fruits, tubers, and leafy vegetables but featured few or no cereals and no dairy products. Although meat accounted for much of the food energy, the

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meat was lean and a high proportion of the fat in wild meat is polyunsaturated.[20] Moreover, judging from the ancient middens of shellfish and fish bones found on all the continents save Antarctica, seafood (with its omega 3 fatty acids) constituted still another important source of good quality protein.[21]

Diet also molded humans during their evolutionary journey in ways that influence the physiology of their modern descendents. Plants, for example, synthesize thiamine, but humans and the rest of the animal kingdom lost that ability. It conferred little advantage on animals that ate plants or other animals or both. With vitamin C, however, although most animals retained the ability to synthesize it, humans did not, confirming among other things that our hunter-gatherer ancestors consumed much in the way of plant foods and raw meat (which contains vitamin C) – and consequently were among the few animals to enjoy an abundance of the vitamin.

But abundance was a relative state of affairs. The feast part of "feast or famine," and certainly the famine part – hunger and its appeasement – were the forces that propelled hunter-gatherers from their early days of mostly gathering and scavenging throughout the world in pursuit of an increasingly carnivorous diet. However, during their long and arduous trek to reach the various parts of the globe and the process of adapting to them, natural selection planted the seeds of some of humankind's modern health difficulties. Energy was stored as fat against seasonally decreased food intakes, and those who stored fat efficiently survived during bad times, whereas others did not.[22] The trouble is that our bodies are genetically programmed to store calories against lean times that nowadays (at least for affluent populations) never come. Lifestyles have become increasingly sedentary but our diets are more energy-packed, with less fiber and more refined carbohydrates.[23] As a consequence, the "thrifty mechanisms" of carbohydrate metabolism that saved our forebears now curse us with obesity, diabetes, and heart problems.

And finally, it was during the last 200,000 years that *Homo sapiens* – the wise man – appeared on earth with a brain as large as our own. Evolution had transformed him from a scavenging and gathering, ape-like australopithecine to a fully modern human being – the large brain facilitating the exploitation of a wide range of food sources and the colonization of marginal environments. However, an enhanced brain size was metabolically expensive, accounting for only 3 percent of the adult body weight but demanding around 20 percent of its energy. Calorie-dense meat, shellfish, and fish became even more nutritionally important to supply that energy and the larger brains devised the strategies, weapons, and tools necessary to acquire them.

In that symbiotic process, Hiam Ofek points out, the body managed to compensate for the enlarged brain and bring about some balance by paring down its digestive system to around 60 percent of that expected for a similar-sized primate. This paring was also the result of a large brain that relieved much stress on the gastrointestinal (GI) tract by thinking – thinking to remove dirt from foods, to peel them, to husk and crack them, and to chemically alter them by cooking. In the end, the increase in the size of the brain was balanced almost exactly by a reduction in the size of the gut. At that stage humans became omnivores with the GI tract of a carnivore – and the ability to eat large quantities of meat is a cardinal difference between humans and the other primates.[24]

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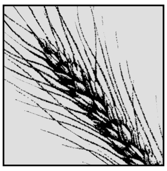
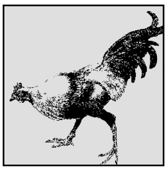



CHAPTER 1




LAST HUNTERS, FIRST FARMERS

Animals feed, man eats; the man of intellect alone knows how to eat.

Anthelme Brilllat Savarin (1755–1826)

Acorns were good until bread was found.

Francis Bacon (1561–1626)

OUR ANCESTORS began the deliberate and systematic hunting of animals some 700,000 years ago in Africa. Before this their diet had been based mostly on plant foods, occasionally enlivened with meat from scavenged carcasses – other animals' leftovers. But by the time we became *Homo sapiens* – Our Kind – which happened in eastern Africa some 100,000 years ago, we were hunters, not scavengers – opportunistic hunters who apparently became so good at it that those ancestors put a considerable dent in their food supply. Around 80,000 years ago they began to radiate out of northeast Africa to western Asia, where they once again encountered plenty of protein on the hoof, and in this larger world they mustered the momentum to out-compete all others of the genus *Homo* that had preceded them.

This was the modern human species, which began colonizing Australia around 50,000 years ago, moved from the Asian steppes into Europe from around 40,000 years ago, and into the Americas 15,000 to 30,000 years ago. And it was in these wanderings that the progressively larger brains of humans gave birth to progressively better tools and weapons and increasing social organization.

There is evidence of specialized hunting strategies by 20,000 years ago that allowed our big-brained ancestors to consistently bag really big game. In the middle latitudes of Eurasia large gregarious herbivores such as horses, wooly mammoths, reindeer, and bison were victims of these strategies. Elsewhere the prey consisted of buffalo, wild pig, aurochs, and camel. Large animal carcasses had numerous advantages over plant foods. A day of foraging for plants produced the food value of just one small animal, whereas by eating animals humans took in a highly concentrated food that contained all the essential amino acids. Moreover one large animal could feed an entire band, and food sharing seems to have been the norm for hunter-gatherers.[1]

Others of Our Kind made a living from the water. Ancient rock art the world over depicts fish, although it is relatively silent about how they were caught. Probably, until late in the Paleolithic – when bows, arrows, and harpoons appeared, large animals were on their way to extinction, and flimsy dugout canoes and reed rafts were replaced by more reliable watercraft – fish procurement was largely limited to rivers. There fish could be taken with clubs, spears, nets made of twisted fiber, and lines (the fish-gorge, a kind of hook, dates from around 27,000 years ago) often after damming the water. Then, too, hunter-gatherers were surely familiar with the annual "runs" of various anadromous species such as salmon that swim from the ocean into and up ancestral rivers to spawn.[2]

The exploitation of coastal, as opposed to riverine environments, involved not so much fish, but shellfish – mussels, oysters, cockles, scallops, whelks, clams and the like – whose shells comprise the myriad middens of both Paleolithic and Neolithic origin found on seacoasts and rivers around the world. The succulent nuggets within these shells represented easily collected, high-quality protein (and also bait for fishing) – the drawback being that the food came in small increments so that large-scale gathering efforts were required. Sea slugs and sea anemones were also collected (still eaten by the French), as were lampreys – too many are famously said to have killed England's Henry II in 1189. Inland, mollusks such as snails also offered a living to gatherers – their discarded shells contributing to still other middens.

Many coastal and inland middens indicate intensive activity during the early years of the Neolithic – perhaps another indication of big game disappearing? In any event, collecting mollusks must have been a pleasant alternative to the rigors (and dangers) of the hunt or labor in the fields. So too was the collection of health-giving algae – excellent sources of vitamins, minerals, even fats.[3] Perhaps the only reason that beaches were not jammed was that the coasts could not provide enough food for everyone.

Giant sea turtles were another vital marine resource for many, although reliable watercraft were required to exploit their eggs, which were often deposited on uninhabited offshore islands.[4] The eggs, of all of the six or seven species (the number is in dispute) of these giant marine reptiles have long been good food for humans but the sea turtle most favored for its veal-like meat is the green turtle (*Chelonia mydas*) – named green not for its color but for the green gelatinous substance found underneath its lower shell, called "calipee." When scraped out, calipee is the base for the justly famous green turtle soup.[5] Even though sea turtles are easy to catch when out of the water, turtle flesh – but not turtle eggs – is avoided by many around the world. For others, however, like the coastal Miskito population of Nicaragua, whose home coasts are one of the principal feeding grounds for green turtles, they are a staple.[6]

Many of these foods, including turtle eggs, were eaten raw throughout much of humankind's time on earth and some still are, like oysters, clams, mussels, fish, and fish eggs (caviar and its pretenders). In Japan eating raw fish (called *sashimi* since the seventeenth century) has been traditional since ancient times.[7] Meats, too, are still eaten raw, such as hams (although cured or smoked) and beef (as steak tartare and carpaccio).

Insects consumed, sometimes raw and sometimes cooked, served as another important food source for hunter-gatherers and their descendents. To name but a few of the many more than one thousand species that have figured into the practice of entomophagy: North American natives ate the larvae of moths, grasshoppers, crickets, and caterpillars; in Mexico several hundred species of insects, including caterpillars, dragonflies, ants, bees, and wasps, are still eaten; and in South America giant queen ants are not only thought tasty but are depended on as an aphrodisiac as well.[8]

In the Old World the ancient Greeks and Romans enjoyed grasshoppers and large grubs, and European peasants continued to make insects important sources of protein until the nineteenth century. In Africa entomophagy is still practiced on a large scale with caterpillars ("the snack that crawls") a widespread favorite. Locusts, termites, and palm grubs are also commonly eaten. Until recently locusts were regularly popped into human mouths in South Asia and the Middle East. Beetle consumption has long been popular in Southeast Asia, where ant larvae and pupae are not only regularly

consumed but also canned and exported to specialty food outlets, as is bee brood. Silkworm pupae are shipped to the United States from Korea and regularly consumed in China. The Japanese are fond of wasp pupae and larvae, and locusts are regularly consumed throughout East Asia. In Australia the black honey ant, a special kind of bee, and witchetty and bardi grubs (the larvae of a moth and a beetle, respectively) were all local delicacies for hunter-gatherers that have recently found their way into restaurant menus – a modern reminder that these were all important Aborigine foods, along with moths collected during migrations.[9]

Vegetables and fruits comprise other groups of foods often eaten raw. Lettuce has been fried and boiled, but as a rule it is not. One does not say raw oranges to differentiate them from cooked varieties because they are seldom cooked – a good thing, too, because heat kills the vitamin C they contain. But, this having been said, although numerous food items have been, and still are, eaten raw, cooked food is generally the best tasting and the best for us. Heat destroys toxins in plants and unwanted wildlife in meat and fish such as worms and a gamut of smaller pathogens.[10] It increases the nutritional value of many foods, makes others more digestible by the denaturation of protein and the gelation of starch, even makes some inedible foods edible. Cooking softens tough foods by breaking down animal and vegetable fibers while simultaneously liberating protein and carbohydrate materials – indeed, starch requires heat to release its sugars.[11]

The domestication of fire, then, was not only the first but the most important of all the domestications that humankind has managed. Although its permanent acquisition is told in a thousand myths and legends, generally of divine gift-giving, in reality fire must have been acquired only to be lost again countless times over millennia as (often painful) trial and error led from the capture of naturally occurring fire (fire collecting) to its preservation in embers that could later be fanned into flame. Tamed fire (fire production) was probably initially employed for illumination, to frighten away dangerous carnivores, and for hunting rather than for cooking. However as cooking became routine, more reliable tools for fire kindling such as flints, fire drills, and other friction devices came about, and the art