EVERYONE EATS

UNDERSTANDING FOOD AND CULTURE

SECOND EDITION

E. N. ANDERSON

EVERYONE EATS

Second Edition

This page intentionally left blank

EVERYONE EATS

Understanding Food and Culture

Second Edition

E. N. Anderson

NEW YORK UNIVERSITY PRESS

New York and London

NEW YORK UNIVERSITY PRESS
New York and London
www.nyupress.org

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA
Anderson, Eugene N. (Eugene Newton), 1941–
Everyone eats : understanding food and culture / E. N. Anderson.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-8147-7014-6 (cloth : alk. paper) — ISBN 978-0-8147-6006-2 (pbk. : alk. paper)
1. Food habits. 2. Food preferences. I. Title.
GT2850.A6644 2004
394.1'2—dc22 2004014366

New York University Press books are printed on acid-free paper, and their binding materials are chosen for strength and durability. We strive to use environmentally responsible suppliers and materials to the greatest extent possible in publishing our books.

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

Book design by Marcelo Agudo

Also available as an ebook

To all the unknown men and women who created the staple foods and the cuisines of the world: our greatest and least known benefactors.

With special thanks to my (fortunately less obscure) mentors, especially:

Paul Buell
Jack Goody
Solomon Katz
Sidney Mintz

This page intentionally left blank

CONTENTS

ACKNOWLEDGMENTS

This is the place to acknowledge some of the people who have helped me understand food over the years and thus perhaps help a small amount in saving them from the general obscurity of those who have fed the world. I wish I could extend this list indefinitely; I would like to include everyone who has ever cooked for me or grown food that I ate. My mother and my father's mother were the first of these; they taught me the joys of eating. I thank my wife Barbara, my children, and all my family. But, to keep things manageable, let me restrict the rest of this list to my friends and advisors among the serious scholars of foodways. In addition to those singled out in my dedication, I am grateful especially to Ken Albala; Marja Anderson; Myra Appell; Marilyn Beaudry-Corbett; Alan Davidson; Alan Fix; Rachel Laudan; Françoise Sabban; Ellen Messer; Charles Perry; Nevin, Mary, and Susan Scrimshaw; Penny van Esterik; and Christine Wilson. Special thanks to Sid Mintz, who undertook the awful task of reading the entire manuscript, on which he made perceptive and insightful comments. Anonymous reviewers also helped. I apologize to friends and colleagues for not devoting more attention to their work, but space is limited. Thanks also to Ilene Kalish and the wonderful editing staff of New York University Press!

This page intentionally left blank

Everyone Eats
Everyone eats rice
Yet no one knows why
When I say this now
People laugh at me
But instead of laughing along with them
You ought to step back
and give it some thought
Think it over, and don't let up
I guarantee the time will come
When you'll really have something worth laughing at
—Ryokan, Great Fool: Zen Master Ryōkan (1996)

INTRODUCTION

The eighteenth-century Zen poet Ryokan probes us on many levels. He is most concerned with the ultimate questions: What is life? Why live? Is there such a thing as life or existence? Indeed, if you ponder those, you will find much to laugh about. . . .

But there are more immediate, if no less laughable, questions posed by this innocent-seeming verse. Why do we eat what we eat? How did "rice" become synonymous with "food" throughout so much of eastern Asia?

We may further ask, How many of our foodways are determined by biology, how many by culture? Why do we love spices, sweets, coffee? Why do the British and the French not only eat so differently but also tease each other so mercilessly about it, century after century? The British call the French "frogs," to which the French respond that "the English have a hundred religions and only one sauce."[1] Why did pizza zoom from total obscurity to favorite American food in only a few years? In fact, human foodways are a complex result of the interaction of human nutritional needs, ecology, human logic or lack of it, and historical accident. Humans make food, but, as Karl Marx said of history, "they do not make it just as they please" (Marx 1986:276). They construct their foodways within limits set by biology, economics, and psychology. There is an infinite number of possible dietary regimes, but no dietary regime can long endure if it does not provide protein, carbohydrates, fats, vitamins, and necessary minerals.

Ryokan also stimulates us to ask, Who developed the staple foods that support us? Who created the wondrous variety and complexity of cuisines that so greatly enrich our lives? The answer is thought provoking, and this time the humor is subdued and gentle. No one knows the names of the great inventors. We know the names of a few latter-day chefs, but food history—unlike the history of war and violence—is generally a history without names. Whoever developed bread wheat—a complicated, difficult hybrid—benefited humanity more than any named hero, yet we have no clue as to his or her name or language, though we know every detail of the lives of archvillains like Stalin and Hitler. The unknown Mexican indigenous people who developed maize gave life to countless people. We know nothing about the maize breeders, though we know the names of the conquistadors and generals who massacred their descendants.

Millions and millions of humble, gentle, caring human beings—farmers and homemakers, innkeepers and famine-relief workers, lovers and helpers—gave us the benefit of their insight, brilliance, creativity, and labor. To the familiar record of oppression and exploitation, they counterpose a hidden record of generosity, concern, and responsibility. We do not know who they were. They live on, but only in the silence of bread, the calm of a bowl of rice, the joy of wine, the light of a cup of coffee.

Strange immortality! To help so much, to pour the goodness and care of life into the most neglected and most important of everyday things, and then to be forgotten. Perhaps they did not care; perhaps they felt that fame is for those who have nothing better to leave.

Even their modern descendants, whose names we know, are not household words. From the late unlamented twentieth century, almost everyone knows of Madonna and Elvis, but few indeed recall E. V. McCollum or Albert Szent-György (the discoverers of vitamins A and C, respectively). Ryokan, in other poems, poses the classic Buddhist opposition between the glory, fame, and transience of kings and the obscure but enduring world of the common folk. Those ordinary people must survive the wars and famines that their rulers unleash. Somehow, those ordinary people have not only kept their loved ones fed; they have steadily improved crops, recipes, and cultures. One can only repeat, in their memory, that most poignant of all food metaphors: "Ye are the salt of the earth" (Matt. 5:13).[2]

> Savoir pour prévoir, prévoir pour pouvoir. (Know in order to predict, predict in order to be able to do something.)
> —Attributed to Condorcet (France, eighteenth century)

This book attempts to explain why people eat what they eat and to apply that knowledge to the world food problem—the increasingly severe problem of feeding a huge and rapidly growing population. A great deal of this book is devoted to looking at contingent factors that determine foodways on the ground.

Knowing about food is fun, but there are more cogent reasons to worry about understanding foodways. At least 15% of the world's population does not have enough to eat (Farley 2002). The figure rises to 18% of those in developing regions. UNICEF (2002) reports that almost 30% of children are undernourished. Most of the hungry are in areas of war and unrest or of massive disease epidemics, especially AIDS epidemics.

Conversely, many people have too much, or at least too much of the wrong things. A far larger percentage of the world's people has too little iron, or too little vitamin A, or folic acid deficiency (a common cause of horrible birth defects). Even iodine, easily added to salt, is deficient in some areas (UNICEF 2002). The problems of hunger, of obesity, and of malnutrition are among the world's most serious concerns. Diabetes, heart disease, cancer, and other diseases owe much of their prevalence to poor eating habits.

Humanity has succeeded—only recently—in providing food for everyone. Yet undernutrition continues. Much food is lost in storage or distribution. Most important of all, those who need it are the poor who cannot afford it.

Population growth threatens our hard-won food security. Environmental damage is a more serious and immediate threat. Most unfortunate of all, however, are the wasteful eating habits of those who can afford to ignore the poor and the needy. Grain that could go to the poor is fed to chickens and cows. Too much farmland is producing luxury crops of no nutritional value. Too much of the world's fish catch is thrown away because buyers accept only a few luxury species. Many people who should be eating fruits and vegetables are living largely on highly processed foods, especially bulk starch, oil, and sugar. In all these matters, we need better understanding so that we can provide better food and encourage better use of it (Brown 1995, 1996; Smil 2000). Environment can modify our needs somewhat but cannot change our basic biology; we all need protein, vitamin C, and so on, no matter what we think or believe.

Most studies of world food problems, until recently, concentrated on production and took consumption for granted. This has changed with the rise of nutritional anthropology (Bryant et al. 2003; Counihan and van Esterik 2007; Goodman et al. 2000; Goody 1982) and food history (Davidson 2000; Flandrin and Montanari 1999; Kiple and Ornelas 2000). This changes our understanding of what to do about world food problems. Until recently, the sober literature stressed producing more and convincing people to eat more healthily. Consumption determines what is produced by creating effective demand (i.e., basically, the actual buying or otherwise acquiring of food). Production and consumption determine each other. Thus, recent works often deal with the entire *food system,* looking at production, distribution, and consumption as part of a single process (West 2012). That is the approach used here. I follow a biocultural approach. This involves paying close attention to human biology, to culture, and to political economy, all at once—recognizing that all are necessary and important determinants of food systems (Goodman et al. 2000; Goodman and Leatherman 1998). The biocultural approach contrasts with narrowly biological or narrowly cultural ones. Foodways simply cannot be explained by simple nutritional considerations or by simple cultural ones, such as symbol, meaning, or text.

The alternatives to a biocultural practice theory are two. First, there are strictly ecological and economic theories that see foodways as determined by biology—human nutritional needs, instincts, and environment. Second, there are theories that see society and culture as monolithic structures, separate from biology and (usually) divorced from the ordinary actions of mere mortals—who are expected to be the "bearers" of culture, not its creators. These two types of theory have dominated nutritional anthropology at various times in the past but are now rather widely seen as inadequate. We need to combine them into a biocultural synthesis to get at why everyone eats.

Society is made up of individuals interacting with each other to try to satisfy their various needs. "Culture" is a word used by anthropologists to refer to the rules, customs, and other shared plans and behaviors that result from this interaction. The understanding of society as interaction, and of culture as the knowledge that dynamically flows from that interaction, goes back to Kant (1978 [1798]), if not earlier; it was developed as a theory of society by the nineteenth-century Kantian social scientist Wilhelm Dilthey (1985 [late nineteenth century]) and his student George Herbert Mead (1964). My own understanding of it is practice oriented, and draws on theories of culture as practice (Bourdieu 1977, 1990 [1980]; Latour 2005; Lave 1988). I see both economics and ideas as growing out of practice—out of interactions that are repeated and repeated until people develop from these interactions the generalizations that we know as "foodways" or, more broadly, as "knowledge" and "culture." Practice is structured by class, gender, ethnic, and regional identities, as well as by historical accident and incident, including sheer fads.

It is easy to understand why impoverished Mexicans ate maize until recently and have now switched (locally) to white bread; these were and are the cheapest foods available. It is not so easy to understand why slightly more affluent Mexicans love chiles, avocados, and tamarind. The chiles are nutritious as well as tasty, but they hurt the mouth, at least until one is accustomed to them. The avocados are nourishing also, but expensive, and they were a rather unpromising candidate for domestication when they were brought into cultivation thousands of years ago. Tamarind, a newcomer to Mexico from Asia, is sour and strange flavored—not the sort of taste one would expect to see spreading like wildfire among ordinary people. Nobody knows how it managed to do this in Mexico, especially since it is not popular elsewhere in North America.

Foodways provide us with an almost perfect case study in social theory. Unlike sex habits, they are easy to study. Unlike religion, they are grounded in obvious biological fact; no one can deny the reality of food or of starvation. Unlike politics, they are not often the subject of highly polarized and violent debate. They rank with kinship—social scientists' favorite institution for cross-cultural study—in being universal, well recorded, and usually highly structured.

Basic biology makes some regimens more likely than others; where grain abounds, people will rarely overlook it. No one will use strychnine as a staple food or construct a diet lacking in vitamin C. However, biological, economic, and ecological realities underdetermine foodways, except in desperate cases. Starving people will eat anything available, but anyone above the desperation threshold exercises considerable choice. Food is used in every society on earth to communicate messages. Preeminent among these are messages of group solidarity. Food sharing is literally sacred in almost all religions and takes on a near-sacred quality in many (most?) families around the world. It also carries messages about status, gender, role, ethnicity, religion, identity, and other socially constructed regimes. It is also, very often, used in even more finely tuned ways to mark or indicate particular occasions, particular personal qualities, particular hangups and concerns. It is subject to snobbism, manipulation, and debate. It has served as a source of metaphors for writers and artists from ancient Egypt and Mesopotamia on down to Marcel Proust, James Joyce, and D. H. Lawrence, to say nothing of films like Ang Lee's *Eat, Drink, Man, Woman.* (If there is one omission I most regret in the present book, it is the lack of a section on food in art and literature; I am simply not qualified to go there.)

Many anthropologists explain cultural ways by recourse to functions—usually fairly simple, straightforward functions such as providing food, getting money, protecting the group, or keeping the society together (Malinowski 1944; Turner and Maryanski 1979). Optimal foraging theory (see Chapters 2 and 3) is a functionalist theory. Functionalists often see culture as an adaptive mechanism, allowing people to survive and reproduce. They are concerned with nutrition, mating, and child rearing, economics, social conflict, and harmony. Other anthropologists see culture as a complex network of symbols and symbol systems and see the anthropologist's task as one of interpreting and explaining these meanings. They see culture as communication and representation. They are thus concerned with art, music, traditional literature—in short, texts. Foodways, for them, become texts to interpret and analyze. Many, perhaps most, anthropologists see these explanatory styles as complementary, not exclusive. In general, the more they see humans as united by broad, general concerns based on common human genetics, the more they look toward biological functionalism; the more they see humans as dramatically different from each other because of profound cultural differences, the more they involve themselves with meaning and experience.

I see them as the two wings of the bird of social theory; without both wings, equally developed, the bird doesn't fly. People everywhere have to deal with the full range; they have to get food and shelter, but they also have complex personal lives heavily informed by language and belief. Experientially and phenomenologically (to use the long words), people are simple functionalists sometimes, complex meaning generators at other times. One can follow Mennell et al. (1992) in classifying foodways explanations as functionalist, structuralist, or developmental (broadly historic and political-economic). However, structuralist explanations do not capture all the interpretive, meaning-based explanations in the field.

Humans are not simple, uniform, easily understood creatures. One corollary is that the present book is not tightly organized around one theme. A more unified work would ensue if foodways were all ecology (Harris 1985) or all political economy (as the Marxists hold) or all cognitive structure (Lévi-Strauss 1962). But they aren't. Foodways can only be understood holistically, with every aspect of human life taken into account. Daily practice brings together many disparate determinants, from need for vitamin A to desire to emulate the rich and famous. Unity is provided by the fact that people must integrate into one meal, or one snack, or one shopping trip, the satisfaction of many needs: health, affordability, social and sexual life, a sense of control, and, last but not least, enjoyment. No computer on earth could run a program optimizing the satisfaction of all these. But people are brilliant approximators, and they manage to integrate all those goals—not perfectly effortlessly, but successfully enough for everyday purposes.

Many encyclopedic and comprehensive works on food already exist (notably Katz and Weaver [2003] and Kiple and Ornelas [2000]).[3] I have tried to minimize repetition of easily available information. Standard sources, including my own works, are not summarized in much detail. I have concentrated instead on less well known material and especially on my own observations and unpublished research. I have included as much as I can from my own experience—verifying published material when I could not do the research. This means that, among other things, China, Maya Mexico, and the Mediterranean area—the areas I know reasonably well—get a good deal of attention, while other areas—including India (for which, see Achaya 1994, 2002) and northern Europe (see Adamson 2002 and references therein)—get short coverage. I have included a good deal on hunter-gatherer foraging and on scent, but I have regretfully left to others the task of going in detail into matters like obesity and anorexia, where my expertise is not sufficient to allow me to add much to the many excellent works available.

One of the best ways to improve world nutrition is to pick up the best ideas from the thousands of cultures that humanity has developed. Each culture encodes a vast amount of knowledge of local foods: how to identify them, prepare them, grow them (if they are planted), and so on. We need to see "other people's foods" as not merely exotic delicacies, to be eaten for variety, but as sources of ideas for saving the planet. The most cost-effective, time-effective way to broaden our food systems enough to insure nutrition through the twenty-first century is to draw on these vast existing stocks of knowledge. We have no guarantee that this will be enough to put us over, but at least it will help; we need to investigate all possibilities. "Valuing diversity" is a life-and-death matter.

> If these sleeves
> of my black robe
> were only wider
> I'd shelter all the people
> in this up-and-down world
> —Ryokan (1996)

INTRODUCTION TO THE SECOND EDITION
One More Round

When I finished the first edition of this book, in the early twenty-first century, I was cautiously hopeful. The world was producing enough food. Distribution was improving. Structural reforms had forced many people off needed supports and hurt food production in some areas, but they had also freed up food production in many other areas. Above all, governments were showing some awareness that they had to take action to save key natural resources and to make food widely available and affordable or else face mass disasters.

The situation in the subsequent 10 years has been a disappointment, especially the economic crisis that began in 2008. Little has been done for farming.

The world food situation has unraveled, while governments have often—perhaps understandably—acted in ways that relieved short-term problems (or at least attempted to relieve them) while sacrificing long-term interests. World food supplies have been devastated by urbanization and erosion. Cropland and forest land has been sacrificed to produce biofuels or to grow non-nutritious commodities, from sugar to palm oil (used largely to make biofuel or heart-damaging trans fats). Distribution has broken down in many nations as a result of wars often due to religious and regional hatreds. Structural reforms have run out of control; no longer freeing up economies, they have become ways of taking control by giant multinational corporations, often those most destructive to the food-producing environment (Anderson 2010b, 2012).

As pointed out over many years by Amartya Sen (1992), there has been enough food for all since at least World War II. Starvation and hunger are due to political decisions that simply deny consideration to the world's poor, especially the world's "invisible" rural poor—the people who live what Giorgio Agamben (1998) calls "bare lives." They are forgotten by planners, especially in this time when even the rich are facing economic stresses. The world problem especially involves the "bottom billion" (Collier 2007), if not 2 or 3 billion.

Governments have retreated from commitments. Not only do they refuse to cope seriously with global warming, many refuse to admit that it exists—though it has long been settled science, and the denials that still circulate in the media are dishonest (see Oreskes and Conway 2010). The United States has not ratified the International Biodiversity Treaty, a baby step but a necessary one for beginning any serious program of coping with the future.

There are still plenty of natural resources in the world, but the day is now past when we can simply draw them down and use them without economizing or working for efficiency. The world economy since the Age of Discovery has found new areas, rapidly used their forests, waters, soils, and minerals, and gone on to the next area that could be conquered or colonialized. There is now no land left unclaimed or easily conquered, in spite of attempts by some crowded Asian countries to buy large tracts of Africa. The world economy simply has to change to one based on efficiency and good management. Yet the great agencies, such as the World Bank, International Monetary Fund, and World Trade Organization, are still too often devoted to mass-drawdown, mass-throughput economies. Suggested cures range from abolishing capitalism to setting it free of subsidies and controls, and from going back to organic farming to going on to a new, far more technological farming. These cures are discussed and evaluated—to some extent—in the present book, but we really do not know the ideal mix. What we do know is that the destruction of world water, soil, forests, fisheries, and biodiversity *must stop now*.

The world has faced many challenges before, and people have always coped—sooner or later. However, in many cases the coping was very late indeed, and the disasters on the way were appalling. One thinks of the fall of the Roman Empire in the West, the collapse of central Maya civilization in the 800s CE, the collapse of China in the 200s CE and again in the 900s CE, and the bubonic plague epidemics that ravaged the Western world in the medieval and Renaissance periods.

Such things are wholly preventable today. We know what is wrong and, in general, how to stop it. The treaties and technology are there.

Much of the problem is due to the economic decline—which, for billions of people, began long before 2008. Decline leads to increasing fear and stress. Those who deal with it by joining forces to attack other groups become more visible and usually succeed in the short run.

The purpose of this book is not to push any particular political agenda. We simply do not know enough to prescribe a perfect political-economic formula. Those who promote either socialism or capitalism as the answer to all problems do so in the absence of evidence. The one thing that emerges clearly from the historical record is that absolutist and totalitarian governments always fail to provide adequate food. But many governments of all political stripes have also failed. Grassroots efforts have better success records but are not a cure-all. Anyone committed to solving the world food problem must be skeptical and agnostic about political and economic solutions until further evidence comes in.

The response of the continental European nations to the last world depression, in the 1930s, was a mix of totalitarianism, corporate power, and bigotry: fascism. If the current economic doldrums worsen again and produce a real depression, we may expect the same on a worldwide scale; too many nations are already well along the path.

If, however, the world economy continues to grow, slowly but surely, we may be able to seize the opportunity to rebuild world food production capacity and potential. This would involve saving resources, helping small-scale and middle-scale farmers as well as (or even instead of) large operators, and greatly improving storage and distribution so that food gets to humans rather than being lost to rot and rodents. It would involve greatly broadening the genetic base of our crops, to avoid the dangers and problems of a world food system based on only a handful of varieties of a handful of species. It would involve much more research on food safety and on the problems of obesity and diabetes. Above all, it would involve retargeting world food policy, including research, to benefit the wide mass of humanity.

As the economy recovers, the need is to look pragmatically and open-mindedly at what can actually help feed the world better. Too many grand political-economic plans and programs have failed. Efforts need to go into serious research, development, and education, not only in food production but also in finding out what policies are actually effective in fighting poverty, changing food habits, and raising hopes and dreams of a better future.

E. N. ANDERSON, 2012

> Only those who can appreciate the least palatable of vegetable roots know the meaning of life.
> —*Hung Tzu-ch'eng, A Chinese Garden of Serenity (1959 [sixteenth century])*

1 OBLIGATORY OMNIVORES

Omnivore Origins

The long and circumstantial story of human evolution explains why we need, and want, so much variety in our diets. It explains why we crave sugar and fat. It explains specific nutritional needs: vitamin C from our fruit-eating heritage, protein in quantity because of our large size, active life, and long history of eating not only meat but also high-nutrient plant foods like beans.

It does not explain the specifics of human diets. In fact, it explains why there *are* no such specifics. Humans have been selected for three key things:

- the ability to live on anything we can bite (with our relatively small teeth);
- the ability to learn, reason, and plan; and
- social life, including conformity to local group ways.

Thanks to that complex of abilities and faculties, we can figure out how to leach poisons from nuts, how to cook down sinews to make them edible, how to mash bones and boil them for marrow, and, ultimately, how to grow, process, and distribute the thousands of domestic crops. A particularly interesting accomplishment, considering it was done thousands of years ago, was the domestication of life forms we could not even see: the yeasts and bacteria that are now necessary for making bread, beer, wine, and other common foods.

Humans are fond of ascribing their success in populating the world to their great intelligence. At least some of the credit is due to our adaptable guts. Humans manage on almost anything. The Inuit lived until recently on seal and whale meat. The staple food of Roti, in Indonesia, is palm sugar (Fox 1977). Termites are vital to survival in central Africa. Salmon provided perhaps 80% of the food of the native nations of northwestern North America. And Americans today subsist on food so indigestible that American zoos have had to prevent visitors from feeding the animals; the junk foods that zoos sell to people can be fatal to the other zoo inmates (as explained by warning signs at the San Diego Zoo).

Withal, we cannot compete with true specialists in surviving on one thing. Unlike the koala, we cannot digest eucalyptus leaves. Unlike the cat, we cannot live on mice. We do not have squirrels' internal enzyme laboratory, which lets them devour mushrooms fatal to us and to most other mammals. We cannot even fall back on grass, as horses do. Our eating apparatus, so ready to adapt to new and strange foods, cannot deal effectively with such common matters as cellulose, tannins, or large bones. We usually eat only relatively soft, chemically simple items.

We come from a long line of primate generalists. Our ape ancestors lived in Africa, a land of dramatic contrasts. Not only does it have lush rain forests, glacial mountains, vast swamps, parched deserts, and game-rich savannahs, it often has them all in the same area (O'Brien and Peters 1999). In parts of East Africa, a highly mobile hominid could visit all five of those habitats within a few days. When I first visited Africa, I expected vast sun-baked plains and deserts, relieved in some areas by rain forests. But, especially in the Rift areas, I found an incredible variety of scenery packed into small areas. Any hominid, in a daily feeding range, would almost inevitably move through several habitats. Diverse habitats with much woodland, especially riparian habitats, are the most promising for human evolution (Bromage and Schrenk 1999; see esp. O'Brien and Peters 1999).

Some 6 or 8 MYA (million years ago), the common ancestor of chimpanzees and humans was living a sleepy, contented sort of life in the forests of Africa. We now have some skulls from this period, indicating that the human line may have branched from the chimpanzee-gorilla line by 7 MYA or somewhat later. This idyll was not to last. By 5 MYA, the continent was facing ever drier conditions. Lightning fires swept through droughty forests, creating vast openings. Grasses, previously humble members of the plant community, exploded in abundance. Tough and resilient, able to regrow from root stocks when grazed, these plants took over most of the continent in the next few million years. Either the drying up of the continent (Vrba et al. 1995) or the very change and diversity itself (Potts 1996), or both, selected apes that could live in diverse habitats and lifestyles.

Fossil evidence implies that humans evolved in mixed environments, with streamside forests, marshes, rocks, woodlands, and savannahs together; almost all the fossils come from riparian environments, though this is at least partly an accident of preservation.

Chimpanzees retreated with the forest, there to evolve into Rousseau's Savage—for his Savage was, in fact, the chimp (Rousseau 1983 [1782]:204–206). Rousseau saw these animals as powerful, wild, sociable, unencumbered by the trammels of civilization (and *not* "noble"; he did not use the word). So indeed they are. And, like most higher primates (Milton 2000a, 2000b, 2000c), they eat a diet far higher in vitamins and minerals—and also in odd and varied plant chemicals—than the diet of modern humans. Chimps live largely on fruits and leaves, and their intake of nutrients such as vitamin C is many times that of most of us. Their diet is rather insipid, except for bitter medicinal herbs they know and use, and a few sweets; like some humans, some chimps can't taste the bitter principle in cabbages (see Chapter 4; Nishida et al. 2000). They eat a little meat and hunt monkeys on occasion, but they are not well adapted to meat eating; a small amount of saturated fat sends their cholesterol levels very high (Mestel 2002:A20). Humans can eat more meat without this problem, especially when they are young; this is clearly an adaptation to a higher-meat diet. But humans, too, may form too much cholesterol when they eat too much saturated fat from animals.

Other apes of the original lineage began to adjust to drier conditions in East and South Africa. We have skeletons more than 4 million

One place it all began. Olduvai Gorge, Tanzania, where human remains reveal 2 million years of human evolution. Louis and Mary Leakey and their associates excavated here over many decades, finding a long sequence of hominids. The gorge is named for the abundance of sansevieria, called *olduvai* locally. It is an aloe-like plant that supplies a good, hard fiber from the leaves. Photo by E. N. Anderson, 1998.

years old now, from the Great Rift Valley, that vast fracture zone where Africa almost tore itself apart before giving up and opting (geologically) for unity. These skeletons—*Australopithecus* and its apparent ancestral form *Ardipithecus*—are ape-like: the animals were small (three or four feet tall), with limbs still adapted for tree climbing and brains the size of chimps'. Their bones and skulls are small and light. They ate a varied diet with seeds, meat, and other items. They too evidently got far more nutrients and phytochemicals in their diets than we do today.

Most interesting of all, their teeth are small and diverse. They do not have anything like the savage canine tusks of chimpanzees and gorillas. Their teeth, in fact, are very much like our own. The one striking difference (leaving aside certain technical obscurities) lies in the molars: Australopithecines (but not *Ardipithecus*) were basically grinders of vegetable matter. Their molars are large and millstone-like. Their tiny front teeth were adapted to nipping off vegetation, and not too much else; the work was in the back, where powerful jaws and strong, heavy teeth ground tough vegetable matter down. But the early Australopithecines were not very specialized as vegetarians either, and there is no doubt that they—like chimpanzees—ate small animals, eggs, termites and other insects, and any other animal food that couldn't defend itself. Tooth-wear patterns resemble those of chimps, indicating a similar diet (Unger and Sponheimer 2011).

Several species have been described for the Australopithecines, but there may have been, at first, only one slowly evolving lineage. Somewhat more than 2 MYA, this lineage branched in at least two directions. This process was presumably the result of continued climatic change in the direction of a drier and more variable climate. Once again, some authorities stress the "dry" side, some the "variable"; we do not know enough to decide which was more directly important, so the cautious researcher opts for both factors.

Australopithecine and early *Homo* fossils have been found largely in river valleys, where forests along the rivers alternate with marshes and lakes and where savannahs, deserts, rock cliffs, and mountains may all surround the river and marsh landscape. Lions, hyenas, hippopotami, antelopes, giraffes, and hundreds of smaller animals and birds abound. Wild figs, grass seeds, berries, oily palm fruits, and a wealth of edible roots and tubers can be reliable sources of food, but only if one follows a complex round, moving from resource to resource as ripening progresses. One of the Australopithecine species, *Australopithecus sediba*, turns out to have had a diet like that of modern foragers in the same area (southern Africa): leaves, fruit, probably small animals, but, at any rate, not much grass (Henry et al. 2012; Schoeninger 2012).

One branch of the Australopithecines grew larger, with thick skulls and enormous molar teeth. This "robust" branch, represented by *Australopithecus robustus* and *A.* (*robustus*) *boisei,* died out in a million years or so. Apparently, the robust Australopithecine line evolved to exploit the river-and-savannah plant world by eating more and more of it. They lived to process tough, resistant plant material, specializing in grass (Sponheimer et al. 2006; Unger and Sponheimer 2011). The idea of a grazing human seems a bit strange, but other australopithecines and even early *Homo* used a good deal of grass, possibly seeds. They made a good living at it for about a million years, but a combination of factors—progressive drying, fire, predators, and very possibly some hunting by *Homo*—finally wiped them out.

The other branch, which led to modern humanity, took the opposite path; presumably the process of "disruptive selection" was working here. Their molar teeth grew smaller, yet their bodies grew larger. By that time, the members of this branch were within the category we recognize as *Homo.* Several species have been described from around 2–3 MYA; whether these species are valid or merely members of one highly variable population remains to be determined.

After 1.7–1.8 MYA, as the third molars shrank, the brain suddenly began to grow, much faster than the body. There followed a sustained, spectacular increase that is without any known parallel in all geologic history. In a million and a half years, the brain increased in size by almost 400%. Such a rate of evolution is rare enough for any organ; for the nervous system, it is unique (according to present knowledge).

Moreover, the growth was not a mere expansion to keep up with the body. The whole brain expanded, but the real explosion occurred in the frontal lobes and a few other specialized structures. This, of course, is the system that gives us the fine-tuned complex of abilities that enables us to combine exceedingly involved social lives, highly adaptable and learning-based foraging, and, above all, especially in the orbitofrontal cortex, the integration of emotional drives with a sophisticated ability to weigh many factors in making decisions.[1] Social sensitivity, responsiveness, and engagement are mediated in the anterior cingulate cortex.

Robin Dunbar (1993, 1996) notes that social animals have larger brains than their non-social relatives. The larger and/or more complex the group, the larger the difference. Humans, with brains almost four times the size of chimps', would be expected to have social groups proportionately larger; Dunbar figures about 50–150 people. This is an educated guess, but it fits uncannily well with a number of estimates of the size of the typical face-to-face, intimate, manageable social group found among humans today. However, people also aggregate into much larger groups, numbering about 500 in Dunbar's calculation of early human life, but up to millions in modern times. This aggregation seems to rely on socialization by slightly older peers in early adolescence (Bowles and Gintis 2011; Boyd and Richerson 2005; Harris 1998; Richerson and Boyd 2005). Whoever gets to the teenager just breaking out of the family's tight grip—be it school, military, gang, or national service—tends to win a lifelong allegiance. This makes possible civil society, in the sense of some real identification with and responsibility toward a group much bigger than 50–150 close associates.

Our lineage evolved from the small-sized, small-brained *Homo* forms (*Homo habilis,* etc.) through the larger-sized and brainier *Homo erectus* to modern *Homo sapiens.* Various intermediate and transitional forms, as well as local side branches, have been dignified by other species names, but they seem to reflect minor variation. Most of the real action took place in *Homo erectus.* This is a "temporal species"; it evolved into *Homo sapiens.* It is, basically, a name given to that slice of human history in which the brain grew from 400 cubic centimeters (at most) to almost its modern size of 1,400 cubic centimeters. The same period saw the social group number increase from perhaps 20 to the above-mentioned 50–150 (or some comparable level).

The Result: A Hypersocial Omnivore

Brains are incredibly costly. The human nervous system makes up only 3% of body weight but uses fully 25% of basal metabolic calories. This means that (if one is completely resting) 25% of blood flow must go to the head, and that, in turn, means that 25% of heat loss is from the head (given the thin scalp), a reason for long, thick hair. Moreover, in conditions of stress, the brain is protected; it gets first call on the blood and the heat. As outdoorspeople proverbially say, "If your feet are cold, put on your hat"—because the head is draining the heat from the rest of the body.

A woman must provide enough milk not only to permit her baby to grow but also to permit it to develop this enormous, demanding brain. Human infants are born with very small brains (roughly the size of a chimp brain), since erect posture and a huge pelvic opening cannot go together in this world and a small pelvic opening means a small head. Therefore, most brain growth has to be outside the mother's body—to a degree otherwise found (in mammals) largely among carnivores. Rapid brain growth requires excellent maternal nutrition, typically a fairly high level of meat eating, around 20% or more. This is especially true since humans wean their young after only 2 or 3 years (as opposed to 4 or 5 for chimps). In a mammal, weaning from milk is possible only if the brain has grown to a certain point (Psouni et al. 2012), and only high-quality nutrition for the mother allows high-quality nutrition for the baby. Meat provides that, and carnivores are often born tiny, with small brains, thereafter growing fast, as is seen in dogs and cats. Rapid growth and fairly early weaning gave us an advantage over other apes.

Our fully erect posture and striding walk have other costs. A dog with a broken leg can manage on the other three. A human with a broken leg needs help. Being fully bipedal and depending on both running (probably newly evolved in *Homo*) and walking are developments that could occur only in a highly social species with mutual care. Our powerful running muscles give us terrific endurance. Our ability to sweat lets us dissipate heat fast. Thus we can run down animals (Noakes and Spedding 2012)—especially wounded ones.

Finally, there is the gut. Here we differ less from the chimps, who are rather similarly equipped. We have a moderate-sized stomach, a moderately long intestinal tube, and a digestive apparatus that can handle moderate but not overwhelming amounts of fats or proteins. By contrast, a true carnivore like a cat has a shorter, straighter, smoother intestinal array, while a true vegetarian like a koala or langur monkey has much longer, more convoluted intestines. Human intestines are closely comparable to those of other omnivores, such as swine. Nothing more clearly shows our omnivorous heritage (see Mann 1987; Navarrete et al. [2011] point out that we manage to support a big brain, a big gut, and often a big fat layer).

Noteworthy, also, is the ability of the human stomach to expand. Few mammals can eat more at a sitting than humans can. Today, this ability goes unappreciated except at seasonal feasts (such as Thanksgiving or Id al-Fitr), but in the old days it was vital. Humans could gorge when they had the chance and live off stored fat for days.

We probably evolved from an opportunistic vegetation eater that ate some animal food (*Australopithecus*) to an opportunistic specialist in high-nutrient foods: meat, eggs, shoots, tubers, nuts, seeds, honey (*Homo*). By 1.95 MYA, right at the *Australopithecus*/*Homo* border, people in Kenya were eating elephants, crocodiles, hippos, and fish—mostly scavenged (Braun et al. 2010). The early hominids would have been as adept as we are now at shifting from dead animals to starchy tubers to oily fruits, depending on what their range afforded them at the time.

The average human of 1 MYA probably lived largely on tender young plant material, got at least 10%–20% of calories from meat from hunting and scavenging, ate many insects and loved them, dug up roots and tubers during bad times, and gorged on anything and everything edible when a good patch was found. Most of the meat would have been from small animals, insects, and carrion. Five hundred thousand years later, more hunted game and fewer small animals would have been in the picture, and perhaps by then cooking was important, rendering available a vast range of roots, tubers, and seeds such as beans. Fifty thousand years ago, when modern *Homo sapiens* was established throughout most of the Old World, hunting was more important, but taming fire had probably made cooking-dependent plant foods even more so. Carrion, coarse shoots and leaves, small seeds, and the tougher insects were falling out of the picture. Various views and topics related to early human nutrition are well treated in various sources (see Ungar and Teaford 2002). Meat has been the focus of a superb collection of papers, *Meat-Eating and Human Evolution*, edited by Craig Stanford and Henry Bunn (2001), which greatly advances our understanding of carnivory among modern primates and ancient humans as well as among us moderns.

The shift to more meat, often credited with allowing brain expansion by providing high-quality food, has recently been confirmed from an odd direction: tapeworms (Hoberg et al. 2001; Shipman 2001). Human tapeworms are derived from those infesting hyenas, lions, jackals, and (more rarely) other scavenger/hunters of the African savannah. Their intermediate hosts there are wild pigs (including hippopotami, basically overgrown pigs) and antelopes. (Modern human populations are more apt to catch them from domestic pigs and cattle.) Apparently, humans became infested with these tapeworms at about the time that *Homo* appeared. The assumption is that this is the point at which people were eating enough meat regularly enough to keep the transmission links going.

There are three reasonable explanations for this pattern of development. First, the sudden change at 1.7–1.8 MYA could represent the invention of cooking and its use to tenderize a wide range of plant materials, such as tough tubers. This has been advocated by Richard Wrangham and others (Carmody et al. 2011; Wrangham 2009), but there is little evidence for it, and Pat Shipman (2009) points out that we really have looked enough to find evidence if there was very much out there. If hominids were using fire in a controlled way and on a large scale, they left astonishingly little record of it. There is now, however, burned bone from Wonderwerk Cave in South Africa, so deep in the cave that it could not be from a natural wildfire, and associated with tools of *Homo erectus* (or someone very similar; see Berna et al. 2012). So Wrangham's ideas look more plausible.

Second, the sudden change could represent the progressive addition of more meat to the diet, as humans became better at scavenging leopard and lion kills and hunting small animals (Blumenschine and Cavallo 1992). Recent research makes it seem likely that humans (like lions and hyenas) both scavenged and hunted. Stone tools were being made by this time and were being used to butcher animals. Tools begin to increase in sophistication and variety right around the 1.7 MYA date.

The problem with the hunter theory (at least its extreme forms) is that, as full-time carnivores, we are failures. We do not have the canine teeth or the shearing carnassial cheek teeth that a cat or dog has. We do not have claws or even much arm strength.

Moreover, we cannot live on lean meat (Cordain et al. 2000; Kelly 1995; Milton 2000b). For one thing, it is low in calories and hard to digest, thus providing real problems for an animal that has to run a brain that takes as many calories as is needed to run a good-sized dog. For another, our kidneys cannot handle the nitrogenous wastes produced by digesting it. They get overloaded, and if they do not fail, the heart fails through trying to push more and more blood through them. Too many people find this out too late during the recurrent fads for high-protein weight-loss diets. Even without those, one recent study found that people who eat red meat have about 13% higher death rates than those who do not (Brown 2012), though this may have more to do with preserved meat than with red meat in general. A minor bit of evidence is our ability to taste, and crave, sweets; specialized carnivores usually cannot taste sweetness (Jiang et al. 2012). Conversely, raw lean meat doesn't taste particularly strong or good. We like meat because we like the flavors of cooked meat and especially its fats.

Finally, humans need a great deal of vitamin C and other nutrients that are notably more abundant in plant foods than in meat. The early tools, though adequate for butchering, were not spectacularly good for hunting and were not good enough to be a fully adequate substitute for the lack of carnassial teeth; surely we would have evolved better if we had been carnivores. We are not "killer apes" or specialized meat eaters or hunters. It seems clear that the rise of *Homo* went with a rise in meat eating, but that seems almost a by-product of something else: a general improvement in overall foraging skills.

One reasonable theory of human dietary evolution is that the early hominids just became better and better at omnivory. They got better at finding meat, both by scavenging and by hunting, but also at finding roots, seeds, shoots, eggs, and anything else edible. Termites, for instance, were a resource; they are large and abundant in Africa and are still a popular food. Stone tools from 1.8 MYA, in South Africa, show marks attributed to their use in breaking into termite mounds ("Dinner in a Mound" 2001). The only way an animal with a huge, demanding brain can survive is by using the brain to figure out how to draw on a wide range of good foods to get the most nutrition with the least effort. No doubt, early hominids were beginning to understand the art of comparing a dead elephant 5 miles off with a patch of seeds only 1 mile off. How big an elephant balanced out how many seeds? When was it worth the extra 4 miles?

There is every reason to believe that this sort of foraging ability—"optimal foraging"—entailed another skill: the ability to fine-tune a social foraging plan. This is the skill that led, much later, to the rise of modern civilization. A large social group can scatter out all over the landscape. When one member finds a rich patch of food, he or she can summon the others. Surely this was one way language developed: to make it possible to explain ever more clearly what food was available when and how many people it would feed.

The larger the brain, and the larger the social group, the larger and richer the patches had to be. It takes a very large and rich patch indeed to feed a whole group with brains all burning several hundred calories a day. Moreover, the robust Australopithecines (and other animals) had already sewn up another potentially possible lifestyle: individual foraging for small, numerous, widely dispersed patches of food. The robust Australopithecines ate grass, roots, nuts, and other tough plant matter, wandering the savannahs or woodlands in search of coarse vegetation. Such foraging for large volumes of low-value food does not encourage large social groups. Selection will not produce or maintain a big brain on such a regime.

Early *Homo*, by contrast, would scatter over the landscape in hopes of finding a dead elephant, a fruiting tree, or a termite nest swarming with the highly nutritious winged forms. Most important of all would have been areas recently cleared by fire or flood. Adriaan Kortlandt (1978) argued especially for recent rains and floods; I believe fire was more important. Flooded and burned areas regrow rapidly with tender young vegetation and are often selectively colonized by berry bushes. (The berry is a fruit type adapted to dispersal by birds and animals and is often developed by plants that need to disperse from burn to burn.) Moreover, recent burns and other regrowing habitats attract animals, both small and large, and are thus ideal hunting spots; in fact, most hunting peoples selectively burn tracts of land for this reason. Regrowing burns and floodplains concentrate, in one place, all a human needs: tender young leaves, berries, roots, and vulnerable game animals. This would be a rich patch indeed, and no sane human would neglect any one resource to go after another. Concentrating on either meat or plant foods would be suicidally foolish. People would go through the habitat eating anything they could bite or swallow. Their watchword would have been the one we used to say (when hungry enough) in Texas: "I'll eat anything that won't eat back faster."

Fire must have been an important part of the adaptation. Initially, people would have followed wildfires, but with increasing intelligence they learned to set their own. It seems almost certain that fire was first used not for warmth or for cooking but for burning brush to open hunting grounds. Fire drives game, eliminates thorns and brush, kills poisonous snakes, and generally makes the country better for people. Above all, it creates new burns that quickly regrow with berries, beans, tender shoots, and other things people want to eat. It is easy to start. Therefore, all hunting and gathering peoples use fire on a large scale, except those in environments that are almost impossible to burn. Campfires and cooking fires require special knowledge and a great deal of care and control; such knowledge was probably learned through starting wildfires. Fire thus became the first tool of environmental management. It still is the most important one—either directly, or controlled within an internal combustion engine. In short, humans evolved as fire followers, then fire makers. Burning and cooking were critical to our development.

Planning for a social group's daily foraging fine-tuned our skills in complex rational thought. Such skills could easily and naturally be put to use in developing storage, food-processing, and even environmental-management plans. Burning and other manipulations trained humans in conservation and scheduling of resource use, and thence, ultimately, came agriculture. From such things as planning to leave a resource for later, so as to get a more perishable one today, humans developed concepts of storage. From the task of bringing foods to a central area, where less mobile members of the group were waiting, humans developed the systems of distribution and reallocation that later became "economics." Some processing—crushing bones, cutting up meat, leaching bitterness from nuts, grinding seeds, mashing tough plant material—must have taken place in such central areas. Increasing sophistication in these is obvious over the long-term archeological record. Possible stone tool use in cutting up animals is attested far back in the *Australopithecus* record, perhaps to 3.4 MYA (McPherron et al. 2010), and is certain throughout the record of *Homo*.

Cooking, as noted above, renders tough tubers digestible. Starches like inulin—very common in tubers, and virtually indigestible to humans—are broken down, by prolonged cooking, into sugars that we can digest. But this is not all (Wrangham 2009). Cooking also breaks down tendons and muscle fibers. It detoxifies many foods—or compounds in foods—that are poisonous in the raw. It softens all manner of stems, leaves, and fruits. It opens the shells of mollusks. It kills bacteria and molds that would otherwise cause disease.

Claude Lévi-Strauss (1964) pointed out that many South American native peoples see cooking as the invention that made humans human. After all, ants and bees have societies; parrots and other animals can learn to talk. Clothing, the invention that got Adam and Eve out of Eden, was not an issue to these tropical forest dwellers, who wore virtually nothing. Only cooking distinguished human persons from non-human animals.

The modern ecologist has to agree with Levi-Strauss's South Americans. Of all the inventions of the human animal, fire and its use in producing and processing food has been the most important—the one that changed our lives most and brought us irrevocably into a new and different world. It may have been one of the major factors behind the final stages of human brain evolution.

There has recently been a minor fad for the "paleolithic diet," variously defined. The real paleolithic diet was anything but uniform. It did, however, have some common traits that are clearly different from modern industrial eating. First, the amount of vitamins and minerals in a day's food was quite considerable; eating a varied diet of natural foods guaranteed at least the equivalent of a modern multivitamin supplement, and often more. Second, the protein was lean and very often high in omega-3 fatty acids (see Chapter 2). Third, simple sugars were rare, and highly processed carbohydrates non-existent; this meant that everything took a lot of digestion—a lot of energy, time, and gut activity, with consequent effects (probably very good effects) on gut bacteria. Fourth, drugs like caffeine, alcohol, and mind-altering substances were rare to unknown. Fifth, people had to chew hard, developing better teeth and jaws. Sixth, and more important than any of the others, is that the diet took work. Humans had to walk or run all over the territory looking for it, subduing it if necessary, and carrying it back to camp if it was worth sharing. It took calories—a lot of them—to get calories. This forced serious rational choices, as well as good healthful exercise. It forced planning for social sharing if there was a windfall. It led to shared, widely distributed knowledge of everything about the local environment—particularly how any plants and animals could be used, not only for food but for making tools and other purposes. Humans learned to hunt with wolves, watch ravens for signs of meat, know the habits of deer and leopards. Paleolithic life required an exquisite knowledge and an ability to think, decide, and adapt with extreme speed and precision.

Social Foraging and Social Evolution

The importance of social, omnivorous foraging was first stressed by Glynn Isaac in the 1970s (Isaac 1978, 1979; cf. Lovejoy 1981). He theorized that early hominids brought food back to a "base camp," a relatively permanent and stable inhabited site. There is, however, no need to imagine such a specific scenario. Groups could also have roamed at will, reassembling at night and planning where to move next. No doubt such discussions helped in the evolution of language. Groups that could be more specific and detailed about planning routes and routines might have grown faster and spun off more descendants. Eventually, we arrived at a world in which thousands of people can get together in social groups and enjoy it thoroughly—a world in which food is traded worldwide.

The evolution of sociability in the human line parallels the evolution of social life among canines, crows and jays, bee eaters, geese, and other lineages. Typically, in these groups, the less social species forage for widely distributed resources in more or less homogenous environments while the more socially complex species live in harsh or unpredictable environments where food tends to occur in big clumps or patches. It is somewhat thought provoking that this is especially true of those social animals that have strong, long-term pair bonds between mated pairs. Contrary to some claims in the literature, humans are normally pair-bonded animals,[2] though they can be otherwise with ease. The conventional wisdom, since Darwin and even before, has been that pair bonding is largely about raising young in situations where a single parent cannot reliably find enough food while also protecting the young. An animal that must feed a fast-growing brain and protect a young one for 15 years or so is obviously a good candidate for pair bonding.

Most non-primate social mammals are carnivores, and to find a highly social omnivore to compare with humans, we may go to the corvids—jays and crows. Perhaps the huge social groups characteristic of humans arose the way they have in jays and crows: by aggregation of family units. Early Australopithecines presumably lived in smallish groups, consisting of a small core of closely related males or females and their mates and young. The larger the group, the more it could forage for rich patches, defend itself, and share skills and knowledge (in child rearing as well as foraging). Small kin groups developed more and more ability to clump together into larger aggregations when food afforded. Chimpanzees do this; they may have evolved it independently or may retain an ancestral condition shared with the human line. Eventually, people evolved enough social skills to allow them to aggregate into huge social groups that included many non-kin. Apparently, females traveled from parent group to mate's group, unlike the situation in many primates.

Group living on a large scale required evolving true sociability: the friendliness, generosity, openness, and trust that we extend even to strangers. It would also require evolving an ability to deal with "cheaters," deadbeats, aggressive individuals, psychopaths, and other hard cases. In general, humans are trusting and friendly to strangers but quick to turn against any stranger that does not reciprocate. Humans are even quicker to turn against any member of their own group that does not play by the rules! (The ways this could lead to a highly developed moral sense have been the subject of speculation; e.g., see Cronk [1999] and Petrinovitch [1995]. More recent speculations have the benefit of better models and experimental evidence; notable reviews of the evolution of morality includes Bowles and Gintis [2011], Boyd and Richerson [2005], and Gintis et al. [2005]. Bowles and Gintis stress the role of group defense and aggression.)

Humans show the kin-based roots of sociability and morality in a number of ways. Human traits such as collective defense, generosity, and constant gossip (cf. Dunbar 1993, 1996) make good sense in the context of a family, or even a small group. They are not necessarily so rational when groups become large and kin ties become weak. Thus humans invoke family metaphors in teaching morality: "All men are brothers," "the sisterhood of women," "the human family," and so on. Conversely, humans work hard to distance or dehumanize hated enemies (Staub 1989).

Particularly interesting, and relevant to food, is the tendency of humans to conform to the behavioral norms set by senior or more powerful members of the group. This makes excellent sense when it is a case of children imitating parents. It is less sensible when it is a case of subjects imitating rulers. It is irrational when it is a whole nation imitating media stars.

Language seems especially adapted to communication about social matters, as Robin Dunbar has persuasively argued. Among other things, he has shown that most conversation today is about face-to-face social issues—gossip, in short. The need for such complex social fine-tuning would have increased with group size, brain size, and the need to forage widely for high-quality foods. It is sometimes alleged, by linguists, that language must have been "invented" at some recent point in the past. This is clearly not the case.[3] The human lips, tongue, vocal cords, and throat are massively altered (compared to other hominids) to allow complex linguistic production, and the human brain has specific centers for language processing (though they are also useful for some other purposes and evidently arose from simpler and less tightly entailed structures). These are all enormously different from anything a chimpanzee has and bespeak a very long period of very active evolution. Human communication took a long time to reach its present level of complexity, and the change was gradual. Social foraging had much to do with that—though social problems such as finding a mate must have been major factors as well. Language is clearly a phenomenon of large groups; it is vastly overadequate for anything a family really needs. It is also tightly tied, through recursion (nesting clauses and the like), to long-range complex planning. Nothing close is known among apes; the nearest parallel is bird song, which also involves considerable learning in group contexts (Kroodsma 2005; Marler and Slabbekoorn 2004). However, bird song communicates a limited range of messages to a small local community; language is designed to do more.

Many writers over time—most recently sociobiologists and some evolutionary psychologists—have alleged that we are now city dwellers with cave-dweller instincts. However—leaving aside the fact that people have very rarely lived in caves—it is obvious from the record that humans evolved not to be "cave dwellers" but to be adaptable, flexible, and quick to learn. Our genes allowed Einstein to develop his theories and Edison his inventions. Our ways of loving, worshiping, and—of course—eating are just as far from the Australopithecine condition as our math and electric systems are. We evolved to keep looking, as creatively as possible, for the next good place. That is the human story.

Social and Kin Selection

The degree of human sociability remains truly astonishing. Darwinian theory predicts that we will prefer close relatives to others. Evolution is based on a tautology: the genes that leave the most descendants leave the most descendants. "Fitness" is measured by how many of one's genes are actually passed on. All the excitement lies in just how the fitness is maximized.

Obviously, it is best maximized by raising a lot of children. However, it is also maximized by helping one's gene-sharing blood relatives raise children—so long as that does not come out of one's own children's hides. The unmarried aunt who helps all her sisters and brothers raise their children is thus doing her own genes a favor. Commoner than unmarried aunts, and equally useful evolutionarily, is the constant trading of favors that goes on within families: mutual babysitting, food sharing, resource loaning.

An individual should therefore sacrifice himself or herself for his or her children, if they are old enough not to need that individual's care. An individual should also theoretically be prepared to sacrifice self for a large set of brothers and cousins. One's sibling shares half one's genes, so, in an ideal Darwinian situation, a childless person who can save three siblings by sacrificing his or her life certainly should do it. In the real world, choices are seldom so simple, but people do regularly die for their families. The more closely related they are, the more they are ready to sacrifice time, effort, or even life for each other.

This allows us to speak of *kin selection,* a shorthand way of saying that kin can often maximize everyone's Darwinian fitness by sticking together and helping with the total gene pool. Kin selection can build on itself and lead to quite incredible levels of altruism by a kind of bootstrapping—even in amoebas, let alone humans. A wonderful book by Andrew Bourke, *Principles of Social Evolution* (2011), discusses this process in comparative detail. Women helping not only children, but also grandchildren and grandnieces and grandnephews and anyone else available, can make a major selective difference (Hill and Hurtado 2012).

Yet people also regularly sacrifice themselves for perfect strangers and even for abstractions like religion and the flag. They even jump into icy rivers to save strangers' pet dogs. Similarly, although stepparents are far more likely to abuse their stepchildren than biological parents are likely to abuse their own young (Daly and Wilson 1999), the vast majority of stepparents and adopting parents take perfectly good care of their stepchildren. The "cruel stepmother" is common enough to be a stock figure of folktales, but she is not a majority case. Why are we so fond of adopting or stepparenting children to whom we are not close kin? Why do we usually treat them as well as we treat our genetic descendants?

Perhaps one reason (not very satisfying to a hard-core selectionist) is that we actually share over 99% of our genes with all our fellow humans; the human species is an exceptionally uniform one, with astonishingly little genetic variation. Geneticists calculate that we went through a genetic bottleneck about 100,000–150,000 years ago. This is often phrased as descent from a single "mitochondrial Eve" in southern Africa, but actually it means we descend from a small founder population, or populations, that may have been very widely dispersed. In any case, the result is that we are so close to other humans that sacrificing oneself to save a lot of strangers is not at all foolish from the point of view of inclusive fitness.

Also, it is almost certain that, over time, many fairly sizable groups fought it out or competed, with the more solidary being more successful. Darwin made this point, and it has recently been modeled convincingly by Samuel Bowles (see Bowles 2006; Bowles and Gintis 2011). This might lead to a form of "group selection" (Sober and Wilson 1999). Yet, contrary to the impression one gets from some literature, out-competing and killing one's fellow humans is not always a good way of maximizing fitness. Nature is not particularly "red in tooth and claw," and "survival of the fittest" does not mean a dogfight. The trouble with fighting is that many of the fighters get killed. Moreover, while the tougher members of the species are out there fighting and dying, there are other, less tough individuals staying home "making love not war." When that happens, it is pretty obvious who will leave more descendants and thus win the selection sweepstakes. And once cooperation is established, its benefits make altruism, exclusion of outsiders, sanctioning of unfair or cheating behavior (often by ostracism), and other core bits of morality all feasible and beneficial—so long as the group holds together and the whole process allows more rearing of children by related families (see, e.g., Boehm 2012; Boyd and Mathew 2007; Boyd and Richerson 2005). Immediate, contingent changes for immediate selective reasons can thus change the whole context of selection, making much more basic changes in the evolutionary situation (Laland et al. 2011).

Humans are not the most peaceful of animals, but they do not deserve the frantic exaggeration of their violent nature in books with titles like *Demonic Males* (Wrangham and Peterson 1996; see the devastating review by Dolhinow [1999]). Social behavior is beneficial for allowing individuals—or, more accurately, for individual genes and genetic lines—to continue. This causes a paradox—why doesn't everyone cheat? There are many answers, including a supposed skill at detecting and stopping cheaters (see, e.g., Atran 2002; Cronk 1999). People, and even chimps, are fair at "cheater detection," but con artists still make a good living. Suffice it to say that cheating stays uncommon enough to allow social life to exist, in crows as in humans, but common enough to make it profitable for some individuals to send out millions of spam messages a day.

A separate point is that malnutrition and disease (infectious or degenerative) are, and probably always have been, the major causes of death in humans—especially children, who are thus removed from the breeding pool before they have a chance to pass their genes on. Thus they are the major selective forces acting on humanity. This is far too often forgotten.

In all this, there lies a most valuable lesson. Recently, a host of authors, some competent, most not, have rushed to tell us that genes are destiny—that we are the slaves of our "selfish genes" (Dawkins 1976),[4] which force us to carry out countless highly specific behaviors. We have also heard that genetics, not parenting, determines child behavior (see Harris [1996], who, in fairness, adds peer-group influence), and there are still a few racists maintaining long-disproved theories of biological difference. Also, the media speaks of "fat genes," genes for conservatism, and other such entities. Without going into a long digression, suffice it to say that genetics is never that specific. Genes control a great deal, but they do not rigidly entail whole classes of behavior (see, e.g., Marks 2010).

Nowhere are genes more genuinely determinative than in nutrition. Unlike "IQ" (whatever it is) and aggressive behavior, our body's needs for iron, vitamin B1, and lysine are really genetically given and under tight genetic control. Our tastes, too, are heavily influenced by genetics, as we shall see; fat and sugar are just the beginning.

Yet, individuals vary enormously in their needs (Mielke et al. 2006; Williams 1956). Close relatives are closer in body chemistry, of course, but even newborn identical twins differ slightly because of differences in the womb environment. Also, the human body, adaptable as always, can adjust to great differences in nutrient intake. Not only is ordinary adaptation involved; we now know a good deal about "epigenetics," the study of how genes are turned on or turned off (or partially turned off) by experience. This is true in nutrition as in other areas. Nutritional stress in the womb, and probably in early childhood, can turn on genes for using nutrients more efficiently, which can lead to stronger children but also to fatter ones.

In north China and south India, poor people had until recently no easily available sources of vitamin C, at least during winter, yet they survived (see Anderson [1990] for the Chinese case). They seem to have developed a very C-sparing physiology. (Many animals that cannot synthesize vitamin C still maintain appropriate levels of it in spite of eating very little of it; see Hughes 2000:757). Conversely, devotees of "megadosing" with vitamin C seem not to be gaining much benefit from these higher doses (see summary by Hughes 2000:760); apparently the body adapts in that direction, too. Similar, if less spectacular, adjustments are recorded for protein, fats, and other nutrients.

The same is true for behavior. Capacity for aggression is innate, but actual aggression depends on situations and decisions about them. Intellectual ability, even insofar as genetically specified, does not determine one's survival or even one's welfare; many a genius goes through life unnoticed, and many a fool has posed for a great mind. No one lives long without food. No one can choose to do without vitamin B1. No cultural construction or social convention can decouple iron deficiency from anemia.

The problems with the genetic-determinist theories are simple.

First, and *critically important: genes do not specify final results; they guide development.* They are packets of information, and what they code is not behavior or even physical appearance but the assembly of proteins. They guide the body's patient construction of enzymes and fibers and neurohumors from stray bits of carbohydrate and amino acid. They guide the assembling of molecules into cells and cells into final systems.[5]

Second, in humans, genes usually code for flexibility—for an ability to develop along alternative channels. They code for a body that can adapt to many environments and a brain that can learn, plan, revise, and change. The genes code for specific types of growth and change in specific neurochemicals and neural linkages. When we have employed our genetically given ability to make the transmission of certain molecules easier and easier along one pathway, while harder and harder along another, we have learned something.

To be sure, there are certain behaviors that are very tightly specified. A human cannot keep his or her eyes open while sneezing, or stop breathing for more than a few minutes. One cannot stop one's heart at will. So the genes can do hardwiring when they have to. However, it isn't the human way.

Genes make it easy for us to learn certain things—languages, faces, maps—while other things are much more difficult to learn. It is easier for a computer (one with no built-in biases) to multiply billions of million-digit numbers than for it to recognize a face after several years' worth of changes. Yet humans find the latter a trivial chore. Hunters and gatherers think nothing of following a complicated route for miles, after rain and vegetation growth have totally changed the appearance of the landscape.

Sharing may have evolved as a reproductive strategy. Giving out food has the useful spin-off that food can be, and often is, exchanged for sex. Of course, this is a sure way to make Darwinian selection go into overdrive. Among the Ache of Paraguay, the best hunters leave the most children. Many of those children are by women married to someone else. No one has stepped forward to replicate this study in the elite restaurants of Paris or Beverly Hills—but only because no one needs to.

A million years of this, and we find humans who are self-sacrificing, generous, and fond of starting soup kitchens and food banks.

Nowhere are we more prone to give than when there is food to share. I have walked in, as a perfect stranger, to countless hungry households in odd corners of the world, only to be offered the best in the house and welcome.

Our social feeding is not entirely unique. Wolves manage some degree of social feeding, though with a rigid dominance hierarchy. Chimpanzees eat socially and even have some concept of "eating"—socially—versus mere "feeding" (de Waal 1996). Closest, perhaps, are the acorn woodpeckers studied by Walter Koenig (Koenig, personal communication, 1997; Koenig and Mumme 1987). Large groups of these birds cooperate in storing acorns and sharing them out. They also cooperate in raising each other's young, using the acorns as a back-up food resource for themselves. Like humans, they plan ahead and conserve, drilling pits far in advance and then storing acorns in them for up to years at a time. Like humans, they share with open-hearted generosity and cooperate to drive off thieves; I recently watched my neighborhood flock frantically working together to salvage acorns from a blown-down storage site. Like humans, they are fond of competing noisily with each other over trivial social matters, such as who gets the favored perch. Koenig showed that this all arose from straightforward kin selection.

People dying of starvation tend to become selfish toward the very end. A harrowing account of this is given by Colin Turnbull in *The Mountain People* (1972). At first Turnbull thought the behavior of the Ik was cultural, but he later learned of Ancel Keyes's experiments with conscientious-objector volunteers during the Second World War, and other treatments, which show that people normally respond this way to extreme famine (C. Turnbull, personal communication, 1975).

The most thought-provoking thing here takes us back to genetics. It appears that our genes really do "tell" us to get selfish when things are desperate. In that case, it follows that they are telling us to be unselfish and generous the rest of the time. Surely, this would make old Ryokan laugh.

People are *really different*. The extreme selfish-gene theories of Dawkins, Wrangham, and others predict the behavior of mountain lions, eagles, and cheetahs but cannot possibly predict the behavior of humans. These sociobiologists can explain why people often act like rats, but they cannot explain why people sometimes act like humans.

Optimal Foraging

It is the group that forages most successfully, not the one that fights most successfully, that is in the best position to raise the most children.

This perception gives us "optimal foraging theory." Individuals are expected to forage optimally, that is, to find the most calories or (better) the most adequate overall diet for the least effort.

There have been countless tests of this theory among non-human animals, and—to make a long and fascinating story short—most of them forage more or less optimally. It is amazing to watch warblers or flycatchers adjusting their insect-hunting behavior to circumstances. They can take account of competition, of newly available resources, and of shortages. Even more amazing is the performance of some small wasps that lay their eggs on caterpillars, which the wasp larvae then slowly eat from within. The female wasp can assess the size of the caterpillar, calculate exactly how many larvae it will support, and then lay exactly that number of eggs—all female except one, so there will always be one and only one male per brood (Hannah Nadel, personal communication, 1982). Other primates, too, are superb choosers of the best foods and the best routes to the best sources of the best foods (Milton 2000a, 2000b).

Indeed, hunters and gatherers do forage fairly optimally (Kelly 1995; Smith 1991; Smith and Winterhalder 1992). Given that they need, and prefer fat, and that they have other pressing concerns (mates to keep, children to protect, lions to avoid . . .), they forage very efficiently indeed (cf. the important exchange on optimal foraging theory between Hawkes [1993] and Hill and Kaplan [1993]). Close studies of surviving hunter-gatherer groups in remote environments, such as the Hadza and San of Africa and the Ache of Paraguay (Gurven 2006; Gurven and Hill 2009), reveal that actual foraging comes close to computer models of optimum regimes. By and large, they get the most calories for the least effort, and they get all the nutrients they need, making special provision for those that are not more or less automatically obtained by eating a balanced diet. (The conclusions are rendered somewhat tentative by the fact that all these peoples have, and have long had, extensive contact with agricultural groups and get some weapons and/or food therefrom. The Ache were once agricultural themselves and still trade with farmers.)

Fat is often the most problematic of these. The Ache of Paraguay, who are otherwise among the classic "optimal foragers," display an inordinate fondness for armadillos, largely because these animals are fat and animal fats are not easy to come by in the Chaco. Recall that those successful armadillo hunters leave a disproportionate share of genes.

Eric A. Smith (1991) showed that the Inuit of Hudson Bay usually hunt in such a way that they expend minimal effort and resources for maximum yield of meat, except that they prefer sea mammals to fish, at least in part because the sea mammals are fat. They thus tend to miss fishing opportunities that would provide more calories (but not more fat) per unit of effort than the sea mammals. But there is more: by reworking some of Smith's data, one finds that the Inuit he studied could have done even better by staying home, making crafts for sale, and buying food with the money—not hunting at all. The lure of the hunt seems to have been "irrational" but compelling. Of course the store-bought food would not have been so nutritious, so perhaps the hunters were right to ignore it.

Hunters and gatherers can usually assume that any batch of foods they can find will be a reasonably balanced diet. They are foraging on nutrient-rich items: berries, small animals, nuts. Optimal foraging breaks down as agriculture becomes intensive. Plants make starch easily, and farmers find it easiest to grow starchy and low-nutrient foods like maize and potatoes. They may know how to eat to stay optimally nourished, but they can rarely afford the foodstuffs. Optimal foraging for sheer calories becomes more and more distant from, and even antithetical to, foraging for optimal nutrition.

Modern hunter-gatherers vary enormously in their diet. In the high Arctic and Subarctic, they live almost entirely on meat, since there is not much else to find; this means they have to get much fat, since lean meat is not a viable diet by itself (Cordain et al. 2000). In inland California and the Great Basin, they lived largely on seeds and tubers. In the pre-agricultural Netherlands, they had a diet based on salmon, deer, eels, shellfish, hazelnuts, and berries (C. Meiklejohn, personal communication, 1978)—an enviable diet indeed. The !Kung San of the Kalahari, until recently, lived largely on mongongo nuts (*Schinziophyton rautanenii,* rather similar to hazelnuts or macadamia nuts). When anthropologist Richard Lee asked them why they didn't farm, a man named Xashe answered: "Why should we plant, when there are so many mongongos in the world?" (Lee 1973:307). Australian aborigines lived on a wide variety of wild plant foods. People are versatile animals and have always been (see Kelly 1995). There is a clear trend, long known in anthropology, from almost entirely animal foods in high latitudes down to overwhelming dependence on plant foods in low latitudes, especially in dry areas where animals are few (Keeley 1998; Kelly 1995). An exception are rain forests, which are similar to subarctic forests in that most of the plant biomass is tied up in wood, and people have to hunt; but rain forests are such poor habitats for hunter-gatherers that doubt has been cast on whether they were inhabited at all in pre-agricultural times (Bailey et al. 1989). Keeley (1998) points out that latitude, and plant-rich habitat in general, account for most of the variance, as opposed to population pressure or cultural preference.[6]

Most recent authorities believe that the vast majority of hunter-gatherers in the past lived largely on plant foods or, locally, on fish and shellfish. The ethnographic record might seem to suggest otherwise (Cordain et al. 2000; Kelly 1995), but that is because ethnographies have overemphasized hunting. In particular, hunting is overemphasized in the work summarized in the Human Relations Area Files, a huge compendium of ethnographic records of human cultures. This is partly because of the natural bias of male ethnographers in the Indiana Jones era of anthropology. It is also partly because many of the surviving hunter-gatherer cultures were in refuge areas where crop plant growth was too poor to tempt settled farmers: the Subarctic, the High Plains, the South American Chaco and Pampas, the Australian deserts.

Also, many contemporary hunter-gatherers are not actually independent and self-reliant societies; rather, they are specialized meat suppliers to settled agricultural peoples. This accounts for the heavy meat harvest of the Mbutu of Africa, the Agta of the Philippines, and other groups. These peoples live not so much by hunting for food as by hunting for meat to trade for agricultural staples. Even the San of southern Africa, the prototypic hunter-gatherers of anthropology textbooks, were in contact with agricultural peoples and often traded extensively with them (Wilmsen and Denbow 1990; cf. Headland and Reid [1989] and Solway and Lee [1990] for balanced views of the whole issue).

Finally, there are outright errors in many published sources (especially those based on the Human Relations Area Files material), and they seem to be systematically pro-meat—that male bias again. For instance, Kelly (1995:66) estimates that the Haida of the Queen Charlotte Islands (now Haida Gwaii) of British Columbia obtained 20% of their food from hunting land animals and 60% from fishing (the rest from gathering plants). I have worked with the Haida there and can testify that this is flatly impossible. Before deer were introduced around 1900, there were no large animals on the Charlottes except a few bears (large and dangerous) and a tiny (now extinct) relict population of caribou. The population of the Haida, however, was high, at least 8,000 people. They could not possibly have gotten even 10% of their food from meat. In fact, they lived almost entirely on fish. Similar if less extreme overweighting of land-animal meat is evident in all the

Northwest Coast societies in Kelly's sample. His estimates of the role of animal food in California Indian diets also seem far too high.[7]

Hunters and gatherers range from almost entirely meat-eating to almost entirely vegetarian. The average is certainly not the 50-50 proposed by Cordain et al. (2000; somewhat corrected in Cordain et al. [2005]; see Milton 2000b), but it seems beyond question that the average hunting-gathering group ate more meat than the average agriculturalist group. Hunting peoples often got well over 20% of calories from meat. Even the modern American, carnivorous by inclination but agricultural by dependence, gets only about 10% of calories from meat.

If one were to calculate an average for 10,000 BCE, one would have to decide whether to average *societies* or *individuals.* Many societies but few individuals live in high latitudes or in tropical forests. The vast majority of humans would have lived in the lush plains, steppes, and woodlands. At a wild guess, I would bet the average for *societies* would be 20%–30% animal foods (meat or fish), the average for *individuals* more like 15%–20%. Moreover, fish probably was far more important than meat. Almost all groups near a sea or a large lake or river depended heavily on fish and shellfish. Very, very few depended overwhelmingly on mammal meat, and they maintained exceedingly low population densities. The Ice Age hunters of Europe and probably a few other areas almost certainly lived mostly on meat also, maintaining fairly large populations, but even they ate more plants than was once thought (Mason et al. 1994). Elsewhere, "Man the Hunter" (Lee and Devore 1962) may have hunted successfully and happily, but "Woman the Gatherer" (Dahlberg 1981) was producing most of the calories.

Cravings and Choices

The modern urbanite, foraging in the supermarket, is faced with the hardest choices of all. There are thousands of items. The cheap, easily prepared foods are exceedingly non-nutritious, while the nutritious foods are not particularly cheap and take some serious cooking. White bread and candy bars contrast with stew meat and broccoli.

There is another consequence of our primate heritage and hypertrophied brain: we are blessed and cursed with an insensate craving for sweets and fats. These are high-calorie, easily digestible foods that are most easily found in a rich patch following a burn. We seem especially fond of sweet-sour foods—which, in nature, would be ripe fruits and berries. We love animal fats and vegetable fats equally. It has been said, in defense of the "hunter" theory noted above, that humans "all like meat." Lean meat, such as game, is apt to be singularly tough and tasteless. Some do like it, but what we all like is fat. We love the taste of it, the feel of it, and above all the full, good sensation in the stomach when some high-energy lipids are down there. Thus, what passes for "meat" in American restaurants is basically fat, held together with an absolute minimum of protein fibers: bacon for breakfast, hamburger and hot dog for lunch, and prime rib roast, T-bone steak, or tenderloin for dinner.

The situation in the rest of the world is comparable: gourmet foods are fatty. Now that we know fatty meat is sometimes bad for us, many simply become vegetarian or near-vegetarian rather than face lean meat. Meanwhile, vegetable fat consumption has skyrocketed all over the world and vies with fatty meat as an indicator of economic improvement. This is not new; our early hominid ancestors knew and relished vegetable fats in the form of nuts, seeds, and oily fruits, such as the fruit of the African oil palm.

Our cravings for sweets and fats made sense when it motivated us to look for such things, as well as for berries (often rich in vitamin C), bone marrow (rich in minerals), and other highly nutritious items. Such desires have become less functional in modern times, when technology allowed refined sugar and vegetable oil to become the cheapest calorie sources. Biocultural nutritional anthropologist George Armelagos (2010) has pointed out that culture, recently including advertising, greatly sharpens our natural tendency to want sweet, fat, and high-nutrient foods.

Also biological is the human ability to regulate intake, and individuals differ in their ability to control themselves. However, this does not mean that anyone is doomed by a "fatness gene" or saved by a "willpower gene." These myths are the darlings of the media, especially the mass media (see, e.g., Nash [2002], in *Time* magazine, for a typical account—paying lip service to behavior and then settling in for several pages of gene blaming). Even journals that should know better, and write better, overemphasize the hard wiring (e.g., *Science* [2003] gives the same lip service to exercise and diet but focuses on genes and hormones). Recall that genes code for adaptations to environment, not usually for fixed responses. It should have given the writers some pause to note that Americans have been eating fewer and fewer calories since 1900, while getting fatter and fatter. Even more thought provoking is the fairly well known fact that people tend to be about as fat as their friends and as their pets (*BBC News* 2007; Holden 2003). Even within a family, one can often tell who is a pet's favorite family member by similarities in physique. Genes give us a back brain full of desires and a front brain full of abilities for rational planning. At best, we use the latter to balance, accommodate, and deal with the former. We figure out how to get what we want, at the least cost.

Predictably, humans differ enormously in their genetic equipment for metabolizing food, according to James Neel's "thrifty genotype" hypothesis (see discussion in Bryant et al. 2003). Efficient metabolizers turn food (especially carbohydrates) into fat with ease. This may cause them sorrow today, but it was the salvation of their ancestors. Such efficient metabolizers are disproportionately abundant among peoples with long, recently ended histories of seasonal hunger. By contrast, poor metabolizers stay healthy and thin today, but will starve if famine comes. Similarly, some people are naturally active and fidgety, some quiescent; culture and experience affect how these tendencies are expressed.

The desires—which also differ in strength from person to person—are for bulk calories, for fat, for sweet and sour-sweet, and for salt. These are obvious survival needs. The body detects them in a number of ways. Salt, for instance, is monitored by the hypothalamus (a tiny structure in the back brain). When blood levels fall below a certain point, the hypothalamus sends out messages that make salt taste good. Also, we tend to get used to a particular level of salt consumption; eat a lot, excrete a lot; eat little, conserve that little. Other needs are more complicated to monitor. Satiety—just the feeling of having enough—is so complex that no one has it quite figured out yet. Physical fullness of the gut, blood sugar levels, knowledge that one has eaten, and many other hard-to-compare indicators are all involved, and all are complex accommodations of genetics and past experience. Our craving for sourness, or possibly for a sour-sweet taste blend, is poorly understood. It is probably an adaptation that leads wild primates and human hunter-gatherers to seek out vitamin C sources. Among modern humans, it drives a fondness not only for vitamin C–rich foods but also for pickles, lemons, and soft drinks—none of these being particularly good vitamin C sources. Maturation, illness, and other changes change our appetites and our metabolism of foods (Simpson and Raubenheimer 2012).

Chocolate is not an aphrodisiac, does not have miraculous power over premenstrual syndrome, and does not soothe. What it has is simply a formidable combination of fat, sweetness, flavor, and stimulant (theobromine—a variant of the caffeine molecule). It does, however, appear to contribute to health and to staying thin, a rather surprising finding apparently explained by high antioxidant and polyphenol content (Roberts 2012).

Alcohol also has a wide appeal, but an uneven one. For complex reasons, some people reject it, many appreciate it in moderation, a few abuse it seriously. The latest fad is to maintain that alcoholism is genetically determined, but having every genetic predisposition in the book will not make an alcoholic out of a devout Muslim raised in a devoutly Muslim community; the individual may never see alcohol in his or her lifetime. Conversely, I have studied certain unfortunate communities where every adult abused alcohol, genes or no. These were minority communities in which racism had led to destruction both of their cultures and of their economic coping, and they were reduced to desperation. Immigrant communities change their alcoholism rates over time—usually within two generations or so—to approximate their host communities' rates. Thus, again, genes are not destiny.

When it comes to new foods, our genes pull us in two directions (see Chapter 7). Especially as children, humans are very diffident about trying new foods. The condition is known as "neophobia." However, humans are also fond of trying new things. We love variety. The same old taste gets dull. This is why so many staple foods are bland and tasteless. One cannot get tired of something with no taste or texture to notice.

A large percentage of modern food consists either of sugar in virtually pure form or of some tasteless or near-tasteless starch base used as a carrier for fat and for sugar or salt (cf. Schlosser 2001). Such food is now appropriately called "junk food," a term translated into various languages (*comida chatarra* in Spanish, for example). No one has accurately defined this category, but in general it refers to overpriced snack food that is low in nutritional value and high in sugar and/or fat. Close reading of the "ingredients" list on the label always shocks naïve buyers of frozen dinners, fancy breads, and other ready-made foods. The goods almost always turn out to have formidable amounts of salt, sugar, fat, and bulk starch, a number of unpronounceable chemicals, and astonishingly little else. Anything called fruit juice has to be real fruit juice, by United States law, but most buyers do not realize that "fruit punch," "nectar," "cocktail" and the like are basically sugar water; sometimes they contain some fruit juice, often they contain none at all. Thus does junk food subtly invade our homes, and thus do the giant corporations take advantage of human instincts.

One effect is tooth decay. Traditional societies, studied archaeologically or in earlier decades of history, usually show very few tooth cavities. They not only ate little processed sugars and starches, they also ate enough fiber and grit to wear the teeth down, eliminating cavities as they started. Agriculture brought something of an increase in cavities, early sugar trade brought more (Queen Elizabeth I had poor teeth, and it was recognized that sugar was the likely cause; see McGee 2004:658), but the real problem came with the rise of cheap sugar and starch in the nineteenth and twentieth centuries (Gibbons 2012). A soft, sugary diet not only brought cavities, it led to more gum disease and to smaller jaws—especially smaller lower jaws—and thus worse bite, more tooth crowding, endless orthodontia bills, and worse health all round. The Yucatec Maya who live a traditional life (see Anderson 2010a) do not have bad teeth, but as the Maya acculturate to world junk-food norms, their teeth are getting worse fast (Gibbons 2012; and my own observations). Good dental hygiene and fluoridation help greatly, but the problems persist. One really unpleasant consequence is heart disease, often caused by gum disease bacteria.

In the United States, calorie consumption has dropped, over the last century, from an average of 3,300 per adult American per day to a mere 2,800. (This is actually a rather tricky figure; food "disappearance" is much higher than that but involves a lot of plate waste. Twenty-eight hundred is an estimate.) Yet obesity has skyrocketed. A third of Americans are overweight. People weigh far more than they did in 1900. This is dangerous; heart disease, cancer, diabetes, cognitive decline (*BBC News Online* 2012b), and other degenerative conditions are much more common among the obese. Obesity has skyrocketed in Latin America, too (Eberwine 2002), and, indeed, in most of the world—at least among urbanites (Nash 2003).

Diabetes becomes common, for good physiological reasons (Lieberman 2008; Popkin 2006). In more general terms, this is an aspect of "metabolic syndrome," a condition involving insulin resistance, unbalanced blood lipids with high-density lipids too low, unbalanced hormone secretions with the fat secreting its own hormones that often inhibit weight loss, and other problems; it is highly associated with fat levels, especially abdominal fat.

Diabetes, especially the type 2 diabetes associated with food consumption, is a major sequel or component. Some people are more genetically susceptible, but a search for the "thrifty gene" has not been stunningly successful. Native Americans, Asian Indians, and some other populations (typically those with long histories of uncertain food supply) seem about twice as susceptible as others, but this needs confirmation. Meanwhile, diabetes certainly correlates with consumption of fat and of sugars and simple starches. It also correlates with lack of exercise. Worldwide, rates are climbing, especially in the Middle East and India.

Part of the problem is developmental; from the womb on, epigenetic and metabolic changes take place in response to overnutrition with easily processed foods. Thus by late childhood an individual may already be doomed to a life of fighting fat. (This and many other issues are addressed in *Fat, Fate and Disease*, by obesity experts Peter Gluckman and Mark Hanson [2012], a worthy reference.) But foods with a high glycemic index—foods whose starches or sugars are quickly digested and contribute glucose to the blood—are particularly problematic. Fructose, potato starch, and white rice are particularly high in this regard, and white rice eaters are now showing higher rates of diabetes than bread or pasta eaters; pasta has a particularly low index for a starch.

Politics is to blame for obesity as well as lack of exercise (Nestle 2002; Willett 2002). The food industry is powerful, influential, and well connected in the halls of education and government. It can push high-calorie, low-nutrient foods in schools and even via the U.S. Department of Agriculture (Imhoff 2012).

Perception is involved. People tend to believe they eat better than they really do; they eat less fruit and vegetables and dairy products and more fatty and sugary snacks and other unhealthy items than they realize (Squires 2002).

In 1900 we were farmers and blue-collar workers; only the few idle rich had a chance to get fat. Thus fat was idealized, and such behemoths as Diamond Jim Brady and his love Diamond Lil were the targets of emulation. Today we are computer programmers, store clerks, secretaries. We drive instead of walking and turn on the gas instead of chopping wood. We are almost all urban, and much of our habitat is too crime-ridden for walking. Only the relatively affluent can afford gym membership and mountaineering vacations. So obesity increases.

Moreover, people idealize what is expensive and hard to get. In West Africa and Oceania, where inadequate and starchy food was the rule, fat is beautiful—or was in traditional times. In the modern city, thinness is idealized, and the bird-boned anorexic becomes the supermodel. Even areas that traditionally idealized fat are now even more paranoid about obesity than is the United States (as revealed by a rather striking study by Brewis et al. [2011]). Women (and some men) continue to subject themselves to diets so extreme that the body rebels. They often suffer serious malnutrition, particularly when the diet slides over into anorexia nervosa, a serious condition with its own characteristics and etiology (on obesity and anorexia, see *American Psychologist* [2007]).

This is no way to lose weight. The natural, human way is to eat a huge amount and exercise a huge amount. We evolved as hunter-gatherers, ranging 10 or 20 miles a day, carrying food back to camp, and fighting off the odd lion or enraged buffalo. We should be eating more than 3,500 calories a day and working it off. We also evolved in a world in which fats, salt, and sugars were rare and were valuable; now that they are all too common and cheap, we must be careful with them.

Food pyramids are well enough in their way but do not provide adequate guides (partly because they have been worked over by the food industry; see Mestel 2000; Nestle 2002; Willett and Stampfer 2003). In general, food education campaigns have had their problems, not least because of the politics above mentioned (Nestle 2002; Willett 2002). The modern omnivore is best advised to eat as much like a hunter-gatherer as possible, and to exercise accordingly (see Treviathan et al. [2008] for many details). We evolved by eating a highly varied, and variable, diet and by working very hard at a diverse range of activities to get it.

2 HUMAN NUTRITIONAL NEEDS

Basic Needs

Human needs are far more than physical requirements. Dan Jantzen, the distinguished biologist, has said that human needs are "food, shelter, and sex" (Jantzen 1998). If only it were that simple. Shelter by itself is no adequate way to stay warm; one needs fire, clothing, and materials for repair, at the very least. Sex is only the beginning of reproduction. Among humans, 5 minutes of sex leads to 15 years or more of hard child-rearing work.

Food, likewise, is complicated. (For this and what follows, I have relied on Kiple and Ornelas [2000] and, especially, Shils et al. [1999]; see these sources for more details). We do not need simply "food"; we need a vast range of nutrients. We also use food to provide feelings of security, control, communication, and nurturance. We need air and water, which are not strictly nutrition but are closely related. Air is rarely problematical except at very high altitudes, but water is a real problem. The human animal needs a great deal of it—far more than most animals, since we stay cool by sweating, and we also produce a great deal of fairly dilute urine. By contrast, birds do not sweat and produce solid wastes, thus being adapted for deserts and for the demands of flight. We seem to have lost our hair partly to allow unconstrained sweating. Humans die rapidly from dehydration and need a great deal of liquid, not only for body maintenance but also to flush wastes, pathogens, and toxins out of the system. That said, there is no believable evidence that we need the proverbial "eight glasses a day," and humans can (to a limited extent) train their bodies to retain water, thus adjusting to heavy work demands and desert living.

The average "reference human" (in the nutrition literature, a 72-kilogram, or 150-pound, adult), if active, needs about 3,000 calories a day, as well as a large but variable amount of water. Around 1,600 of those calories go to support basal metabolic activities: heartbeat, digestion, and such, including the 400 calories needed for the nervous system.

The rest go into activity. Some adults get by for long periods (famines or hungry seasons) on little more than the basic 1600.[1] Audrey Richards describes people virtually hibernating during the dry season in the starved lands of interior Zambia (Richards 1939, 1948 [1932]), and similar conditions existed in north China in winter in the bad old days (Hinton 1966). Metabolism slows, activity ceases; people lie down until food arrives. At the other extreme, lumberjacks in the old hand-logging days in the North Woods (whether Finland or British Columbia) needed 5,000–6,000 calories, and consumption of 7,500 calories/day has been reported (though there was probably some waste going unnoticed). I recorded consumption of 5,000 calories/day by fishermen dragging heavy nets in winter storms on the South China Sea. Chill temperatures as well as heavy activity force the body to burn more. Just as they can adapt to famine, humans can adapt to chronic cold by running up calorie consumption. They also adapt to high levels of food intake by using the food less efficiently or, perhaps, by harvesting vitamins from the intake and letting much of the rest go rather poorly digested.

Any activity takes some calories; reading and watching television require 70–90 per hour, housework about 170, sex 88–102 (Cromley 2006), serious hard work 300–400 or more.

Nervous, fidgeting people may use a few hundred calories per day more than tranquil people. Conversely, some people use fewer calories because they have notably more efficient metabolisms than others.

Muscle uses 30–50 calories/pound for basal metabolic functions; fat uses only 2. Extreme dieting wastes muscle, and restored body weight after such loss often takes the form of fat.

In calorie deficiency, fats are burned first, then less necessary muscles and tissues, then vital organs; the brain is most spared. The stomach and gut shrink to adapt to long deprivation, making it necessary to feed famine victims very carefully when saving them. Pythons routinely lose half their gut tissue between their huge but very infrequent meals (Simpson and Raubenheimer 2012); we cannot do that, but we can survive a surprising amount of gut and other tissue loss.

Worldwide, most calories are from carbohydrates. In fact, outside of a few hunting societies of former times, almost all human groups get most of their calories from that source. (Many hunter-gatherer societies, and some postindustrial societies like that of the United States, get as many or more calories from fats and oils.) The great staples of world commerce, such as wheat, maize, potatoes, rice, and sugar, are all largely carbohydrate.[2]

Carbohydrates are, however, needed only in small amounts. Complex carbohydrates (starches are the main ones humans can digest) are better for human bodies than are simple ones (sugars, and some very simple or highly refined starches).

Carbohydrates are carbon chains with the general formula CHO. The standard basic one that we use for ordinary metabolism is glucose, C6H12O6. Some other simple sugars have the same empirical formula but different structure; fructose is one structural form (the levorotatory form) of the same compound. (Glucose is the dextrorotatory form; galactose is yet another variant). The human body converts fructose and galactose to glucose for metabolic purposes.

Short-chain compound sugars include sucrose—ordinary white sugar. It breaks down easily into a molecule of glucose and a molecule of fructose. Maltose breaks down into two glucose molecules. Breaking a sugar molecule takes some effort, and that means that even these simple compounds are less rapidly digested than the simple sugars.

Sugar is associated with everything from diabetes to dental caries (which increased with the development of agriculture; see Lucas 2008), both of which can go on to cause heart disease. Recent uncompromising advocates for health—maintaining that sugar is now as damaging to the public as alcohol—want it kept entirely out of school lunches (Lustig et al. 2012). There is also increasing evidence that heavy consumption of fructose is worse than sucrose. It apparently produces a very rapid spike in blood sugar followed by a crash, and it may have other disadvantages. It is associated with inflammation, though exactly why is still somewhat controversial. High-fructose corn syrup, very widespread in technological foods (even non-sweet ones) is thus under some suspicion.

Lactose is broken down by digestion into glucose plus galactose. Human babies are born with the enzyme lactase, which performs this cleavage. However, most humans stop producing this enzyme around ages 6–10. Thus most adult humans cannot digest lactose (Patterson 2000). Like other undigested sugars, it causes diarrhea and flatulence and, in large quantities, outright sickness. Small amounts of milk are tolerated; more leads to indigestion. However, Europeans (especially north Europeans) and East Africans have depended on fresh milk for so long that they have evolved the ability to keep producing lactase throughout life. Presumably, children without lactase did not thrive, as fresh dairy products became more and more vital as staple foods—though at least some humans can also adapt to high-milk diets by continuing to produce lactase when they would not otherwise have done so.

Dairying has been extremely important for thousands of years in the Western world, going back 8,000 years in some places (Clutton-Brock 2012:42; Mulville and Outram 2005), creating strong selection pressures. East African cattle nomads are even more dependent on fresh milk—some get over 80% of calories from it—and have not one but three genes to keep them producing lactase throughout life (Check 2006; Dunne et al. 2012).

Outside of Europe and East Africa, most humans cannot eat fresh dairy foods. Even in Mediterranean Europe, most cannot; in East and Southeast Asia, virtually all cannot, even after long exposure. But they have learned to make microorganisms do the enzyme work. Fermenting milk into yogurt, cheese, and the like involves breakdown of lactose by *Lactobacillus* bacteria. Yogurt is generally made by *L. bulgaricus.* (Other *Lactobacillus* species give us salami, sauerkraut, and San Francisco sourdough bread.) Thanks to yogurt making and other processing, peoples in West and Central Asia and the Indian subcontinent depend on dairy foods even though only 10%–20% of them can digest lactose (see Huang 2002; Patterson 2000:1060). *Lactobacillus* and *Lactococcus* fermentation also gives us cheese, with the rather odd result that Wisconsin—America's cheese center—designated *Lactococcus lactis* the Wisconsin State Microbe in 2010 (Davey 2010).

Some Arctic-dwelling humans—as well as some birds, such as starlings—have lost the ability to produce the enzyme sucrase and thus cannot digest ordinary sugar (sucrose; see Draper 2000).

There are longer-chain sugars, mostly indigestible. Stachyose and raffinose, in beans, cause the indigestion and flatulence associated with beans because we cannot digest them.

Still longer chain carbohydrates (polysaccharides) are starches, and these we can digest, breaking them down into glucose. Potato starch is particularly easy to digest and thus can cause a "sugar rush." The glycemic index measures how fast this digestion process takes place; fructose and glucose, absorbed immediately, are at the top, with potato and white rice starch close behind. White flour is also a problem. Sucrose is farther down. Some foods with high glycemic index are not a problem because there is very little carbohydrate per serving; carrots are an example. These are said to have a low glycemic load (Chauncey 2009:53).

Still longer chains include fiber compounds like lignin and cellulose, which cannot be digested by higher animals. Ruminant mammals, termites, and other such creatures have symbiotic microorganisms to do the digestive work for them. Humans have gut flora to digest some of these compounds as well, especially in areas with high-fiber diets. Fiber is extremely good for the gut and may protect against various diseases; soluble fiber certainly helps with heart disease. Doctors now recommend 25 grams of fiber a day for women and 38 for men (Chauncey 2009:55). This is true paleolithic diet feeding; it is almost impossible to get in a normal contemporary diet; one has to live on unprocessed vegetables, grains and beans or eat special high-fiber foods like oat bran. (I make bread with stone-ground flour, oat bran, and wheat germ, thus getting enough.)

Proteins are carbon-nitrogen structures that are made up of chemically combined amino acids. An amino acid is a carbon atom to which are joined $-NH_2$ (an amine group), $-COOH$ (a carboxylic acid group), a hydrogen atom, and a more complex fourth functional group, a side chain that is different in each amino acid. Compared to carbohydrates, proteins are difficult for plants to make and difficult to digest.

Protein, per se, is not actually a physical need. What we need are eight (some say nine) of the amino acids that are the "building blocks" of proteins. Since amino acids do not often occur in nature except in the form of proteins, the term "protein" is used as shorthand for this requirement. The body makes the other fourteen or more amino acids it needs, and all its proteins, from the basic eight. Proteins, when eaten, are first broken down by digestion into the component amino acids, then reassembled in the cells of the body into whatever proteins we may need at the moment. The "reference human" needs about two ounces of protein a day, about what you get from six ounces of meat or a cup of beans. This "reference human," recall, is an active, large adult storing up supplies for times of stress. Disease, burns, and other major stressors lead to mass drawdown of bodily protein supplies. A seriously burned individual can starve to death simply because it is difficult to take in enough calories for tissue repair. Superefficient intravenous feeds have been developed to prevent this.

The amino acids most commonly deficient in food are lysine and methionine. Grain is usually low in lysine, beans in methionine; a combination of the two (or use of a high-lysine grain) provides better nutrition. It has long been noted that almost all cultures that have spent a long time at high population densities have figured out ways to combine beans and grains: *kichri* (bean-grain mixes) and *dal* (split lentils or beans) with rice in India, bean curd and rice in China, *pasta e fagioli* (pasta and bean soup) in Italy, tortillas and beans in Mexico, and so on. The value of protein to the body is only as great as the value of the most deficient amino acid. Justus Liebig, a nineteenth-century nutritionist, discovered the Law of the Minimum: If you need to build tissue and have everything except one nutrient, you can't build the tissue. The least adequately supplied nutrient sets the Liebig limit. Thus a person getting all her protein from grain may seem to be getting enough protein, but in fact she may be getting only two-thirds as much as she needs.

The balance of amino acids in a given food is called the "protein score." The more perfect the balance of amino acids for human growth and tissue repair, the higher the score. This is a rather arbitrary measure, though the concept is clear enough. Various authorities score foods in different ways. Usually, human milk, being ideal for young humans, is assigned a score of 100. Egg white runs around 96. (Sometimes egg white, or even whole egg protein, is scored at the 100 mark—in which case the whole table has to be redone.) Muscle meat runs around 85. Grain and beans are around 65–75; rice is rather high in score, soybeans are protein rich but low in score. Potatoes have some of the best plant protein, scoring around 75–80. (Different laboratories report different scores, and different potato varieties have different scores.) Grain-bean mixes run around 75 or even higher.

The belief that vegetable proteins are "incomplete" is pure myth. The only really incomplete proteins (lacking one or more essential amino acids and thus scoring zero) that one meets in everyday life are gelatin and casein—both *animal* proteins.

Note that the protein score has nothing to do with the *amount* of protein in the food. Leaf protein is very high scoring, but most leaves have so little available protein that they are very poor sources for a hungry human, though alfalfa sprouts and other young leaves of protein-rich plants are better in this regard. Conversely, beans have low scores but are high enough in total protein to be widely called "the poor man's meat."

The body requires fats—or, more accurately, linoleic and linolenic acids. Usually, people need only trace amounts. The exceptions are women who are pregnant or, above all, lactating. Human milk is quite fatty. Producing it thus requires fat in the diet and, usually, fat stores in the body. A woman's body is programmed to store about 20 pounds of fat during pregnancy; this is a reserve that is drawn on for lactation. In addition, a lactating woman needs to get about 7% (at least) of her calories directly from fat.

The popularity of animal foods cross-culturally is explained by desire for fat better than by the value of the protein (Michael Baksh, personal communication, 1983, 1992). People love fat. Left to themselves, they tend to select exceedingly high-fat diets. Arctic peoples may get 80% or more of their calories from fat during good times. Perhaps it is only cost and habit that keep other cultures from joining some Americans, Greeks, Inuit, and Northwest Coast Indians in using fat as a main staple.

Animal fats are, of course, notoriously bad for the circulatory system—especially if one is male, genetically prone to make a lot of "bad cholesterol," and older.

Fats are esters ("salts") of fatty acids. Fatty acids are made up of CHO chains, like carbohydrates, but with a -COOH tail at one end. Digestion breaks fatty acids down into the component ions, with lipase being the key enzyme. Fatty acids can be saturated (all carbon atoms in the fatty acid chain are bonded to four other atoms), monounsaturated (one of the carbon atoms in the fatty acid chain is double bonded to another carbon atom in the chain—so that it has only three other atoms attached to it), and polyunsaturated (several of the carbon atoms in the fatty acid chain are double bonded). Saturated fatty acids include palmitic and myristic acids, which are considered bad for health (at least among sedentary persons), lauric acid (which may be good; see below) and stearic acid, which is not known to be implicated in health problems. Dairy foods and palm oils are high in the first three; beef is high in stearic, and thus less of a problem for the heart-disease candidate.

Monounsaturated fatty acids include oleic (the major one in olive oil) and several other fatty acids. Polyunsaturated ones are primarily linoleic, linolenic, and derivatives thereof. Linoleic is one of a class of closely related "omega-6 fatty acids" (two double-bonded carbon atoms). Linolenic and its relatives, "omega-3 fatty acids," are associated with very low heart disease rates (Allport 2006). The mysterious name refers to how far back the last unsaturated bond is from the end (the omega carbon) of the molecule.

On the whole, polyunsaturates are found in plant foods, but omega-3's abound in the marine food chain and thus in marine animal fats—being especially common in salmon, mackerel, herring, and similar fish and in the marine mammals that eat them. Most plant polyunsaturates are omega-6, but omega-3's are common in flaxseed, walnut, and evening primrose seed oils, among others. It appears that linoleic, linolenic, and possibly arachidonic acids (another polyunsaturate) are necessary for humans (Jones and Kubow 1999). Hunters and gatherers got more omega-3's than most of us do today and thus had a better balance in their diets, presumably with good effects on health (Eaton et al. 2002).

Consumption of walnuts and similar nuts, and of marine animal fats, is associated with lower blood cholesterol and thus lower circulatory-system disease because of the omega-3's. The dangers of a high-fat diet are due to overconsumption of saturated fatty acids and perhaps to a high ratio of linoleic to linolenic acid among the unsaturated ones. With more linolenic acid, protective and compensating mechanisms kick in. Heart disease rates are low among even the most assiduous of marine-animal-fat eaters—the Inuit, for example. Eating linolenic acid by itself apparently does not protect against heart disease; one must eat it and/or its metabolites in natural foods. Omega-6 acids are cleaved by enzymes into a number of chemicals, including prostaglandins, which are associated with inflammation. Omega-3's are cleaved into complementary compounds that balance these out. A balance appears necessary; too much omega-6 may mean too much inflammation, but too much omega-3 might be bad, too (it is such a rare condition that no one seems to know).

The ratio of "good cholesterol" (high-density lipids, or HDL) to "bad cholesterol" (low-density lipids, or LDL) is also affected by this. It depends on total consumption of unsaturated fats as opposed to saturated fats and, rather surprisingly, carbohydrates. A high-carbohydrate diet is worse than a diet with appreciable saturated fat (Mensink et al. 2003). Moreover, one saturated fat has a virtuous role here: lauric acid, a short-chain fatty acid that is common in coconut oil and some other tropical vegetable oils, raises overall cholesterol, but largely by raising HDL. This may explain the anomalous heart health of those Polynesian islanders who consume many coconuts.

Vitamins

Vitamins are the next important class of nutrients. Vitamins are defined as complex chemical compounds that must be eaten, but only in small amounts. The first to be discovered was vitamin B1, but the vitamins begin with A because it was the first to be scientifically described, analyzed, and named (by E. V. McCollum and associates, in 1913; see Ross 1999:305). Casimir Funk coined the term "vitamine" (with final "e") about the same time. Only later did scientists refine the concept (and the spelling), adding the B vitamins and then the rest.

Vitamin A, like many nutrients, is poisonous in overdose. Many deaths have occurred from self-medication with megadoses of vitamin

A or from eating the livers of polar bears and other large arctic animals that concentrate huge amounts of vitamin A for the long polar night. Vitamin A illustrates the value of the old Greek concept of moderation and the worthlessness of the modern attitude that "if *x* is good, 10*x* is ten times as good." Gabriel Bertrand in 1912 postulated a rule that nutrients typically become toxic in overdose, with a rising and then falling curve plotting their value as one consumes more and then their toxicity as one consumes even more (Simpson and Raubenheimer 2012:74). Vitamin A is the clearest case among vitamins, but several other vitamins and all the mineral nutrients (from salt to iron and from calcium to copper) fit the picture, and even water can be deadly—a few cases are known of compulsive water drinkers who depleted their bodies' electrolytes and died.

Vitamin A is needed for general physiological functioning and, more specifically, for seeing in dim light, since rhodopsin (the chemical in the rods of the eye) is made from vitamin A by a simple, direct metabolic change. Deficiency shows itself first in night blindness, a condition that impairs the lives of millions of people today. Deficiency in childhood can lead to permanent total blindness; therefore, charitable agencies such as the Helen Keller Foundation have taken a very active role in getting vitamin A to outlying regions—often by encouraging the raising of carotene-rich foods. Vitamin A is not usually eaten, however; we get most of our vitamin A from carotene, especially beta-carotene. Another simple change turns it to vitamin A in the body. Carotene is abundant in carrots, of course—and in other bright orange or deep green foods: orange sweet potatoes, red peppers, leaf vegetables, and so on. (The orange of oranges and the red of beets are not from carotenes.) There are actually several carotenes, beta-carotene being the main feedstock for vitamin A. Yellow maize has some, but other grains don't. (A rice with engineered genes to produce carotene has been developed and has become predictably controversial.) Carotenes and some chemical relatives appear to protect against cancer; at least, consumption of carotene-rich foods is associated with low cancer incidence, but consumption of large amounts of beta-carotene and vitamin A, by themselves, is not.

Vitamin A itself occurs mainly in liver, also in some other organ meats and in milk, and to a small extent in meat. Vitamin A deficiency is especially common in areas where rapid modernization has led to a change in diet, with store-bought foods replacing traditional fruits and vegetables, or in areas where sheer poverty forces people to depend on starch staples. Vitamin A is fat soluble, and eating it without any fat means that the eater does not digest it—it is excreted unused. This is a problem in some poverty areas where carotene-rich foods are common enough but fats are rare. It used to be a problem for people taking vitamin pills, but now the vitamin is bonded to a fatty acid in the pills.

B vitamins are a series of chemically related water-soluble vitamins. They are necessary to the whole body, but lack of them tends to show up first in nervous-system functioning.

B1 (thiamine) is common in most foods, but much of it is lost when grain is milled. Thus beri-beri (thiamine deficiency, leading to neurological damage that typically is characterized by paralysis of the feet) is a disease of polished rice and white flour. Flour is usually sold enriched today, with the major B vitamins put back in, but this is not universal. Enriched rice is, unfortunately, not the rule worldwide. Polished rice has only about half the thiamine of whole-grain rice; this has been a major problem in many rice-dependent areas. A fair account of beriberi is found in the *Shang Han Lun,* a Chinese text of the second century CE (though its final form was not set until perhaps 500 CE); the book advises curing it by eating fresh, varied foods (Chang 1981).

B2 (riboflavin) is common in the same foods as other B vitamins and is rather rarely deficient by itself. If it is deficient, the other B vitamins are too, and probably several other nutrients. Thus it may be passed over in silence here.

B3 (niacin), by contrast, is one of the world's most serious vitamin problems. It is rather widespread in foods but is often milled out like thiamine (though to a lesser degree). The real problem is that it is chemically quite active as a base. It reacts with strong acids in foods (such as oxalic acid) to form compounds that human beings cannot digest. The worst problem comes when the diet is rich in phytic acid, a strong acid found commonly in seed coatings and husks and in many leaves, especially where phosphorus is abundant in the soil. (The plants use the acid to store phosphorus. See Weaver and Heaney 1999:esp. 147.) The phytate radical of the acid bonds with the niacin. This is classically a problem with maize eaters because corn is low in niacin and high in phytate. Avitaminosis B3, known as *pellagra,* is thus classically called "a plague of corn." It was common in the old South, in Italy, in Romania, and elsewhere. It is a serious danger in Africa and north China today, as maize becomes more important due to its high yields. One of the most unpleasant conditions imaginable, it is characterized by the "four D's": diarrhea, dermatitis, dementia, and death. Agonizing pain often accompanies the mental deterioration.

The Mexican Indians found a trick that saved the pre-Columbian world from pellagra. They boiled maize with lime (calcium oxide, not the citrus fruit) to soften its hard kernels. This boiling process produces the familiar *nixtamal* of Latin America. The lime, of course, reacts with the acid and neutralizes it, saving the niacin and minerals (Katz et al. 1974). In other areas, including the pre-Columbian and post-Columbian South of what is now the United States, wood ashes were used with the same effect. Lye in the ashes neutralized the phytate.

Hard maize kernels had been selected, in turn, as a protection from weevils. In the American Southwest, weevils were not a major problem, so the Indians grew softer corn. This meant they were less prone to process the maize, though the Zuni did process it with alkali from alkaline springs, and other groups used wood ashes. Nutritional deficiencies had much to do with the fall of the great pueblos of the twelfth and thirteenth centuries. Some of these deficiencies may have been due to overmuch phytate in the maize, though there were also sheer shortages of food, as drought affected an overused ecosystem.

In more recent times, maize meal in Mexico has sometimes not been treated with lime, resulting not only in inferior tortillas but also in a resurgence of vitamin and mineral deficiency. I was told in Yucatan that this happened in particular when U.S. maize meal was imported or used in food aid. Today, the major Mexican food purveyors are careful to use lime in processing their corn meal.

Not only maize but also wheat and soybeans, as well as many other seed foods, are rich in phytate. Thus, people in areas where these are important foods can only flourish if they have processing techniques that destroy the phytate. Leavening in bread does this. Yeasts metabolize the stuff and destroy it, so yeast-raised whole-grain wheat bread has half (or less) of the phytate of unleavened bread. Unleavened whole-grain bread is also associated with metal deficiencies, including zinc deficiency in Iraq, for the same reason: phytate takes up active metal ions. Making soybeans into tofu (bean curd), soy sauce, miso, etc., gets rid of the phytate. Historically, soybeans did not become an important food till such processing technologies were established, since the Chinese realized they were nutritionally inferior (before processing). Soybeans have other serious problems (iodine-bonding chemicals, etc.) that are also reduced or eliminated by processing.

B6, B12, and other minor B vitamins are rarely deficient in diets. An exception is folic acid (B9), a B vitamin necessary in large quantities for fetal development. As its name suggests, it is found abundantly in leaves, but it is also found in other fresh foods. It is thus common in natural foods. However, life on a modern processed diet often leads to deficiency, which in turn can lead to defects in neural-tube development in the fetus, as well as other problems for all ages (Herbert 1999). It is estimated that as many as a third of the pregnant women in the world are deficient in folic acid, though one serving of relatively vitamin-rich fruit or vegetables provides enough (Herbert 1999:444). Folic acid has become a major concern of maternal- and child-health workers and advocates and is being widely distributed. My wife Barbara, a maternal- and child-health specialist, proselytizes for it wherever she goes.

B12 is necessary for iron metabolism, and lack of it causes anemia. This vitamin, more technically known as cyanocobalamine, can easily be deficient in vegans, since it is not found in true vegetable foods. It is, however, found in fungi, especially yeasts. Brewer's yeast is the richest source (though there is a controversy on how available the B12 in yeast is to human digestion). Vegetarians have learned to sprinkle it on their food, or—in other cultures—to use various fermented products rich in yeast, such as soy sauce, south India's sourdough foods, and, at least formerly, beer. Old-time beer was not strained and clarified, as it is now; such processing eliminates most of the yeast. I have had rice beer in Malaysia that had to be eaten with a spoon. The rice mash was full of yeast. Some modern beers, sakes, and Chinese "wines" (which are brewed from grain) have a fair yeast content.

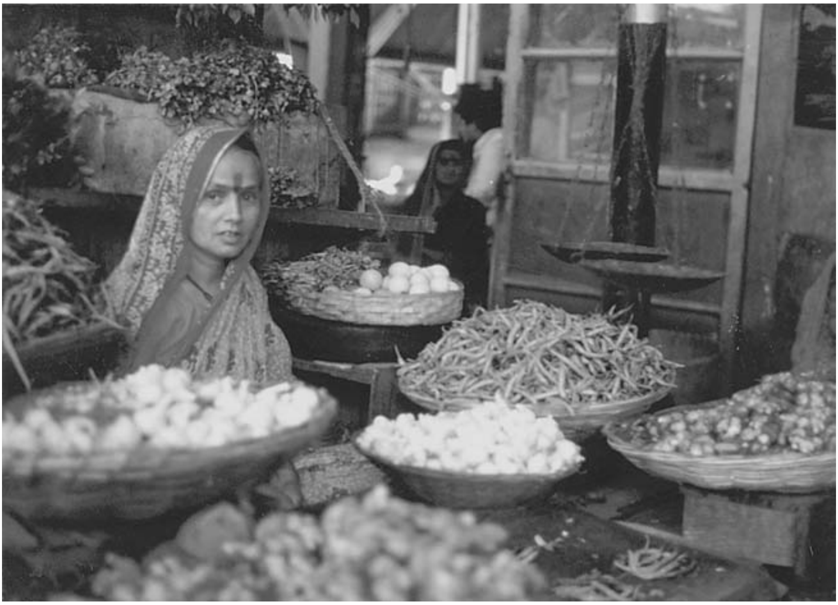
Vitamin C is a special problem for higher primates. Most other organisms make their own, metabolically. (Guinea pigs are among the few others that do not, which is one reason they are so popular as lab animals in nutrition studies.) The ability to make vitamin C was probably lost because we were eating fruit and leaves, and primates who wasted metabolic effort doing unnecessary vitamin-making left slightly fewer descendants. In any case, the body uses up vitamin C stores fairly rapidly, in a few weeks or months. The result, if no further vitamin C is taken in, is scurvy—once one of the most dreaded of all conditions, and a virtually inevitable corollary of long residence on shipboard or in jail. Long winters led to scurvy in the days before modern transport made fresh food available. Vitamin C being necessary to all bodily processes, scurvy is really a breakdown of the whole bodily machine. Skin deteriorates; rashes, dry flakiness, and eventually fissures and scaling patches develop. Wounds and illnesses don't heal. Teeth loosen; gums deteriorate and develop painful sores.[3] A very painful death eventually supervenes.

The main sources of vitamin C are fresh plant materials. Those with the highest levels include the acerola or Barbados cherry, the lemon guava, green and red peppers, and certain other fruits. Rose hips from *Rosa rugosa* are extremely high, but most other rose hips are not particularly rich in vitamin C. Grain and other dry foods are lacking in vitamin C. White potatoes are the only important starch staple that has it. Meat has a little in the blood (but not in the actual muscle tissue), and organ meats (especially liver) can be high in vitamin C, but an animal diet is usually not an adequate source. Arctic peoples eat stomach and intestinal contents of animals such as reindeer, and so survive.

Vitamin C is easily destroyed by oxidation, dissolved by water, and otherwise wiped out, so it is lost when food is dried, heated, pickled, boiled with the water thrown away, or destructively processed. Thus people must have access to fresh foods. Before James Lind popularized the use of lime juice to prevent scurvy, in the eighteenth century, ships often lost most of their crew on long voyages (Hughes 2000).

People in old China and India often managed for long periods of time without vitamin C and clearly had adapted, but perhaps at last some of them did not need it. The mutation to produce it naturally is simple (it would merely require a genetic change back to ancestral mammal state of producing L-gulonolactone oxidase). This has happened in some guinea pigs, and very likely in some humans, too (Cummings 1981).

Vitamin D is necessary to calcium metabolism, and deficiency causes bone problems (rickets or osteomalacia). Sources include sea animal livers, D being a fat-soluble vitamin like A. It is normally manufactured



Vegetable seller, India. Small-scale marketing remains a desperate need for people, especially women, around the world. Photo by Barbara Anderson, 1997.

by the skin in the presence of ultraviolet light, and thus is a dietary necessity only for people who live in foggy or long-night areas (e.g., the industrial slums of England in winter) or who live indoors all the time—especially dark-skinned people, since melanin blocks ultraviolet rays. Veiling and seclusion of women in extreme Muslim areas like Libya leads to vitamin D deficiency. (Incidentally, veiling and seclusion of women is *not* Quranic or religiously enjoined by Islam; it is a habit picked up from Christian communities in the early centuries of Islam.) Vitamin D deficiency—rickets in children, osteomalacia in adults—is characterized by weak bones. It has resurfaced as a problem in the United States, owing to indoor lifestyles (Stokstad 2003). It is correlated with some cancers and apparently with multiple sclerosis, leading to very high rates of multiple sclerosis in sun-short parts of the Pacific Northwest (on vitamin D I have greatly benefited from discussions, acknowledged here, with my colleagues Anthony Norman and Helen Henry, world experts on this vitamin).

Vitamin E is necessary to most body functions but is so common and is needed in such trace amounts that it is virtually never deficient in humans (despite the dishonest claims of certain "health" food promoters). Vitamin K is necessary to produce the chemical that allows blood to clot. It too is almost never deficient. Both these vitamins are fat soluble.

Minerals

The human body needs at least fifteen mineral nutrients, but few are of broad anthropological interest. Things like vanadium and arsenic (the ultimate proof that many a necessity is poison in overdose) are needed in such small quantities (if at all) that they are picked up without anyone noticing.

As for the major mineral nutrients, phytic acid is again a problem. Being a fairly strong acid, it bonds tightly with the more chemically active metals. Thus iron, calcium, zinc, copper, manganese, magnesium, and some minor metal nutrients are rendered undigestible, and can even be pulled actively out of the body's preexisting stores.

Iron (Fairbanks 1999) is often deficient even in the absence of food phytate. It is necessary mainly for hemoglobin—the chemical in red blood cells that carries oxygen to the tissues—and deficiency causes anemia. Women are at particular risk, since menstruation almost doubles the iron requirement and pregnancy and childbirth triples it. Thus, iron supplements are routinely supplied to expecting mothers. In traditional societies, iron was once supplied by an omnivorous diet high in small animals, fish, leaves, and the like. The shift to grain agriculture and the rise of dense, impoverished populations have been devastating. Today, it is estimated that over 80% of women of child-bearing age in India are anemic. Indian spices are often high in iron—that is one reason for the spicy Indian diet: people early learned that spices prevent the weakness and pallor we now know as anemia. But most women in India have trouble affording much spice or, indeed, affording anything beyond minimal grain staples.

The main iron source for most people is vegetable tissue, with leaves being a rich source—but this is precisely the area where oxalic, phytic, and other acids are a problem. Even without them, iron is hard to

Faces of malnutrition and hope, Dhaka, Bangladesh. Malnourished woman and child in desperately resource-short area of Dhaka, Bangladesh. Behind her is a squash vine, trained up a shack built of salvaged boards and scraps. The vine promises much good food to come and suggests that even under the worst circumstances, people find creative ways to survive. Unfortunately, gardening here was prohibited by the landlord—he was afraid that it would establish de facto land-tenure rights and challenge his power. Photo by E. N. Anderson, 1999.

digest unless already in animal tissues. Humans can absorb only a small percentage (as low as 2%) of the iron in vegetable sources. Thus meat and especially blood and liver are valuable. Billions of people manage to survive without much animal protein, but they tend to get anemia, especially if they are women of reproductive age.

Conversely, too much iron is also a bad thing. The level of supplementation needed by a woman for childbirth is potentially dangerous for an old man. This has led to a major worldwide controversy over whether to begin iron supplementation of common foods. Currently, it is not done, and reproductive women need iron pills.

Another problematic active metal is calcium, necessary in enormous quantities for bone growth, but (like iron and most other metal nutrients) potentially dangerous in overdose. Calcium deficiency is one cause of osteoporosis—bone deterioration with age—which is common among the elderly, especially among women who have not exercised much and who did not build up good bone mass in youth. Calcium, too, is subject to blotting up by phytic acid, as noted above. Moreover, it must be in proper balance with magnesium, potassium, and phosphorus in the diet for proper nerve function and bone growth. This makes calcium nutrition very complex (Weaver and Heaney 1999; Seely 2000; Spencer 2000). Authorities can reach opposite conclusions. Seely (2000) thinks that ancestral humans ate little calcium and we are now eating too much. Spencer (2000) thinks the exact opposite. For the record, Spencer is correct—in the main—about the high-calcium diet of ancestral humans, who got a great deal of meat, fish, or mineral-rich plants. But some early humans probably ate very little calcium. So both of them may be right, for different people at different times. Many children now get too little calcium and also too little sunlight and thus too little vitamin D; rickets has returned to our cities (Neergaard 2007).

Salt—sodium chloride—is necessary to human life. Being concentrated in only a few spots (outside of the ocean), it is a major stimulus for trade. Many a traditional group was forced to produce all sorts of valuables in order to be able to obtain this vital need. Loss of salt often causes death among people working or traveling in the hot sun. This gave Death Valley its name; ironically, the explorers in question died among salt-rich plants, and any local indigenous person could have told them they could have saved their lives by browsing a bit. They didn't ask.

Salt is yet another nutrient that is dangerous in overdose. At least in genetically susceptible individuals (apparently a large percentage of humanity, and some other primates, are at least somewhat susceptible), it brings on high blood pressure (Kotchen and Kotchen 1999).

Iodine is another problem, being deficient in many of the world's soils. Iodine is needed in only one of the body's chemicals: thyroxin. However, this is a critical compound; it is the hormone, secreted by the thyroid gland, that regulates growth—including brain growth. Marine products (sea salt, sea food, and especially seaweeds) are good sources, but people far from the sea often suffer. The dreadful effects of iodine shortage were superbly described by Greene (1977, 1980). He studied an area in the Andes where iodine was almost lacking in the soil. Cretinism—mental and physical deficiencies caused by iodine deficiency—seriously affected a third of the population. Many victims could at least herd sheep, but many could do nothing but sit on the floor. Greene was able to bring in iodized salt, ending the problem for those he could reach—but the problem is a worldwide one. Iodized salt has eliminated iodine deficiency in most areas, but junk food and processed food tend to use non-iodized salt, and the problem is cropping up again.

Fine-Tuning: Special Needs and Nutrients

Males and postmenopausal women are more at risk for heart disease than reproductive-age women because estrogen is a protector from atherosclerosis. Many plants, notably beans, contain estrogen-like chemicals, and these may lower the heart disease rate. High soybean consumption, for example, is associated with low heart disease incidence.

The danger of saturated fat was established in cross-cultural epidemiological research by Ancel Keys, back in the 1950s (Keys 1980). Initial fears that consumption of cholesterol would lead to too high a level of blood cholesterol have not been supported by evidence. Apparently the body handles cholesterol perfectly well; it is certain saturated fats that are the problem. Hydrogenated vegetable oil—margarine and the like—is significantly worse than any natural saturated fat. The "trans" fats created by hydrogenation seem genuinely damaging to the heart. Following this finding, American snack firms and fast-food chains have been sharply cutting back on their previously heavy use of hydrogenated oils (Allen 2002).

Some foods, like coconut, have almost exclusively saturated fatty acids. Others, like peanuts, have saturated, monounsaturated, and polyunsaturated oils in roughly equal amounts. Finally, such oils as safflower are almost entirely polyunsaturated. There is a weakly supported claim that polyunsaturated oils are better for the heart than monounsaturated oils. However, people who eat great amounts of monounsaturated oils tend to live long and stay healthy. This is most famously true of Mediterranean inhabitants; olive oil may be special. In Keys's studies, South Italians and Greeks—olive oil eaters—stayed heart healthy much longer than North Italians, to say nothing of Dutch and Finns. Even coconut-eating groups live relatively long and healthy lives, a point that needs more research.

The Mediterranean diet (Albala 2000; Matalas 2001; Shils et al. 1999) is also rich in flavonoids (in particular, carotenes), now known to be associated with resistance to cancer and heart disease (Nijveldt et al. 2001). By the "Mediterranean" diet, I mean one that is high in fish, beans, vegetables, fruits, and slow-to-digest carbohydrate foods such as pasta. People from Mediterranean countries are fond of pointing out that there is no one Mediterranean diet. North Italians point out (at times somewhat ruefully) that they eat a great deal of red meat, butter, white bread, and other foods that are the antithesis of what outsiders love to call "Mediterranean."

Red wine has proved to be good for the heart and probably preventive of cancer, and indeed a very moderate consumption of alcohol (one ordinary drink a day) is associated with better health and longer life (Klatsky 2003). However, the advantages of resveratrol, an antioxidant found in red wine and red grape juice, have been greatly exaggerated in the media, owing to some shaky claims.

Oat bran and other sources of soluble fiber, including beans, lower blood cholesterol; oat bran and beans together do better than either one separately. Oat bran became a fad a few years ago but was added to muffins and cereal in such minute amounts that no one benefited much. Adding bulk oat bran to homemade bread, however, provides enough to make a difference.

There remains much to clear up about all this. Several friends of mine were involved in a study of Polynesian migrants to New Zealand (thanks to Tony Hooper, Ed Plummer, and Corinne Wood for the following information). Polynesians eat a lot of saturated fat because of their dependence on coconuts, which are actually the staple food of some islands. Yet they rarely get heart attacks back home. In New Zealand, they move toward a diet of white bread, potatoes, candy, pizza, and so on. Their saturated fat consumption actually goes down dramatically, but their heart disease incidence goes up just as dramatically. There is something protective about the healthy, exercise-filled life in Polynesia, and something dangerous about the sedentary life abounding in refined foods.

At least some of the difference is fish. Fatty fish are rich in omega-3 fatty acids, which protect against cholesterol buildup. Polynesians eat a lot of fat fish: bonito, mackerel, scad. Similar fish protect Arctic and Northwest Coast natives in North America. Seals, whales, salmon,

Fish from the coast, Hong Kong. The woman had bicycled from the coast to an inland village with these fish. Today, the transportation is better, but the wonderful fresh fish have long succumbed to pollution and overfishing. Photo by E. N. Anderson, 1966.

smelts, and other common foods of the North are rich in omega-3 fats. Heart disease is rare. The basic omega-3 fatty acid, linolenic acid, makes little if any difference; other omega-3's seem to be the ones that count (see Conner 2001). Other foods, including island vegetables and fruits, may also have a piece of the action. Factors at work could also include stress and lack of exercise in New Zealand.

There is much to learn about the value of greens in general. Other foods will no doubt prove valuable. Yogurt has been rather equivocally implicated in lowered heart disease incidence. Walnut and pecan consumption reduces heart disease risk, owing to high omega-3 levels in their oil. One controlled study found that daily consumption of these nuts was accompanied by heart disease incidence a striking 50% lower than in comparable non-consumers (Joan Sabate, personal communication, 2000; it is only fair to note that Dr. Sabate's study was supported, in part, by walnut growers—but I trust his objectivity and accuracy). Other nuts seem to have similar effects (Joan Sabate, personal communication, 2000). Many other traditional and favored human foods probably work.

Another chunk of the difference is diabetes. Diabetes, untreated, usually brings about death from heart or kidney failure. Rapid change from the almost sugarless diet of Polynesia to the sweets-loving world of New Zealand is a shock to the system. Polynesians are rather susceptible, genetically, to type 2 diabetes—as are Native Americans, Native Siberians, and many other traditional rural peoples of the world (Cudel 1994).

The Akimel O'odham and Tohono O'odham (the peoples that European settlers called Pima and Papago) of Arizona were virtually free from diabetes until two generations ago. Before the twentieth century, they had lived on desert foods such as mesquite meal, wild greens, and cactus buds and fruits and on traditional crops: maize, locally grown wheat, beans, squash, chiles. In the late nineteenth and early twentieth centuries, they lost most of their land and almost all the water needed to irrigate what land they kept. After World War II, they were progressively incorporated into the wider society of Arizona. This led to the expected dietary changes. Alcoholism, previously very rare, become more common. Sugar and white flour replaced traditional foods. Today most adults suffer from diabetes, and life expectancy is falling as the disease extracts its dreadful toll in heart and kidney failure and in necrosis. Return to traditional diet reverses much of this, but is difficult to effect (Cudel 1994).

The Tohono O'odham in Mexico were slower to change, but they are rapidly catching up. This may presage a vast disaster in Mexico, where most of the population has considerable Native American ancestry. Already, diabetes has become common among the more prosperous of the Maya of the Yucatan Peninsula. It is spreading in other groups as well.

This introduces the subject of alcohol. Obviously, alcohol in large doses is a deadly poison. Death from alcohol poisoning is common. Death is also not infrequent among alcoholics forced to go "cold turkey"; withdrawal from physical addiction to alcohol is extremely harsh. (We are not talking about a "drinking problem" of two beers a night here; we are talking a pint of vodka a day.) Heavy drinking, even without frank addiction, is associated with heart disease, cancer (alcohol is quite carcinogenic), and much else. However, small amounts of red wine (a small glass per day, best taken with food) protect against heart disease, and apparently white wine and beer do some good. This is not so much because of the alcohol as because of various tannins and other compounds in the wine and beer. What the British call "real" beer and the Americans call "microbrewery" beer is better in this regard than the ordinary mass-produced brew, which has little in it beyond alcohol and water.

Proneness to cancer also varies with heredity, but it, too, is manipulable by diet (see Kroes and Weisburger 2000 for an overview). Antioxidant vitamins—vitamins A, C, and E—destroy many carcinogens and are thus a good thing to eat in quantity. Tomatoes, cooked, appear to act against prostate cancer, mostly by keeping up the lycopene levels in the prostate; lycopene is concentrated in tomatoes and prostates, a rather odd pair.

This is a healthy sign; for a long time, it seemed that more and more foods were turning out to *cause* cancer. By the 1980s, people were saying, "Everything causes cancer" and thus were not bothering to avoid the very few things that really are risks. No common foods are serious carcinogens in the class of tobacco and alcohol. Nitrosamines in poorly salted fish appear to cause nasopharyngeal cancer (Anderson et al. 1978). Nitrosamines in grilled meat, soy sauce, and other food products have been implicated by association with various cancers but do not appear to pose much risk. One potentially very serious risk is aflatoxin in spoiled peanuts and similar products. Some aflatoxins are extremely prone to cause liver cancer. But no one eats spoiled peanuts voluntarily, and the tiny amounts of aflatoxin in foods like peanut butter present minimal risk. There are tiny amounts of toxins in many common foods, such as parsnips and arugula, and in many herbs, such as sage and comfrey. No one eats a bushel of parsnips a day.

The extent of poisons in natural foods has been exaggerated in some quarters—especially by people who argue in favor of using artificial additives or of allowing pollution, claiming that nature is full of poisons already. First, this argument is justified if the additives in question are safe (most are), but people are usually good at detoxifying the few natural but somewhat toxic things they eat. Second, if the claim were true, it would mean we should be *more* careful about pollution, not less. The precautionary principle—"first, do no harm," as Hippocrates put it—tells us we should still minimize the risk. More to the point, we can voluntarily abstain from parsnips (indeed, most of us do), but we usually have the pollution dumped on us whether we want it or not (see Fox 1997; Nestle 2002).

Long life is gained through eating a varied diet, rich in high-fiber vegetables—including those trivially "toxic" ones. Long life is not gained through living in a polluted environment. Pesticides, hormones, and artificial coloring and flavoring agents add little at best; we do not need them in the food supply. Feeding antibiotics to livestock, for instance, has led to the evolution of bacterial strains that resist a very wide spectrum of antibiotics and are therefore a huge danger to humans—already at risk from a host of drug-resistant pathogens. McDonald's has now stopped buying antibiotic-fed beef (Drexler 2003).

The biblical prophets already knew the advantages of a simple, nourishing diet. Daniel challenged "the king's men" to a trial: he, Shadrach, Meshach, and Abednego would live on pulses and water while the king's men would continue to eat their usual rich meaty diet, and they would then make a trial of strength. Of course Daniel and his friends wound up in splendid shape, the king's men were decrepit and soft, and case/control experimentation in nutritional science was born (Daniel 1; see Grimes 1995).

Mediterranean peoples live long, healthy lives, even under harsh circumstances. Keys (1980) tells of watching centenarian peasants on the island of Crete putting in a full day's hard work in the fields and coming home cheerful. They lived on bread, yogurt, and olive oil. In general, the Mediterranean diet is based on heavy consumption of grains (often whole grains), fruits, and vegetables, with olive oil as the fat source and most animal protein coming from fish or yogurt. Cheese and meat are allowed in small quantities. DeVore and White (1978), McCune and Kuhnlein (2011), and Nabhan (2008a), among others, have advocated preservation of, or a return to, traditional diets. This is "a consummation devoutly to be wished," as Shakespeare said, in a very different context, but it is not always practical; the desert-dwelling Tohono O'odham are reviving their traditional diet, but other groups find themselves in city slums, eroded farmlands, or other environments where the chance is lost.

Carotene-rich vegetables, especially those of the cabbage family, are uniformly and consistently associated with longer life and lower incidence of heart disease and cancer. So are onions and garlic, though these apparently do not really lower cholesterol (Maugh 2007). Berries, especially strawberries, raspberries, and blueberries, as well as pomegranates (technically berries), are quite suggestively linked. Antioxidants—many and varied chemicals that blot up free radicals—are given the credit. Most intriguing is a recent finding that brains age better in lab rats who eat blueberries (Azar 2001). Senile dementia is lessened and delayed. Of course, no one particularly wants brainier rats, but the hope is that this generalizes to humans. At worst, it provides a good excuse for eating blueberries. Some tropical berries are even richer in antioxidants and have sparked fads in the health stores and juice stands. They may or may not become permanent parts of our diet. Açaí berries (a Brazilian palm fruit) seem here to stay, though their contribution to health is not strictly proven. On the one hand, the European Food Safety Authority casts a dubious eye on them (Kupferschmidt 2012). On the other, the ordinary eater is well advised to eat them in quantity, since the benefits *could* be extremely high and are certainly greater than the small costs of most of these foods.

Odder nutraceuticals (medical foods) have been consumed. Beer in Nubia in ancient times was antibiotic because the starter for it—the mix of yeasts and fungi used to ferment it—included microorganisms that produced tetracycline. Residue analyses showed that there was enough in the beer to treat infectious diseases in the drinkers (Armelagos 2000).

Several areas of the world have been claimed as "long-life" areas. Dan Georgakas, in a delightful book called *The Methuselah Factor* (1980), debunked several of the claims in question. The Hunza of northern Pakistan gained a reputation for health because no one saw sick people among them. Actually, they kept their sick indoors—the climate is fierce. When a medical doctor visited Hunza, he found as much sickness and early death as one would expect in that part of the world. The long-life claims of the Abkhazians, the people of Vilcabamba in Ecuador, and many other communities have been similarly debunked. It seems they were prone to showing visitors the birth records of their grandparents—names are often recycled two or three generations down the line in those areas. Long-life tourism became significant in the local income.

Yet another dubious claim is that starving yourself will make you live longer. It has been known since Hippocrates and Galen that eating too much was dangerous, but newer claims are that yeasts, fruit flies, mice, monkeys and people all live longer if they not only avoid obesity but cut calories to famine levels. In an excellent recent review of biology and nutrition by Stephen Simpson and David Raubenheimer (2012: 57–66), this claim is cut down to size. It seems that the yeasts and fruit flies actually did better when given their favorite ratio of protein to carbohydrates. (It's 1:16 for fruit flies, just in case you want to raise more of them than your summer fruit bowl is already doing.) The mouse and monkey experiments compared lab animals, fed ad lib and given little if any exercise, with animals given a normal lifestyle. In other words, couch potatoes were compared with active outdoors individuals.

Simpson and Raubenheimer point out that humans aim for a 15% protein intake (no special ratio to carbs), but with a diet of processed fast food they rarely get it (fast food runs to carbs and oil); so part of modern obesity is a desperate striving to get enough protein to make a balanced diet, or at least to get enough protein to stay healthy. Simpson and Raubenheimer also emphasize the effects of exercise: reducing exercise not only means that the same amount of food suddenly starts making us fat; it also means that the beneficial metabolic effects of exercise are also reduced (Simpson and Raubenheimer 2012:174–189). Calorie restriction lengthens the life of worms and flies, but in mammals it does not seem to help—unless they were being fed too much. Mice lived longer when fed less, but perhaps this was because they had been eating too much lab chow, and not necessarily the best (see Maxmen 2012). Monkeys do not live obviously longer or better on a restricted diet (Mattison et al. 2012), again unless they have been eating too much lab chow. Self-starvation seems definitely unnecessary.

One may note, also, the recent attention paid to southwest France, the longest-lived part of the Western world. The people of the area eat much butter, cheese, and paté, so there are claims that such foods are "not so bad." The truth, however, is that the southwest French lived hard lives when the current oldsters were growing up. Diet ran heavily to whole grains and fresh vegetables (Strang 1991). Exercise was inevitable for most and came in the form of sixteen-hour days of labor on the peasant farm. Only the richest could afford much meat or butter. It was under those harsh circumstances that they developed their toughness. We can predict that the current generation, raised on butter and cream, will live shorter lives for it.

Elie Metchnikoff, the elucidator of the immune system, noted that Bulgarians lived long, even in the bad old days when poverty and disease were rampant. He ascribed this to yogurt (E. Metchnikoff 1908; O. Metchnikoff 1921). He was partly right, but we now would add their fondness for fresh vegetables and fruits and their poverty-forced abstinence from meat, sugar, and cheese. His enormous prestige as a scientist gave him all appearances of authority, and yogurt rapidly gained popularity. Previously unknown in the English-speaking world, it became more and more popular as a health food, especially after 1950 (Gardner 1957). It is still with us, in every store and market in the United States and now even in urban China—an amazing tribute to the ability of one man to change world foodways.

Japan is the longest-lived country in the world (along with Iceland), and its longest-lived people are found in interior mountain villages, where exercise is forced on one by the terrain and where the diet is (or recently was) largely unpolished rice, fresh vegetables, and soybeans. South China has some similar but slightly less longevous villages, notably among the Zhuang (Thai-speaking) peoples of Kwangsi. Studies in China in the 1980s, by T. Colin Campbell and associates, showed an astonishing level of freedom from degenerative diseases (Campbell and Campbell 2005). Heart and circulatory diseases and diabetes hardly existed. Most cancers were rare. The diet of grains that were not highly milled, along with many and varied vegetables, bean curd, and little else, was healthy and protective. Antioxidants were high. Campbell does not mention it, but one reason is the traditional Chinese use of antioxidant-rich vegetables and fruits as medicinal foods. Meat, fat, sugar, alcohol, and highly processed starches were conspicuously absent from everyday diets. Cholesterol levels averaged 127 milligrams/deciliter, as opposed to over 200 in the United States today. This may have contributed to some cancers, and so did the limited and often polluted diet, but on the whole people were healthy and long-lived if they survived the frequent infantile diseases. Calorie consumption was low, which is associated with long life in all animals from worms to monkeys, and presumably in humans, too,—but only if they were eating too richly before restriction.

Unfortunately, and ironically, economic growth and the improvement of life has proven deadly. As we have seen, people love fats and sweets, and affluence gives them the chance to enjoy. Heart disease, stroke, and diabetes have soared. The vast strides China made in the twentieth century, through fighting poverty, malnutrition, and infectious disease, have come to a sudden halt as degenerative diseases increase.

This is a worldwide story. Developing countries have become major growth areas for such conditions, especially obesity and diabetes. New evidence suggests that dementia is also hastened by poor foodways and is postponed by vitamin- and antioxidant-rich foods (Scarmeas et al. 2006). The problem is a lifestyle change. Affluence is part of it, but commoner and perhaps more tragic is the case in which affluence has not much increased but lifestyles have changed for both rich and poor in the direction of less exercise and worse food. Urbanization, mechanization, and so on have reduced activity even for the hard-working classes. The cheapest food is now often sodas, candy, white bread, heavily milled grain and potato products, and other processed foods with high glycemic indices. The traditional protective foods—the fruits and vegetables, beans and fish—have become rapidly more expensive and difficult to find. They are displaced by environmental deterioration, overfishing, cash-cropping instead of subsistence farming, and badly planned development (see Chapter 13). A worldwide epidemic of disability is confronting us. A reporter for *Time* recently revisited Ancel Keys's field site in south Italy and found these changes all too well under way (Faris 2012). Fortunately, Keys's site in Crete has changed less, and his sites in countries that were then more affluent but ironically less healthy have generally improved. His dramatic findings in Finland, where men were dying in their fifties after a lifetime of hard work, alcohol, rich dairy products, and smoking, led to major public health efforts there: food improved (vegetables were discovered), smoking was fiercely combatted, alcohol consumption was modified somewhat, and life expectancy soared. In the United States, butterfat, beef, and smoking are down considerably, especially among the most at risk—older males. Unfortunately, this is partially offset by consumption of too much sugar and oil. Still, it is clear that people can and will change. It takes considerable effort to do it. The more firmly established are the habits, the more people have to weigh in with increasingly persuasive messages. But it does happen if messages are sustained. Too many change advocates give up when they cannot get the whole job done in a year. These things take time, and the battles are never definitively won; the advertisers of cigarettes, candy, and empty calories are ever with us.

Meanwhile, if you want to live long, remember that reasonable exercise is at least as valuable as food. So is psychological well-being: value your relationships, dedicate your life to good people and causes, and socialize pleasantly (Friedman and Martin 2011). Food isn't everything. I have met too many people who obsessed about food while ignoring serious and evident health problems in other areas.

Were one to go round the world with the intention of giving a good supper to the righteous and a sound drubbing to the wicked, he would frequently be embarrassed in his choice, and would find that the merits of most men [and women] scarcely amount to the value of either.
—*David Hume, "Of the Immortality of the Soul" (1992)*

3 MORE NEEDS THAN ONE

Food may or may not be a source of more pleasure than sex, but it does have one advantage: it is easier to study. Observing people's sex lives is Not Done, at least in societies known to me. Americans love to talk obsessively about their sex lives, but their honesty may lag well behind their talkativeness, and one is not allowed to check by observation.

Food, by contrast, is normally a public matter. There are some societies, all very food-short ones, in which eating is a private or even secret matter. In the vast majority of societies, however, eating is done in an open, sociable fashion. One eats with family, friends, workmates, or the general public. Cafés have large picture windows or, better still, tables right out on the sidewalk. Feasts are wide-open, general-invitation affairs. Food markets and restaurants are open to the world and are often the centers of activity and life for the communities that support them.

Human needs go far beyond nutrition. Inevitably, people use food to satisfy many needs beyond those for simple nutrients. Throwing tomatoes at a politician signals something; taking holy communion signals something very different.

For convenience, we may begin with a somewhat modified version of Abraham Maslow's classic list of the broad classes of human needs. Maslow (1970) began with the biological needs of all organisms, then progressed to the "higher" needs that come with an enlarged brain and, ultimately, with the human condition. For lack of a better way to make sense out of the wellsprings of human motivation, beginning with life-and-death need groups is at least convenient. I follow Maslow, though I have rearranged and revised his table on the basis of information that has come out since 1970.

All needs are complex. We have seen, above, that the need for "food" is actually a whole set of needs for protein, carbohydrates, and almost three dozen other nutrients. Our other needs are equally broad and complex.

1. NUTRITION

This has been covered above.

2. TEMPERATURE REGULATION

One normally thinks of "clothing and shelter" here. However, food is important—and is usually the most important thing—in maintaining body temperature. It is the fuel we burn. Many groups exposed to rough weather adjust by developing high and fast metabolic activity so that they can burn food instead of having to wear layers of clothing. When I worked with the Nuu-chah-nulth of western Canada, I noticed that they ate a great deal but wore very light clothes when working in the almost permanent cold rain of their habitat. (This rain soaked everything, so heavier clothing would have been worse, not better.) Before the twentieth century, they used to drink straight whale oil by the cupful. They had adapted. We are all aware, on a more trivial level, of the value of hot drinks and cooling drinks. Hot soup on a cold day provides immediate body heat as well as calories to withstand the cold. And all that clothing does, after all, is hold in the heat that our bodies manufacture from food or, at most, prevent water from reaching the skin and pulling the body heat out. Water carries heat many times better than air, so even slight wetting will chill.

3. DEALING WITH SICKNESS

Staying healthy is an obvious life-or-death need for any organism. Diet therapy is found commonly in all cultures. Chicken soup is a well-nigh universal recourse in case of colds. Mint tea is a highly effective stomach medicine, and almost everybody knows it (for more on this, see Chapter 6.)

Food may be used to address sickness, but it is also a source of illness. Food-borne infections (notably from *Salmonella,* but also from *Escherichia coli, Listeria,* and dozens of other microbes) are abundant even in rich countries. The United States has about 76 million cases of food-caused illnesses a year, including 5,000 deaths (DeLauro 2003).

4. SLEEP AND AROUSAL

Humans need sleep. In fact, we need a whole cycle, from deep sleep to dreaming sleep to drowsy awaking to bright-eyed alertness. Sleep is easily manipulated by food. For most of us, thankfully, a full meal or a glass of wine remain adequate, and preferable to a sleeping pill.

Arousal is more interesting. We rarely think of it as a problem, yet an enormous percentage of international trade in foodstuffs—up to 15% of the value of international trade in foodstuffs, in past years—is in foods whose sole value is to wake us up: coffee, tea, cola, and other stimulants. These are sources of caffeine or closely related methylxanthine alkaloids; they work by preempting and blocking the brain's receptors to adenosine, the natural "sleepy" chemical (Anderson 2003; the reverse process makes antihistamines good for sleeping, histamine being a natural "wake-up" chemical in the brain). Unlike the demand for alcohol, which was ancient when the first records appeared, the demand for stimulants is quite new. It correlates beautifully with the rise of clocks and timesheets. Tea in China came first, growing in popularity as the Chinese empire developed, instituted dawn or even pre-dawn court sessions, and developed ever more sophisticated timekeeping mechanisms (from sundials to water clocks to real clockwork). Chocolate in the New World was at least as early and was associated with court sessions; no clocks existed there, but ethnography shows that New World indigenous societies stressed the advantages of pre-dawn councils to examine the stars and weather. Coffee spread from Ethiopia to Arabia around 1400 and then spread rapidly throughout a newly time-conscious, clock-infested

Western world. Its association with "work discipline" in Europe has long been known. Less known is the fact that these stimulant-rich drinks have always been associated with lively meetings and meeting places: teahouses, coffee shops, cafés, and so on. These places have chronically been most unpopular with governments, many of which fear above all a citizenry that gets together and thinks and talks. Also associated are religious ceremonies; the need to keep the worshipers awake and excited has led to ceremonial use of almost all the caffeine drinks (Anderson 2003). The coffee place has taken a new life in America, thanks in large measure to Alfred Peet (1920–2007), a Dutch spice merchant turned coffeeshop owner in Berkeley. I used to frequent his establishment in its early days—it opened in 1966—for its truly exceptional coffee. He advised the young men who started a humble hole-in-the-wall called Starbucks in Pike Place Market, Seattle, around 1971, and the rest is history; Peet's and Starbuck's are everywhere now (Rourke 2007). Today in America, only 29% make their own coffee; 25% get it at Starbucks. MacDonald's is next with 16% (Saporito 2012). (I usually make my own but frequently resort to Starbucks, too, having started in 1973 when the only Starbucks was the one in Pike Place Market.)

Perhaps best covered under this rubric is the concept of food as sheer "fun," but that takes us into a much more exotic realm, a realm not necessary for "life" but certainly necessary for "living": aesthetics.

5. SEX AND REPRODUCTION

No foods actually work as aphrodisiacs (though "Spanish fly"—a cantharide beetle preparation that irritates the urethra and thus creates something between desire and discomfort—is used in Moroccan cooking). However, every culture has its body of lore about "aphrodisiac" foods, and countless books have been written about them (Benedek 2000). Most obvious candidates for (purely mythical) "aphrodisiac" value are the penes and testes of notoriously randy animals: bulls in Europe and America, seals and deer in East Asia, and so on. Everything that looks even slightly like testes (oysters . . .), penes (asparagus . . .), or female genitalia (peaches . . .) has been credited with "aphrodisiac" properties.

An ancient Mediterranean belief credits nut candy with such powers; nut lukum (a gelatinous candy, often called "Turkish delight") is now almost universally labeled "Turkish Viagra" in Turkish bazaars, and

Morocco has a commodity sold to tourists as "Moroccan Viagra," made of honey with almonds and argan nut oil.

All of these foods can sometimes work if the eater believes strongly enough. Nothing is more responsive to the placebo effect than the sexual function. A gentleman observed selling tap water as "Viagra" in one Mexican city probably obtained a success rate not far behind the genuine article.

Infant and child nutrition is a far more complex and serious matter than aphrodisiasis. One has to worry about nursing infants, weaning them, and deciding how to feed them as they grow older. Breastfeeding, in particular, has been a problem going far beyond nutrition. Mother's milk remains by far the best food for babies. (On this and what follows, see Blackburn and Loper 1992; Cunningham et al. 1991; Dupuis 2002; Gluckman and Hanson 2012; Lutter and Lutter 2012; Naylor 1997; Quandt 2000; Rebar 1994; Wellstart International 1992. I also acknowledge information from my wife, a nurse-midwife and public health professor.) Human milk is quite high in sugars (some of which nourish beneficent gut flora) and protein and varies according to the age of the infant, according to growth needs at the time (Petherick 2010). (Marsupials do this even more dramatically, varying the milk from each nipple differently; humans may do this to some extent.) Cow's milk is quite different in composition, having less sugar and less available iron. Human milk is rich in vitamin C, which humans must take in, but cow's milk has almost no vitamin C because calves synthesize their own. (Conversely, cow's milk has more B vitamins because calves grow faster and need to build tissue systems quickly. And horse milk has more sugar, whale milk more fat, reindeer milk more protein . . . every mammal has the milk its own babies need.)

Even making up formulas with all these ingredients added does not solve the problem. Mother's milk and colostrum stimulate the formation of the immune system and include poorly understood substances that stimulate brain growth; a bottle-fed baby has a poorer immune response and, all too often, a poorer brain than he or she might have had. Bottle babies are more prone than are breastfed ones to allergies as well as to disease. A Danish study showed breastfed children are slightly more intelligent than bottle-fed, and there has been some replication of this finding (Lutter and Lutter 2012). Breastfeeding also reduces ovarian and breast cancer, hypertension, and ill health in general, compared to bottle feeding.

This problem is not really serious in well-to-do areas—babies raised on formula usually turn out fine, if somewhat less healthy than they could theoretically be—but becomes acute in areas where clean water is not available. A bottle made up from powdered milk or formula, with dirty, contaminated water, is the lot of many babies in the Third World—and even in parts of the United States.

The problems with bottle feeding have been recognized for decades but have not been adequately addressed, in spite of countless resolutions (e.g., World Health Organization 1994) and countless initiatives, such as the "baby-friendly hospital" initiative (Wellstart International 1996). The problems are two (Pelto 2000; Van Esterik 1989, 1992, 1997). First, aggressive marketing by formula-making companies such as Nestlé has led to a widespread belief that formula is "better" than, or at least as good as, breast milk. Reactions have included widespread boycotts and public criticism, but the problem is only partially solved. There are, of course, a few women who cannot nurse—but the vast majority of non-nursers have chosen not to, very often because they were manipulated by hospitals and formula makers.

Second, modern lifestyles are not baby friendly. In particular, employers, especially in the sweatshops of the Third World, have been extremely unwilling to make time for breastfeeding. (Many sweatshops do not even allow bathroom breaks except at lunchtime.) The employers get a few more minutes of work out of women employees, but society pays an appalling cost. More widespread if less damaging is the failure to provide quiet places and other public support for nursing. Many hospitals—significantly, those that receive large donations of materials from formula companies—still make it difficult for new mothers to nurse. My own family has had some bitter experiences with appallingly poor lactation coaching. I have also run into claims that "it's only politics"—formula companies have succeeded in maintaining a controversy.

There are even residual pockets of absurd puritanism. Not to go beyond my own experience: the manager of a bookstore near my home recently expelled a nursing mother for her "scandalous" behavior. The bookstore in question had a huge display of lurid and kinky pornography at child's-eye level.

As a result of all this, babies do not get optimal nutrition in the United States or most of the urban Third World. It is the most civilized and least civilized areas of the world that unite in treating mothers and babies decently; western Europe joins the surviving traditional rural societies (such as my Maya friends in Quintana Roo) in holding stalwartly to breastfeeding.

Of all the ways that human nutrition could be improved, promotion of breastfeeding is the most critical. Not only breastfeeding, but infant nutrition in general, has such huge effects on the health and income of the children in their future lives that this is an area where small investments would have enormous results (Lutter and Lutter 2012).

Milk, breast and otherwise, has been the subject of endless debates in nutritional science, popular culture, and medical discourse. It has become a political topic. It has been comfort food, fattening food, heart disease food, and, in short, a kind of natural projective test. Melanie Dupuis (2002) has chronicled the politicized rhetoric around it in America.

6. CONTROL NEEDS

It has been abundantly shown that humans have a genuine biological need to feel in some control of their situation (Anderson 1996; Bandura 1982, 1986; Baumeister 2005; Langer 1983; Schulz 1976). Without it, they die. Humans *must* feel safe and secure, above all. This is not just a matter of physical safety. It is more important for people to feel accepted, approved, and socially grounded than to feel physically secure. Food is conspicuously important in demonstrating both types of security. Finally, people need to find meaning in their lives, in the sense of that word as used by Viktor Frankl (1959, 1978): something truly to *live for.* Frankl, confined to a Nazi death camp in World War II, found that the few survivors were those who had a career and/or a loved one (or, better, loved ones) to live for. This result has proved robust; it seems general. Few people live for food in that sense, but many live to feed the starving or to increase and improve the world food supply. Such enterprises give meaning. This is a far too rarely considered aspect of human needs.

Anorexia nervosa, bulimia, and similar eating pathologies are apparently due in large part to problems with control of self and self-image (see *American Psychologist* 2007; Bordo 1997; Bruch 1978; Prescott 2000). Genetics and other factors may be involved in these dreadful conditions, which now affect millions of people—the vast majority of them young women. Standards of beauty, perfectionism, and an extreme overdevelopment of the control need combine to produce a life-threatening commitment to being thin. The extreme thinness that has been idealized in Western cultures for the last 30 years is particularly dangerous to women's health; even if they do not get anorexia, they often starve themselves to the point of amenorrhea, and they have no fat reserves to draw on in case of sickness or emergency. It has been frequently noted that fatness is idealized in cultures that are short of food, while thinness is idealized where bulk calories are easier to find than good exercise facilities (Anderson 1988; Brown and Konner 1998). This has come to the point at which some countries are banning fashion models with body mass indices less than 18. Many other factors, both genetic and environmental, clearly enter into the anorexia pattern; many books have been written about this issue, and the full explanation of the phenomenon is not clear.

However, contrary to some claims, anorexia nervosa is not unknown in other cultures. It is widespread in the world today (Prescott 2000). It may have been common during the Middle Ages, judging from the harrowing tales of self-starvation in the lives of saints, but the cultural climate was different and the question remains open (Prescott 2000:1003).

More clear are literary descriptions. The great Chinese novel *The Story of the Stone* (Cao 1973–1986 [eighteenth century]) describes in excruciating detail the progressive wasting away of the heroine, Lin Daiyu, who exhibits a perfect clinical picture of typical anorexia. Raised in luxury but overcontrolled and subjected to perfectionist expectations, the young woman refuses to eat and denies feeling hungry, as part of her painful rebellion against control and subjection. Other sources, including traditional Japanese and Russian literature, include less clear but still suggestive accounts.

Part of feeling in control is understanding one's situation. Learning, study, and scholarship are thus, in part, outgrowths of a basic need to know where one is in the world. Even lab rats, when introduced to a new environment, cannot rest till they have explored every part of it. Humans are far more complex. The endless quest for knowledge is motivated by many things—from need for food to the sheer pleasure of seeking—but it is fundamentally an outgrowth of the same urges to explore, understand, and control. Curiosity about food is, of course, part of this, and fuels a constant interest.

More serious is the need to feel secure, and few things are more worrisome than insecurity about food. "Wondering where your next meal is coming from" is, in fact, proverbial, with equivalents in almost any major language, as the ultimate security worry. Feeding the hungry is enjoined by all the foundational religious texts and by almost all moralists.

7. SOCIAL NEEDS

Finally, the "highest," and perhaps the most serious, of human needs are the social needs. The need for human company is a life-or-death need for infants, not only because adults provide care but also because caregivers provide love. We know this from experiments with other primates but, more directly and poignantly, we know this from stories of abuse and neglect in homes and orphanages. Children with their other needs satisfied die if they do not get loving, nurturant care. If they get only a small amount, they live, but are proportionately damaged. The importance of society to adults needs no elaboration. What does require discussion are the complex ways in which food is manipulated in social contexts.

These interact with the control needs; hierarchies and social insecurity are outcomes of both. Food becomes a symbol of comfort, home, and love. Psychologically devastated people very often overeat or starve themselves.

Sociability and autonomy conflict in us all, guaranteeing that humans will never be satisfied and will always have to make hard choices. Theories that focus on practice, dialogue, and negotiation have been applied to the business of eating (cf. Bourdieu 1977, 1990 [1980]; Certeau 1984; Heldke 1988; see also Curtin and Heldke 1992).

Food is thus not an end in itself, but a means to many ends. Food as fuel is a means to the goal of being able to survive and accomplish. Food as social facilitator is not an end in itself; the end goal is the social life that the food facilitates. Food as fun might be considered an end in itself, but the actual goal is not the food but a sensation of arousal or sometimes a feeling of snobbish gourmetship.

With so many needs to satisfy, and so many foods that can be used, it is difficult indeed for any human to calculate a perfectly optimum foraging strategy. We simply don't have the brains to work it out, unless we are in a place where we have to eat everything we can bite (as among the Ache of Paraguay; see Gurven 2006) or where there is nothing to eat except two or three things. Moreover, we have to trade off control against sociability, pleasure against health, and much more—this in a constantly changing, shifting world.

Many food studies in recent years have been vitiated by extreme "social constructionism," the idea that society or culture "constructs" all that we believe and do. A corollary, sometimes traced, is that the powers-that-be in society construct what we do, inevitably making things worse for us (this is an exaggerated and oversimplified form of a point argued—with subtlety and convincing evidence—by Michel Foucault [e.g., Foucault 1970]). Some writers appear to believe that society or culture determines every belief—that nutritional needs are socially constructed, not biological.

However, nutritional reality cannot be ignored. Moreover, individuals, not cultures, construct their own foodways, for their own reasons. What culture does is provide a wealth of knowledge and rules on which to build. Cultural information is merely one input into the construction process. Individual intention and agency (and, no doubt, some subconscious or unconscious factors too) determine actual food consumption.

That said, it is true that the powers-that-be not infrequently persuade or force people to eat particular things in particular ways. Foucault could have found as much evidence for this in foodways as he did in his studies of the history of sexuality. However, people can learn and resist. The result is constant negotiation, not a stable and fixed "construction."

Recent studies from the strongly constructionist point of view have had one very good result: they have directed attention to the full complexity of cultural/social views of foods. If foods are symbols, used in communication, then one would expect to find the encoding and decoding of messages sent by food to be extremely complex and interesting. This is, indeed, what recent scholars do find.

4 THE SENSES
Taste, Smell, and the Adapted Mind

A walk with a dog can reveal much about scent preferences. While the human enjoys the scent of flowers, resins, and fresh foliage, the dog delights in seeking out garbage, carrion, and excrement. Indeed, the dog often perfumes itself with these substances, by rolling and rubbing its shoulders in them.

The actual taste receptors on the tongue detect salt, sweet, bitter, and sour, as well as the taste of monosodium glutamate (a taste called "umami"), but not other taste characteristics. The receptors—only recently identified—are particular molecules in the taste buds on the tongue. It turns out that these receptors occur also in other areas; sweet receptors in the gut help regulate blood sugar levels. Umami receptors occur in sperm and appear to regulate the actual fertilization process (discharge of DNA into the ovum; see Trivedi 2012).

Otherwise, explaining foodways may reasonably begin with explaining scent preferences. Most of what we call "taste" is actually smell. Everything else—meatiness, rose and saffron flavors, scorched tastes, yeasty and fermented notes, and all—is processed by scent receptors in the nose. Food vapors ascend through the nasopharynx from mouth to nose, there to be analyzed. Thus, to understand food "taste," we have to understand smell. (We also react—probably because of Pavlovian conditioning or simply the power of suggestion—to sounds, textures, and sights associated with good food. Sharp-cornered blocks of cheese taste sharper than rounded ones. White wine dyed red is hard to tell from red wine. Playing sea sounds is said to make sea food taste better, and playing crunchy sounds makes potato chips seem better [Bakalar 2012]. I can vouch for the fact that essentially the same hamburger "tastes better" to most people in a specialty hamburger stand than in a fast-food outlet.)

A "sweet disposition" seems to follow from sweet tastes—at least eating, or even thinking, about sweets makes one act slightly nicer. A literal "bad taste in the mouth" is also apt to affect behavior (Sohn 2012). Whether this is language causing attitude or a natural trait causing metaphor, or even both, remains to be seen.

Humans rely to a considerable extent on appearance, sound, mouthfeel, and other non-scent cues (Shepard 2012). Soggy potato chips taste terrible! Food industry experts work terribly hard to get the right degree of crunch in such products or the right degree of softness in yogurt, custard, and chocolate (McGee 2004). Food adulteration often involves supplying the right appearance—the taste follows, often enough to make this a generally successful scam.

Scent, however, remains the basic sense. The scent preferences of the dog are easily explained. Dogs are scavengers; they are attracted to the scent of their food. They are also acutely sensitive to the odors of other dogs. Pheromones in excreted materials are a major channel of canine communication. In fact, almost all mammals except humans communicate through excreted materials, and I am deeply thankful that we evolved away from that particular channel.

The reasons for the human's preference are less clear. We know much more about the dog. Humans do not usually eat flowers, nor do they eat bark or other tough vegetable matter. Of course, humans also show sensitivity to, and appreciation of, the smells and tastes of typical human foods, but when humans wish to create a beautifully scented environment, they almost invariably fall back on floral or resinous smells. Moreover, the smells and tastes we favor in foods are an odd set. Spices, herbs, onions, garlic, chile peppers, and sharp condiments such as mustard have a worldwide popularity that runs far beyond their small contribution to human nutrition. (Incidentally, this chapter concentrates on food because it is in a book about food, but everything said below goes for perfume as well. When all other animals want to smell each other's body scents and pheromones, humans almost universally prefer to smell flowers and resins on each other. The scents of perfume are all volatile oils, and the favorite ones, like the favorite flavors of spices and herbs, are usually intensely antiseptic.)

The fragrant substances that humans appreciate are almost all volatile oils. These are light molecules based on ring structures.[1] They evaporate easily and hence are available to the nose. Most of them are found in plants, where they usually serve protective functions—repelling insects, killing bacteria, and the like. They do not correlate with edibility or poisonousness in plants. Humans like certain oils and resins that are described in English by adjectives such as "spicy," "minty," "piny," and "floral" (Gibbons 1986; Moncrief 1966; Stoddart 1990).

It is easy to tell apart the species of sage (*Salvia*), for instance, by smell, because each species has its own mix of the two dozen or so volatile oils that commonly perfume plants of this genus. Volatile oils—and, to a lesser extent, resins—are therefore the most efficient guides to use in sniffing one's way through the environment.

Most of the "tastes" we favor in foods are actually the scents of volatile oils. By contrast, the foods that actually give us most of our nutrition—starches, raw meat, leaves—evoke little scent response in humans. We like the tastes of grain, nuts, beans, and meat, but we are relatively insensitive to their smells in the natural, raw state. Fruit is the great exception—an exception easily explained by our primate heritage. We evolved from a long line of fruit eaters, all acutely attuned to the chemicals secreted by ripe fruit (Milton 1993). Pure carbohydrates, proteins, and fats are essentially tasteless and odorless to humans. Simple alcohols have a weakly detectable scent. Humans also react to a range of molecules associated with foods—but, typically, these are reactions to smells released or created during cooking (see McGee 1984:esp. 608–609, 2004:118–178), a process probably invented after humans had evolved to reasonably modern biological status. Animals burned in wildfires do *not* smell like well-cooked meat. As we have seen, however, people have apparently been cooking meat for at least a million years.

Anthropologist Margie Profet has long argued for the evolutionary importance of taste (Profet 1992)—sweetness attracts us to fruit (cf. Mintz 1985); bitterness repels us from poisons. Morning sickness in pregnant women is, in Profet's theory, due to the need to reject anything that could harm the embryo. (Many disagree. See Fessler [2002] for a selection of commentaries.) In addition, Kaplan (1992) and Orians and Heerwagen (1992) argue that human preferences for particular landscapes are indeed founded on instinct. In short, human preferences seem to have biological bases.

Even the *ability* of humans to detect particular volatile oils is of interest and is certainly a genetically determined matter. Why should we have evolved, or retained, the ability to smell these items at all? As Richard Axel has recently written,

> Around 1,000 genes encode 1,000 different odor receptors. . . . Given that mammalian DNA probably contains around 100,000 genes, this finding indicates that 1 percent of all our genes are [*sic*] devoted to the detection of odors, making this the largest gene family thus far identified in mammals. The enormous amount of genetic information devoted to smell perhaps reflects the significance of this sensory system for the survival and reproduction of most mammalian species. (Axel 1995:156)

It seems beyond possibility that such a huge genetic system would not be fine-tuned by natural selection. And we now know that humans have only about 25,000 genes at most, so the percentage is much higher than Axel realized.

Sociobiological and "adapted mind" explanations should, ideally, fulfill two conditions. First, the behavior in question must be universal among human groups or at least so widespread and ancient that diffusion is not a likely explanation for its worldwide presence. Second, the behavior or trait in question should not be more parsimoniously accounted for by the operation of common sense. If everyday human rationality would lead to a given behavior, the burden of proof is on anyone advancing an innatist explanation. A very large range of sociobiological explanations, in particular, are in deep danger from Occam's razor. An intelligent primate can easily figure out social arrangements associated with mating, marrying, rearing young, and finding food. Invoking an evolutionarily complex genetic history for every human behavior is, at the very best, unnecessary. Presumably it is easier for a large-brained primate to change and fine-tune behavior through learning than through evolving fixed action patterns (under rigid genetic guidance) for all behavioral traits.

Many authors, notably Engen (1981), conclude that human preferences in scent are strictly learned. Even Engen, however, admits that musk may possibly have some form of innate appeal (Engen 1981:167, 1991:71).

However, recent research suggests strongly that there is an innate tendency for humans to find some scents attractive and others unattractive (Ehrlichman and Bastone 1992) and that this is evident even in infants (e.g., strawberry and clove being liked very early in life; see Schmidt and Beauchamp 1992). Certainly there are real innate preferences in taste in the narrow sense: Human infants prefer sweet and fat to sour and bitter and soon develop a fondness for salt (Bakalar 2012). It will probably never be possible to separate "nature" from "nurture" in many cases of smell preference (cf. Doty 1991; Kniep and Young 1931; Moncrief 1966), but, in general, it seems that humans dislike a range of toxic chemicals (many of them "aromatics" based on benzene ring structures), and it seems certain that humans have an innate liking for volatiles associated with fruit, flowers, foliage, and plant life in general.

Culture, however, certainly plays an enormous role in defining what smells "good" and what smells "bad." This starts early. Many flavors get into amniotic fluid, and thus babies are born already liking many of their mothers' favorite foods—including garlic (Bakalar 2012). Even more flavors and sensations, including not only garlic and onions but the hotness of chile peppers and many of the tastes of spices and vegetables, get into breast milk. Mothers often make an effort to eat their traditional ethnic foods when they are nursing their babies, to get the latter properly acculturated.

The question is not whether smell preferences are genetic or cultural, but how genetic ability and cultural preference interact. Taste preferences, like other bases of foodways, are a biocultural phenomenon. Biology sets the broad parameters; culture fine-tunes the actual patterns of behavior. In fact, it appears that humanity's acute sensitivity to, and fondness for, these volatiles has a medical explanation.

Paul Sherman and Jennifer Billing (Billing and Sherman 1998; Sherman and Billing 1999) point out that common spices, herbs, chile, and garlic contain potent antimicrobial and antifungal chemicals. They surveyed world use of such compounds and found that they are most used in areas that have major problems with food spoilage—largely tropical lands, the hotter the spicier. From my own research, I can add that extratropical areas with a fondness for spices and "hot" foods are characterized by rural poverty and dense populations, major risk factors for food-borne diseases. So Sherman and Billing argue that people have learned over the millennia to use spices and other chemicals as preservatives and disinfectants. This argument is powerfully confirmed by the extremely widespread and important use of these and other volatile-oil-rich plants in traditional medicine (Etkin 1986, 1994).

Among the most easily detected odors are the smells of mint (menthol and related chemicals), thyme and its relatives (thymol and relatives), and cinnamon (cinnamaldehyde), to say nothing of the well-known fragrances of rose, lavender, nutmeg, vanilla, sagebrush, and many more. Humans can smell these in very low concentrations.

The taste for spicy, herbal, and floral volatile oils is widespread. Paul Sherman, an expert on naked mole-rats, made a brilliant detour into this research area with his students. Billing and Sherman (1998), Sherman and Billing (1999), and Sherman and Flaxman (2001) provide full surveys and documentation (see also Engen 1981; Moncrief 1966; and the articles in Serby and Chobor 1992, esp. Ehrlichman and Bastone 1992). The same basic list seems to provide the basic food flavorings and perfumes in every culture that uses such things. The almost obsessive craving of historic Europe for spices (see, e.g., Toussaint-Samat 1992 [1987]) is not unique; Africa (especially North Africa), west Asia, India, China, Japan, and other regions also imported, and import, spices at great expense. The pre-Columbian civilizations of Mexico independently developed a large spice trade, involving allspice, chiles, chocolate, vanilla, epazote, and dozens of other aromatic plants. Chocolate, like coffee, may owe much of its popularity to its caffeine (and theophylline) content, but it is significant that chocolate is fermented (and coffee is roasted) to bring out the flavor. Fermentation and roasting change

Food and borders, Azrou, Morocco. Spices from around the world in a country market. Photo by E. N. Anderson, 2000.

the chemistry of the volatile oils, making them appealing to the human nose. The explosive success of chocolate around the world certainly owes something to its taste.

Sherman and Flaxman (2001) indicate that onions, garlic, and allspice are almost totally destructive to food-poisoning bacteria, while many other spices, including chiles, are not far behind. They also point out that meat dishes are almost always more highly spiced than nonmeat ones; meat is more prone to incubate dangerous bacteria than vegetables are.

Many or most of the volatiles in question are bacteriocidal or at least bacteriostatic. Others act against fungi, protozoa, and internal and external parasites (Claus 1956; Grieve 1931; Lewis and Elvin-Lewis 1976; Trease and Evans 1978; Tyler et al. 1981). Among the most potent is thymol, still widely used as an antiseptic. Lavender owes its place in the linen closet to its value as a repellent of moths and other insects. Menthol, cinnamon oil, nutmeg oil, rose oil, eucalyptus oil, citrus oils, citronella oil, and many others have been used in antiseptic and insect-repellent preparations. Sage, for instance, has been used in antiseptic medical preparations (Claus 1956:282) as well as folk medicine. Sandalwood oil, cedar oil, juniper oil, and cade oil (derived from the cade juniper), all from popular incense or pleasant-smoke plants, are also effective antiseptics that were widely used in medical practice until recently.[2] The allyl sulfates that give distinctive flavors to onions and garlic are also bacteriostatic and insect repellent and are almost universally liked. There appears to be no more widely used flavoring than onions. Many volatile oils, such as citronella oil, are insect repellent or insecticidal. Peppermint oil, for instance, is intensely insecticidal, killing 85% of mosquito larvae in one set of trials ("Minty Insecticides" 2000). Marr and Tang (1992) have shown that *Zanthoxylum,* a genus whose species (including Chinese brown pepper) are very widely used for flavoring and spicing in East and Southeast Asia and the New World, contains powerful insecticides. Among these are anethole and caryophyllene, both intensely aromatic volatiles found in several other widely liked spices and herbs. In fact, they take their names from their occurrence in dill and clove, respectively.

Many volatiles have stimulant and digestive activity in humans. According to my personal observation (and Grieve 1931), mint is used throughout the world for stomach aches; this is because of the volatile oils it contains, which have carminative, stimulant, and antiseptic properties (Claus 1956:278–279; Tyler et al. 1981:116–121; "carminative" refers to digestive aids that combat indigestion and flatulence). Menthol, the most obvious ingredient in the mints, is antiseptic and antipruritic (Tyler et al. 1981:120–121). Cinnamon, cardamom, fennel seeds, and many related spices are widely eaten for the carminative and digestive effects of their volatile oils (Grieve 1931; Lewis and Elvin-Lewis 1976; Stobart 1970). Most of the volatiles, especially those of spices, have rubefacient (reddening, i.e., circulation-stimulating) and cleansing effects on the skin. An example is carvone, whose the dextrorotatory and levorotatory forms smell like caraway and spearmint, respectively (Engen 1981:6).

Sherman and Flaxman (2001) have extended Profet's argument that pregnant women with morning sickness frequently avoid spicy food.

Morning sickness is widely held to be a protective mechanism, causing women to reject possibly toxic or teratogenic chemicals in foods. Spices are strong stuff, and could be dangerous. Proof is not at hand, however.

Primates appear to use aromatic plants in a "medical" fashion. Chimpanzees have been observed to seek out and feed on herbs known to have medical properties but no significant nutritional value (Baker 1995; Wrangham and Goodall 1989). Mary Baker, in her field studies of *Cebus capucinus* monkeys, has made extensive observations of use by these animals of citrus leaves and fruit and other intensely aromatic leaves (the genera *Citrus, Clematis, Piper,* and *Sloanea* are used; see Baker 1995). Capuchins crush the leaves and rub themselves thoroughly with them. Since citrus oils have some bacteriostatic and insecticidal action, it is very possible that the ultimate purpose of this behavior is to combat fleas, skin diseases, or the like. Other monkeys have been observed using related species, and even lemon-flavored candy (Baker 1995:7). Birds similarly rub themselves with strong-smelling substances, including live ants. Humans have learned to use many of these leaves for the same purpose.

In this realm of self-care, the human animal has more problems than the monkeys do. Thin body hair, long head hair, and copious perspiration form an intractable combination. Moreover, humans are unable to lick or chew many parts of their bodies and cannot even scratch some parts. This is an effect of upright posture and relatively inflexible spine. All of these factors lead to a particularly pressing need for grooming and for use of substances that discourage bacteria and insects.

Antisepsis or insect repelling may have something to do with the human love affair with the cabbage family (*Brassicaceae*), which includes not only cabbage but also mustard, turnips, broccoli, cauliflower, cress, and their relatives. The delightful tastes here are due to a family of chemicals called glucosinolates, which are deadly to insects but merely pleasant stimulants to people. More interesting are a family of chemicals called phenylthiosulfates, which taste intensely bitter to 70% of people (and chimps and many other mammals) and are tasteless to 30%. (You may remember in high school biology encountering a little strip of paper that tasted bitter to some students, tasteless to others. It was impregnated with phenylthiocarbamate, one of these chemicals. This is real "taste," not smell; it is mediated through tongue receptors, especially the fungiform papilli.) This is interestingly and broadly true worldwide. Some people are supertasters and will actually gag and choke on broccoli or (worse) rapini (Bohannon 2010; Carpenter 2003). My family is a crazy quilt of non-tasters, tasters, and supertasters. I am one of the non-tasters and am always bemused by the reaction of my wife, a taster, to rapini (my favorite vegetable)—let alone our older son (a supertaster)! No one has ever figured out why this polymorphism exists and is so widespread. It keeps most people from fully enjoying the stronger cabbage relatives, which might protect them from chemicals that tie up iodine and other nutrients, but this seems inadequate to explain the syndrome.

This leads us to a wider principle: the truth of the old proverb that "one man's meat is another man's poison." At least another species' poison. Humans, descended from a long line of vegetation-eating primates, thrive on a long list of plants that kill many, if not most, other life-forms: brassicas, violets, mint family plants, and so on. The poisons in these plants are usually not alkaloids, and we do well with them. We are much less able to deal with alkaloid poisons (as in the nightshades and their relatives). The whole mosaic of tolerance and toxicity differs for each group of animals, thanks to evolution; natural selection makes animals seek out their proper food and avoid others. Plants evolve new poisons to keep ahead of herbivores, and herbivores evolve new enzymes to break down poisons. Squirrels can thrive on fungi that kill a human with one bite.

The olfactory system and the whole taste apparatus of a given species is generally sensitive to the foods of that species. Turkey vultures can smell carrion for miles (McCartney 1968:95; Stager 1964, and personal communication, 1957). Rats can tell if their food has enough of the right amino acids. Cows can select a good diet from a varied meadow. Humans seem fairly programmed to do this but sorely need cultural traditions to get it right.

USA Today has claimed that food snobs like sour, bitter and umami tastes, while "the rest of us" like salty and sweet tastes (Horovitz 2012). Leaving aside the gratuitous insult, it is pretty clear that culture, biology, experience, and personal idiosyncrasy are all involved, "snobbism" being probably the least of the variables. My family's wildly differing responses to rapini are not a unique spread of experiences.

The olfactory center lies deep in the lower brain. It is ancient in structure and function. It is richly connected to the limbic system, the wellspring of mood and emotionality and a key structure in memory processing. Thus, familiar smells evoke remembered moods in a peculiarly powerful way (Engen 1988; Gibbons 1986; Lawless 1991; Moncrief 1966; Rouby 2002; Serby and Chobor 1992; Stevenson and Boakes 2003; Stoddart 1988, 1990). The scent of madeleines dipped in tea evoked the memories that led Proust to write *À la recherche du temps perdu* (see discussion in Engen 1988, 1991). Stevenson and Boakes (2003) have shown that smell and memory are very closely connected, neurologically and experientially, and have developed a highly sophisticated model of how this works.

Scent picks up volatile chemicals from the environment. These connect with receptors in the nose, which are connected by nerves to the olfactory sectors of the brain. Foods are rich in volatiles—ranging from 90 in crispbread to over 790 in coffee (Stevenson 2009:6). No wonder coffee smells so good and varies so much in taste between different sources and preparations.

Scent was once thought to operate by a "lock and key" system. Certain molecules were said to fit (like keys) into certain molecular receptors (the locks) at the ends of highly specialized nerves in the nasal passages. The truth is now known to be more complex. Molecules are carried into receptor cells by specialized proteins. Particular populations of neurons respond to particular chemicals. The experience of scent emerges from the response of these neurons, their interaction with each other, and the response of the brain to the highly complex message they send (Anholt 1992). "Trained persons can distinguish among at least 10,000 odors upon presentation out of context, while for some experts (e.g., perfumers) this number can be as high as 100,000" (Chobor 1992:356; but Gilbert [2008] disputes this—even the 10,000 figure). About 1,000 of our 25,000 genes code for scent reception (Shepard 2012).

Mice exposed through early life to particular chemicals greatly increase their ability to smell these (Wang et al. 1993), owing to sensitization of neural pathways or to actual neuronal growth. The same is almost certainly true of humans. Humans can even learn to distinguish different molecular shapes of the same scent chemical, though still reporting the shapes all smell the same (Li et al. 2008).[3]

Sheepdogs have at least 20 times as many scent receptors as humans do (Engen 1981:20–21), and bloodhounds are reported to have 300 times as many (Glausiusz 2008). Syrotuck claims that various dog breeds have anywhere from 25 to 44 times as many smell receptors as humans (Syrotuck 1971:13). There is some evidence that humans can smell more things than this implies and that there is actual repression of scent awareness at higher levels of the human brain. Certain pathological conditions, including adrenal cortical insufficiency, may release the human potential in this regard, allowing affected individuals to live in a dog-like world of scents (Henkin 1967; Sacks 1987:156–160). However, human scent genes have lost a lot of activity. Gerstein and Zheng (2006) report that, in primates, the better the color vision, the less the scenting ability. Humans have perhaps the best vision and worst sense of smell among primates.

This comes out in matters such as self-recognition. Humans, visual chauvinists, test animals for self-awareness by putting a spot on the animal's forehead, putting it in front of a mirror, and seeing if it tries to wipe the spot off. This implies that seeing is the only Proper and Right way to recognize anything. I have often tried putting a dog in front of a mirror for the first time, to see what will happen. The dog always reacts with surprise, then sniffs the "dog" in the mirror, and loses all interest—it's obviously a mere trick of the light. But give a dog an article with her own scent on it, or with a strange dog's scent, and watch the reaction! And of course dogs communicate by pheromones, which they can release from glands in feet, anus, shoulders, ears, and so on—all different scents. They can convey messages of exquisite complexity and subtlety by combining these in various ways. The same is true of many, probably most, mammals; they live in a world of scent, not a world of sight.

Humans, however, react strongly to many scents. We can detect extremely low concentrations of butyl mercaptan, a chemical occurring in rancid butter, rotting ginkgo fruit, and other putrefying fatty substances (Engen 1981:4). Sensitivity to butyl mercaptan is a full four orders of magnitude greater than sensitivity to ripe fruit scents (Cain et al. 1992:287). Sensitivity to chemically related compounds associated with spoilage is almost equally high. Most of these smells are perceived as "bad" by adult humans in most cultures. However, experimental and observational data indicate that humans do not instinctively react one way or another to these smells; disgust must be learned (Angyal 1941; Rozin 1987, 1988; Rozin and Fallon 1981). Humans may have evolved as scavengers (Blumenschine and Cavallo 1992) and thus may once have found such smells delightful. Indeed, "high" game and cheese in Europe, "stinking beancurd" in China, and fermented fish sauces in Southeast Asia are culturally approved. The same smell can be experienced as disgusting if experimental subjects are told the smell comes from decay or feces or vomit, attractive if they are told it comes from cheese (Ehrlichman and Bastone 1992; Weir 2011).

Humans also identify individual scents of their family members and apparently have some sensitivity to human pheromones, though this remains under study.

Learning, of course, greatly influences scent and taste preference (Rozin 1982, 1987, 1988; Rozin et al. 1986; Rozin and Fallon 1981; Rozin and Schiller 1980).[4] Even the attractive scent of bacon, noted above, owes more to volatiles in wood smoke (a preservative) than to the pork itself. Many of our most favored food smells (such as frying bacon, fresh bread, and wine) do not occur in nature. Most of human evolution occurred before bacon curing and yeast fermentation were invented or controlled. However, cultural learning leads to highly culture-limited appeal, such as local tastes for particular regional plant foods or highly localized cultural fondnesses for cheese, fish sauce, pickled cabbage, and hung game. According to my research (ongoing), these fermented foods are popular only in areas that had to process foods in these ways in order to store them. Thus cultural learning due to habituation is probable. It is difficult to explain the worldwide appeal of spices and floral scents by recourse to cultural learning.

Several explanations for our affection for herbs and spices do not stand up under investigation. The notion that spices are used to disguise the flavor of rotten food has long been disproved (see, e.g., Billing and Sherman 1998; McGee 1984, 2004; Toussaint-Samat 1992 [1987]). Spices cost their weight in gold in early Renaissance Europe; those who bought them could certainly afford fresh food. In any case, as every cook knows, spices *bring out* the flavors of foods.

Perhaps primates are attentive to flowers—both sight and smell—because these indicate fruit in the future. According to this hypothesis, flowers are attended to because they indicate the size of the coming crop. Kaplan (1992) and Orians and Heerwagen (1992) advance this hypothesis to explain our liking for the appearance of flowers. It fails to explain our attraction to their scent, however. We are extremely sensitive to such things as ylang-ylang and rose but not particularly sensitive to the various aromatic fragrances of such major primate foods as *Ficus* species (various fig species).

Strong plant smells can indicate poison. However, the first line of defense against poisons is the quite different sensory receptor that detects bitterness (Johns 1991; Profet 1992). A few volatile oils are toxic, such as those of juniper, but most are safe, at least in the small amounts usually ingested. Among deadly poisons common in nature, only hydrocyanic acid, with its characteristic flavor familiar from bitter almonds, is easily smelled. Strychnine, botulin, fungal toxins, and other common toxins in nature are not detected by human scent. Finally, toxins that are easily smelled are almost universally considered unpleasant—as any evolutionary biologist would predict.

Some humans try to mask their body scent for hunting purposes. It has been claimed (on thin evidence) that women may camouflage pheromone smells that might indicate ovulation (Damsen 1993; Dobkin de Rios and Hayden 1985; Stoddart 1990). Hunters, however, are more apt to wash carefully to get rid of as much human odor as possible.

There has been a theory that humans wish to reject and deny the animal body and use smells to conceal this aspect of humanity (Rozin and Fallon 1981). This theory, too, does not predict what fragrances will be enjoyed. It has no empirical support; outside of the sour puritanical tradition in the West, humans do not go out of their way to deny the human body.

In fact, there seems to be no doubt that we appreciate spice smells because they mark antibiotic action. We have evolved a desire to anoint ourselves with them. All the volatile oils described in standard pharmacognosy texts (Claus 1956; Tyler et al. 1981) are intensely aromatic and usually considered pleasant. It is a biocultural phenomenon: it is grounded in genetics, but the specific forms it takes are determined by cultural history.[5]

The spice trade has a famous and adventurous history, filled with all the requisite romance, violence, and drama (Dalby 2000; Krondl 2007).

Opening the spice trade with the rest of the world had a great deal to do with the origins of capitalism, science, technology, conquest, and colonialism in Europe. Spices are still a major item of international commerce. Clove, cinnamon, nutmeg, mace, allspice, ginger, cardamom, black pepper, and apiaceous "seeds" (achenes) such as fennel, anise, dill, coriander, and caraway are among the spices whose volatile oils have made them important items in international commerce, used throughout the world, by cooks of literally hundreds of cultures. Current spice trade is one of the world's largest and most far-flung trade networks, involving thousands of tons of botanicals, worth hundreds of millions of dollars, and involving essentially the entire world and all its nations (see, e.g., Purseglove et al. [1981], where extensive figures are reported). Two thousand years ago the spice trade was already extensive and involved most of the known world (Miller 1969). The same spices are consistently the ones most favored.

These spices originated in different parts of the world, sometimes quite obscure and remote parts (clove, nutmeg, and mace from the remote outer islands of Indonesia, allspice and vanilla from tropical Mexico). Their success is not due to their association with some dominant culture. Herbs such as mint, thyme, rosemary, basil, marjoram, and oregano are also very widely popular. The Maya of Mexico and Guatemala, for one example, not only had their own native spices (including allspice, which has gone worldwide) but took enthusiastically to most of the above spices when they became available after the Conquest (Anderson 2010a; Coe 1994). Among Mexican native spices were oreganos and mints of quite similar taste to the Old World species. Native onions were also very widely used by American peoples before contact with Europe. Thus, an inborn fondness for antiseptics, fine-tuned by culture, made history.

5 BASICS
Environment and Economy

Economic Influence

The most basic determinants of foodways are environment and economy.

This is so obvious, and so generally realized, that it is often taken as the whole story (e.g., Harris 1974, 1985; Harris and Ross 1987). Much of the present book is devoted to qualifying such a simple view. However, no one can deny that environment and economy have been the main shapers of foodways for most people over most of history.

In the short run, they can be almost totally determinative. Agriculture in less-than-affluent areas is basically a matter of producing a diet that people can afford. This means it must produce the staples that are the cheapest to grow. That, then, is what people eat. They have no choice.

In a cash economy, economics determines which plants or animals can be grown most cheaply and which will sell at the best price. A plant that grows well but cannot be sold will vanish from a monetized economy. An animal that costs more to rear than it brings on the market will not be reared for sale.

A traditional society, less totally monetized, will reckon in terms of land and labor. The crop that takes the least land will be favored where labor is abundant; rice dominates South China because it produces so much grain per acre, but it demands weeks of work per acre to produce so well (see Geertz 1963). The crop that takes the least labor (per unit output of reasonably good quality food) will dominate in areas where labor is scarce and land abundant. Wheat dominates the north plains of North America, and dominated many plains in the ancient Near East, for this reason.

Overall, traditional societies tend to maximize across nutritional needs. They pick the crop mix that provides the best diet for the least input. They have a high-yield starch staple, a plant protein source, and—almost always—an animal protein source as well. Usually there is a special oil source. They always have high-yield, vitamin-rich fruits and vegetables that serve as "protective foods," supplying necessary micronutrients and often protective chemicals.[1]

One of the most interesting changes was the invention of agriculture. Many theories have been advanced to explain this key development (sometimes called a "revolution"); since no one can go back in time to see it happen, we may never know which is correct. Speculation on the reasons for the rise of agriculture is one of the most fertile sources of publication in the realm of anthropology. However, for reasons of space, crop biology and agroecology must regretfully be left out of this account. Fortunately, these matters are very well covered elsewhere. (For some recent surveys, see Anderson et al. 2011; Barker 2006; Denham et al. 2007; MacNeish 1992; Piperno and Pearsall 2000; Price and Bar-Yosef 2011.)[2]

Changes at the end of the Pleistocene apparently put in process the development of agriculture in several parts of the world. The Near East, China, Mexico, South America (highland and lowland), New Guinea, and perhaps other areas all independently developed agriculture in the few millennia immediately following the last glaciation. This clearly had to do with the spread and increase of plants in those parts of the world; many other factors were no doubt involved. In the Near East and China, in particular, we now know that agriculture started just after the cold, dry Younger Dryas period, around 10,500 BCE. Plants, notably easily domesticated ones like grains and beans, were getting rapidly commoner and lusher growing in these areas. This changed cultivation from almost impossible to almost inevitable (Richerson et al. 2001).

Pounding grain for daily food, Ranomafana, Madagascar. Photo by E. N. Anderson.

A Chinese proverb says, "When you are dying of thirst, it's too late to dig a well." Carl Sauer argued long ago that starving people have no time, energy, or resources; they cannot invent agriculture or develop new crops (Sauer 1952). He proposed that agriculture must have started among reasonably affluent, settled people. This now seems certain. In the Near East, large, complex settlements pre-date agriculture; the spectacular site of Göbekli Tepe, Turkey, just predates the earliest farming and is within sight of the area where chickpeas and one ancient form of wheat (einkorn) were domesticated (Haldorsen et al. 2011; Mann 2011). It seems hard to escape the conclusion that cultivating and domesticating plants was associated with such settlement. At least we can be sure it did not start among the truly desperate. Hunters and gatherers are not as impoverished as many writers still imply. When they do face want, they usually move, a strategy that makes farming even less attractive than it is in good times. Thus farming probably started among people who had enough food; they presumably wanted to produce their favorite foods closer to home.

Sauer's point, and its archaeological confirmation, rule out simple need for food as the reason for agriculture. Therefore, others have sought different explanations. Richard MacNeish (1992) pointed out that agriculture started in seasonally dry, warm-temperate, mountainous areas, where many ecological zones were closely packed together and where many seasonal resources encourage storage and husbanding; he further hypothesized that trade between inhabitants of neighboring ecological zones was important. One might suppose that people in one zone wanted to have their special product close to the house, to be available for trading with people from neighboring zones. I think this was indeed the direct reason for agriculture.

Ecological shifts at the end of the Pleistocene set the stage and context. In some areas this meant more moisture and thus better conditions for plants. However, V. Gordon Childe (1951:67) suggested that local drying at the end of the Pleistocene concentrated people around oases, where they would have much incentive to plant grains like wheat, which they had once found locally but then had to grow in the moist oases if they wanted it. This would have come after the early climatic improvement at the end of the Younger Dryas; a hot, dry period occurred around 4000–6000 BCE. Recent research makes Childe's model seem possible (Leslie Quintero, Philip Wilke, personal communication, 2002, 2003; they are colleagues of mine who have been doing the research in question). Agriculture in the Near East started around 9500 BCE, during a time of rapid climate fluctuations that must have stressed local groups and made them want to keep grain growing close to home. Childe also picked up on the issue of trade, seeing it—surely correctly—as essential to the rise of agriculture (see Childe 1951:72; he also saw women as the inventors—a long-popular, if unprovable, idea).

Did agriculture improve or hurt human nutrition? The conventional wisdom has always been that agriculture provided more food and a more secure livelihood and that this was the reason for its adoption. This idea was challenged and tested in a major research agenda some years ago. The results were stunning and unequivocal. Skeletal evidence showed that, everywhere in the world, hunters and gatherers were reasonably well nourished, but agriculture led to a slow increase in population and a slow *deterioration* in nutrition (Bocquet-Appel and Naji 2006; Cohen and Armelagos 1984). As numbers increased, people turned more and more to starch staples—not adequate nutrition in themselves. Only very recently, with the rise of refrigerated transport and other modern means of shipping and storing, has agriculture fulfilled its promise of providing really adequate diets to a huge population. Even today, billions of people (not just in Third World nations) subsist on unbalanced diets that are too starchy and too thin on the nutrients that hunter-gatherer diets provide in abundance.

In most of the world, the staple is grain, from one or another species of the grass family. (A grain is technically called a caryopsis; it is a fruit consisting of a seed in several layers of thin, dry, tightly adhering seed coats. These coats have a good deal of nutritional value, while the kernel is mostly starch.) Grasses are tough, versatile, and highly productive. Many of them thrive on disturbance and are thus easy to cultivate. Grains have a good balance of carbohydrate and protein and are easy to store.

Most staple foods that are not grasses are some form of tuber or root crop: potatoes, yams, manioc (a.k.a. cassava, yuca, or tapioca), taro, or the like. Again, these must be disturbance tolerant and productive to be good cultivation choices.

Farmers need back-up crops that will succeed if the staple fails. In Europe it is traditional to grow rye, wheat, and barley. Wheat is usually the staple. In a cold, wet year, wheat and barley fail and rye survives. In a hot dry year, rye and wheat do poorly, but barley flourishes. Very widespread until recently was maslin (mixed) cultivation, in which various grains and even peas and the like were all sown together. If one or two or even three crops failed, there was still some crop to succeed. The grains were often harvested and ground all in one batch, producing bread with varied and interesting flavors but, often, rock-like hardness.

Interestingly, maslin cropping is forbidden in the Bible, along with other agricultural mixes:

> "Thou shalt not sow thy vineyard with divers[e] seeds: lest the fruit of thy seed which thou hast sown, and the fruit of thy vineyard, be defiled. Thou shalt not plow with an ox and an ass together. Thou shalt not wear a garment of divers[e] sorts, as of woollen and linen together." (Deut. 22:9–11)

But practical need won over religious rules in this case.

Farmers also need vegetable, fruit, and spice crops to provide vitamins and minerals, which are typically rather thin in grains and root crops. Many of these are quite consciously used as vitamin pills; traditional people may know nothing of vitamins, but they most certainly know that certain conditions can be cured by certain plants, as will appear later in this book.

All major cultivation systems have domesticated animals; most systems independently developed animal domestication. Most are for food, but dogs were domesticated as pets and for guarding and (probably) hunting, cats for religious reasons and to keep mice out of granaries, and various other specialized animals for other reasons—silkworms being a particularly interesting case. Many animals have lost much brain power in the domestication process: pigs lost fully 33.3% of their brain mass, compared to wild boars; dogs and ferrets, 30%; turkeys, 29%; cats, 27.6%; sheep, 24%; llamas, 18%; guinea pigs, 13%; and pigeons, 7% (Zeder 2012). Much of the diminution is in the sensory and motor cortex areas, but emotions are changed, too; dogs in particular have lost a huge percentage of their limbic systems—basically, the huge chunk devoted to fighting and aggression in the wolf.

The staple grains of the world are the clearest and best studied cases to consider. Wheat and barley were the first species to be cultivated (so far as we know). They were domesticated in the Near East around 9000 BCE. Presumably they were chosen because they were common, easy to grow, productive, nutritious, tasty, and easy to store. In comparable environments elsewhere in the world—Spain, California, Chile, southwest Australia—little or nothing was domesticated. The Near Easterners could have done as the Californian native peoples did, remaining hunter-gatherers to the last. Or Californians and Australians could have domesticated grains. Californians actually domesticated barley for at least some period, about 2,500 years ago (Charles Mikcisek, personal communication, 1991; Wohlgemuth 1996). The Near Easterners also domesticated sheep and goats. The Californians had similar sheep; why did they never domesticate them?

The Near East and Mediterranean have, besides their staple grains (wheat and barley), a range of plant protein sources: chickpeas, lentils, broad beans, and the like—all cultivated from the earliest days of agriculture. Sheep and goats—animal protein sources—were also part of the original roster; pigs and cattle came later. Onions, garlic, and a range of vegetables and herbs are protective foods. (On the origins and spread of agriculture in the Near East, see Zohary and Hopf 2000.)

In China, rice and millets were both early; rice outperformed millets but did not compete with them for land. Both could be cultivated: rice in wet places, millets in dry.

Over time, people find and develop plants that provide the maximum nutrients for minimal input. As money enters the economy, people tend to try for the maximum income for minimum expenditure.

In China (Anderson 1988, 1990), rice provided high yields; wheat and millets backed it up. Maize replaced millets when it was found to be more productive. Much earlier, soybeans had similarly displaced adzuki beans. Soybeans, pigs, chickens, and a range of vegetables provided protein. Chinese cabbages provided vitamin-rich greens and also seed oil.

Africa developed several systems, based on grains (sorghum, a local rice species, several millets) or tuber crops (notably yams—of the genus *Dioscorea,* very different from the large sweet potatoes called "yams" in the United States; on African cultivation see National Research Council 1996, 2006). The rice plant (*Oryza glaberrima*) inspired the development of a sophisticated rice agriculture, which later allowed rice production to expand in North America, usually with the use of Asian rice but African slaves, who were skilled rice farmers (Carney 2001). Superior farming skills made them prime targets for slave raids and brutal oppression. This influenced American cuisine; west African cookery was adopted, especially for rice dishes (Hall 1992; Hess 1992). Jambalaya, for instance, is an Americanized version of the African dish called Wolof rice or Jollof rice; the word comes from Wolof words for "mixed stew with grain" (see Peace Corps The Gambia 1995). Influence spread to music; we owe blues and the banjo to Wolof and Mende skill at rice farming. Both come from their musical traditions; the banjo evolved from their instrument the *banja* (Jägfors 2004). Thus do food economics influence all culture.

The pre-Columbian diet of central Mexico was another optimization across needs. In Mexico, grains were independently domesticated. A form of millet (*Setaria viridis*) similar to Chinese foxtail millet came first but was abandoned when maize came into favor. Maize was subjected to spectacular changes, making an unpromising grass into a high-yield grain (Coe 1994). A choice was made; millet was displaced. Mexico could have grown millet on lands too dry or cold for maize, as China did, but the competitive advantage of doing so was apparently too small to make it worthwhile.

Maize provided the most calories per acre and was the staple. Backup staples included amaranth and chia seeds. The protein staple was the common frijol bean; other beans were also domesticated later on. Animal protein came from turkeys, dogs, fish, and a range of insects. Vitamin-rich crops included tomatoes, chiles, squash, and avocados. No free oil was produced, but chia seeds, squash seeds, and avocados were rich in oils.

Andean South America domesticated the potato, as well as quinoa (*Chenopodium quinoa*), for starch staples; lupine or *tarwi* (*Lupinus mutabilis*) for plant protein; llamas (*Lama glama*) for animal protein; and squash (*Cucurbita maxima,* different from Mexican squash), peanuts, chiles (native ones, including species different from Mexico's), and many other species for protective foods. Several tuber crops similar (but not related) to potatoes were important in the Andes, and some still are important there. (On all these crops, see National Research Council 1989.) Andean South America was the only area of the New World in which animal husbandry was highly evolved. Llamas and alpacas (basically, a woolly variety of llama) were the major domesticates. An eating dog similar to the Mexican one was also developed. Small animals were not neglected by the Andeans; guinea pigs were domesticated to provide a family-meal-sized animal (Morales 1995).

In the South American lowlands, a different system was established (Piperno and Pearsall 2000). Sweet potatoes and manioc were important, with manioc being the most widespread staple. The Muscovy duck (*Cairina moschata*) was apparently domesticated in the upper Amazon.

The very different world of the island Pacific (Polynesia and other island realms) had a similar maximizing solution: taro and other root crops for starch, pigs and chickens for animal protein, coconut for plant protein and oil, and pandanus, taro leaves, and various other vegetables for vitamins. Rice was early introduced via Taiwan to the island world, but the grain grows poorly or is subject to typhoon wreckage in the smaller islands. Root crops produced more food under island conditions and had the advantage that the edible part was underground; the top could blow away in a storm without a famine resulting. Roots are hard to store, but the islanders developed incredibly sophisticated systems to overcome this limit (see Pollock 1992).

In the island world, agriculture spread with speakers of Austronesian languages, especially where no one had lived before. (Elsewhere, the New Guinea center also spread some farming.) The Austronesian speakers came from China via Taiwan. This finding led Peter Bellwood, who worked out the travels of Austronesian agriculture, to theorize that languages spread with agriculture all over the world. A resulting volume included papers that supported or critiqued this idea (see Bellwood and Renfrew 2002). Indeed, some languages spread along with farming; some did not. The ancestors of Chinese and Thai probably spread with millet and rice respectively, and several other languages probably did, too. In contrast, the Indo-European languages spread much later than agriculture in Europe and elsewhere—they seem to have spread with the horse and horse-drawn chariots, thousands of years after agriculture was known throughout Europe (Anthony 2007).

Every environment provides a large range of possible domesticates. It also provides settings in which some of these do much better than others, different settings in which the others flourish, and perhaps some settings in which everything can grow. Given that people tend to experiment, that most environments have a huge range of edible items, and that famines may force people to eat what they usually hate, there is always a place for choice.

Once a staple crop is established, we have what economists call a "lock-in." A pattern continues because it is cheap to replicate and would be expensive, both financially and psychologically, to change. The whole of north European agriculture is based around a highly complex but very efficient system of wheat and small-grain production. From the plow types to the bakeries and pasta factories, everything is set up to deal with wheat. So, although the potato came early and proved far more productive and well adapted than wheat, wheat remains the staple food—except in areas too poor and marginal to afford it. The iron hand of economics forced the impoverished Irish and Poles to live on potatoes in the old days, but they yearned for bread—and now they can afford bread, and are eating fewer potatoes. Potatoes added themselves to the system, but did not destroy it. Conversely, the introduction of wheat and barley to the potato's homeland in Peru and Bolivia did not displace the potato there. The potato did better under the conditions of indigenous farming, and the indigenous farmers knew how to grow it. Moreover, they had developed countless varieties, adapted to every niche. So wheat and barley flourish in favorable places, but the harsher lands and many of the less harsh areas are potato country still.

At every point there were choices, but progressively tighter lock-ins occurred as systems got more and more fine-tuned and specialized. At the beginning, people could choose to adopt or not, to eat or not, to grow or not. The potato was a very hard sell in Europe. The efforts of many rulers over several centuries were needed to make the folk eat these strange tubers (Salaman 1985). The ecological and economic advantages of the plant were not a guarantee of success. Historically, shifts in foodways often come from ecological or economic changes. Warmer, drier climates after 900 CE and especially after 1200 ruined maize agriculture from Utah (Coltrain and Leavitt 2002; Diamond 2005) to Mexico (Gill 2000) and rice agriculture in Cambodia; whole civilizations fell. Then when the climate turned seriously cold again, after 1400, the resulting Little Ice Age caused more trouble. The catastrophic freeze of 1709 that devastated and ruined the olive industry in the higher, cooler parts of south France is a famous example (Grove and Rackham 2001:133; Le Roy Ladurie 1971). More generally, the Little Ice Age, of which this freeze was only one episode, changed agriculture throughout Europe. This sharp cold spell, lasting roughly 1400–1800, led to glacial advances, shorter and cooler growing seasons, and much colder winters. Wheat retreated from the north and east, leaving oats dominant in Scotland and rye dominant throughout most of East Europe. The vine retreated southward, leaving England without a wine industry. Greenland lost its Norse settlers (Diamond 2005; McGovern et al. 1988). Economic changes followed. Potatoes and sugar beets replaced or supplemented grains in much of north Europe. Beer waxed as wine waned. Diets simplified; the cold weather not only drove out warm-weather crops but also reduced incomes, putting spices and other expensive imports out of reach. Perhaps this had something to do with the loss of spicing from English and, slightly later, French dishes. The French turned to herbs; the English stayed rather spiceless.

A new invention, or newly opened lands, or new sources of fertilizer may suddenly make a particular food cheap, and consumption goes up, other things being equal. However, consumption may actually go down if the item gets stamped as a poverty food. Or consumption may go up only after substantial advertising campaigns (as with avocados—considered "strange" within my memory) or after progress in food-processing technology (as with soybeans). Success may come through diligent promotion; avocados were publicized by Calavo, a producers' cooperative (personal research), and soybeans in the United States by Charles Piper (see DuBois et al. 2008; Piper and Morse 1923).

Changes in food production follow general patterns. Yujiro Hayami and Vernon Ruttan (1985) showed that people tend to develop agriculture in such a way as to remove bottlenecks. If labor is in short supply, as it has been in the United States through much of history, labor-saving devices will be invented. If land is scarce, as in East Asia, land-sparing technologies will increase and flourish.

Ester Boserup (1965) argued that population pressure would make people intensify their agriculture. She theorized that people, faced with more mouths to feed, would have to work harder. This does often happen. However, Boserup missed the point that, for intensification, capital must be available and society must be secure. If capital is the missing factor, population growth leads to cheaper labor (or simply starvation) and persistently non-intensive land use—as in much of Latin America and Africa. If society is not secure, the powerful seem always to respond to population pressure, or any other pressure, by taking from the weak. Instead of agricultural intensification, one gets war, banditry, or savage oppression. (Today as always. See, e.g., Baro and Deubel [2006] on the anthropology of food insecurity in Africa.) If population pressure alone were enough to cause intensification, Haiti and Bangladesh would be the most agriculturally developed nations, while Canada, Australia, and the United States would be the least. Similar "paradoxes" exist in traditional societies: densely populated aboriginal California relied on hunting and gathering, while agriculture flourished in thinly populated aboriginal New England. Clearly, Boserup's theory is only one part (an important part, to be sure) of a larger picture. Relative prices or availability of land, labor, and capital all play a part. So do taste and

Basics of food production, Bangladesh. These fisherfolk are working on a project of the Grameen Foundation. The Grameen Bank, founded by Bangladeshi economist Muhammad Yunus, provides tiny loans or finances small-scale projects, allowing capital-deprived individuals to start small enterprises, usually ones that produce food. Photo by E. N. Anderson, 1999.

inclination, which are in part determined by the accidents and contingencies of prior history.

It is typical, if ironic, to find that luxury crops get much of the attention of plant breeders and agricultural developers, while the staple foods of the poor are neglected. Two great studies of the history of particular crops—Redcliffe Salaman's (1985) work on the potato and Sidney Mintz's on sugar (1985)—both point out that these began their European cycle of development as luxuries. Their luxury status and price made it worth the bother of developing them into the mass staples they eventually became. Today, beef, turkey, and even sturgeon farming (sturgeon produce caviar) gets plenty of research action. Conversely, staple foods of the poor, such as manioc and chickpeas, or millets in Africa (National Research Council 1996), received little attention until recently and are still far behind luxuries like beef and wine in research efforts.

Recently, agricultural research and development have fallen on hard times. Growth in spending on these vitally important areas dropped from 4% per year to 1% from 1970 to today (Alston et al. 2009). Many universities that were once famous for this research have downplayed it, often for no better reason than that high-level administrators did not want to be seen as running a "cow college"; this was true in my own institution. The result has been a leveling off of increases in productivity. Also, diseases and toxins that kill plants and animals are expanding rapidly. Not only bananas and chocolate, but also wheat and manioc, will be foods of the past in a few years unless something is done to stop current epidemics. Long-term solutions are particularly in need of attention; firms and local governments will fund research that pays off in the local short-term but are less motivated to look to worldwide long-run concerns (Alston et al. 2009; on the woes of agriculture today, see also Grantham 2012). Economic incentives are highly perverse in an age of instant gratification, of politicians who think no farther than the next election (or coup), and of firms with planning horizons of 6 months.

A traditional society (with little or no money at the farm level) has one advantage: it is not tightly limited by market pricing. A plant that is hard to grow and impossible to sell may be kept around because it is locally beloved or because it survives in a famine year. Weeds, not worth selling, may be used simply because they are there. In the Mediterranean region, dozens of mushroom and weed species are eaten (see, e.g., Gray 1997). One sees ordinary people (not just the poor or the highly traditional) foraging for greens in parks or mushrooms on roadsides. Such behavior was once found throughout the world, but it has become rare in most cash economies.

A particularly sad mix of economics and culture has come about as the northwest European world (including the United States) has spread its exceedingly narrow view of "proper crops" to the rest of the planet. Today, a tiny range of crops—wheat, rice, maize, potatoes, manioc, soybeans, sugar cane (the Big Seven), and a few minor grains—produce the vast majority of the world's food. Even fewer animals are grown on a significant scale: only cattle, pigs, sheep, and chickens. What has happened is that geography and history gave north and west Europe a very narrow range of crops—basically, the Near Eastern and Mediterranean crops that could take the cold. This led to a general attitude or assumption, in those areas, that people do "live by bread alone," whatever the Bible says to the contrary, and that we humans should devote all development attention to a tiny handful of species.

At the other extreme are southeast Asia and tropical America, where local and indigenous peoples grow and use hundreds of species without focusing tightly on any one, except for the local starch staple. My Maya friends in Quintana Roo, Mexico, depend largely on maize, but there was no second-most-important crop until purchased wheat products became common. The Maya use hundreds of local plant and animal species for food; I recorded about 150 plants used for food in one community (Anderson 2005, 2010a). The reason became clearer than ever when corn blights and citrus diseases recently devastated their staple and their main cash crop (introduced citrus) owing to monocrop cultivation—something they had prudently avoided in the past.

The world desperately needs to go back to the old tropical pattern and get away from dependence on a few varieties of a few crops. Wheat rust, for instance, could spread worldwide and decimate the world's most important single crop (Hovmøller et al. 2010). See Paul Collier's books (e.g., 2010; see also Myers and Kent 1998; also see Magdoff et al. [2000] for a more radical view); the many extremely good and revealing case studies make it clearer (e.g., Crawford 2008; Dove 2011; Li 2007).

At present some 1.53 billion hectares of land (about 3.6 billion acres) is cultivated worldwide, with grazing occupying another 3.38 billion hectares. Most of the acreage is devoted to the Big Seven plus cotton, and by far the most increase in production and productivity is in these few crops. Fully 35% of crops go to animal feed. One-third of the greenhouse gas emissions that contribute to global warming are from agriculture (Foley et al. 2011), and a great deal of this—probably most of it—comes from deforesting the tropics, a suicidal practice in the long run. This should be reversed, so that new forests and grasslands can take up carbon gases instead of releasing them.

In the United States, a dollar will buy you more than 1,200 calories of potato chips, about 900 of soda, but less than 200 of fresh fruit (Walsh 2009)—and the fruit will mostly be dead green and almost inedible, being picked too soon. Farm animals get 70% of the antibiotics used in the United States (Walsh 2009), which is causing antibiotic resistance to build up in germs of all sorts.

Yet even in solidly market economies in Euro-America, uneconomic but traditional cultivation usually goes on. Many Americans and more Europeans still plant vegetable gardens, though they could often buy the vegetables more cheaply at the store. Vegetable gardens provide a better-liked product, to say nothing of healthful exercise and a general sense of virtue.

However, the sad tendency in market economies is for old and choice "heirloom" varieties to disappear, and the new commercial varieties often lack the flavor and texture of the old (Nabhan 2008a). The ecologically sound farmer will maximize the number of crops and varieties, to have a range of options and to hedge against failure. But the economically best option in the short run (but hardly ever in the long run) may be to grow only one variety of one plant.

Sometimes consumers rebel against monocrop monotony and force the breeders to bring back flavor and texture to a familiar crop that had been debased. I have observed this in the case of strawberries, apples, and tomatoes (cf. Barndt 2008) in California in recent years.

Most of the world has little choice; they buy the cheap food because they lack the money to do otherwise, and, in a world now largely urban, they also lack the opportunity to produce food for themselves. They thus are often exposed to foods that cost very little to produce but can be marketed for high prices: candy bars, sodas, potato chips, and the like. Fresh produce, fresh milk, and good-quality meat and fish are much less available to them; such foods spoil readily and are thus expensive to distribute and sell. Marketers may see healthy foods as appealing only to upper-class buyers; in Los Angeles (as in other American cities, and probably in cities everywhere), fresh foods and health-conscious items are available only in upscale markets, while markets catering to poor neighborhoods often fail to stock even so basic a food as milk (Conis 2003). Such neighborhoods are now called "food deserts" and are the subject of much attention from food security and food policy experts.

In contrast, traditional local markets still manage to provide good fresh food in many areas. I have seen dooryard gardens flourishing in the inner-city slums of Dhaka, Bangladesh, and serving as quite literal lifesavers for the desperately poor inhabitants. Farmers' markets and

Local marketing of staple foods, Azrou, Morocco. Grains and beans of all sorts, as well as spices, pots and pans, and even camels, are for sale on the grounds of the great market at the edge of Azrou. People from the surrounding remote mountains travel to this central town. Photo by E. N. Anderson, 2000.

urban gardening flourish also in affluent cities such as Los Angeles and Seattle. (On these and related matters, see Michael Pollan's work, e.g., Pollan 2005.)

The moral is, To save the hungry of the world, those who are more fortunate have to dedicate serious efforts. We cannot expect population pressure or desperate need to force intensification. Interesting possibilities include things like cereals that could fix nitrogen, as beans do, thus eliminating the need for nitrogen fertilizer (Beatty and Good 2011).

But Not Economic Determinism

Economics, however, is not destiny. A case study of how a dubious ecological explanation can become fixated in the literature is provided

Open-air market selling local produce, Goroka, Papua-New Guinea. Photo by E. N. Anderson.

by an explanation of the potlatch, an institution universal among the native peoples of the Northwest Coast of North America. The potlatch (the word comes from the Nuu-chah-nulth language of southwest British Columbia) is a ceremony found from Washington State to southern Alaska. It involves feasting and giving away property. The feasting can get very elaborate, with hundreds of recipes (analyzed by Walens [1981]); the Northwest Coast peoples are among the few human groups who lack agriculture and have a sophisticated cuisine. Property given away typically includes not only blankets and other useful items but also beautiful art goods; this is one reason why the Northwest peoples have a world-famous art tradition. "Tribes"—actually local groups organized by descent and led by hereditary chiefs—compete with each other to see who can throw the biggest and most spectacular potlatch. Countless explanations for this custom have been offered.

In the 1960s, Wayne Suttles (1985; and personal communication, 1987) and his student Stuart Piddocke (1965) proposed a function for the potlatch as it was practiced among the chiefdoms of the Puget Sound–Vancouver area. They hypothesized that it might serve to even out resources. A group with lavish resources would throw a potlatch, inviting all the neighbors, including impoverished ones who needed the food. The impoverished groups, if they got rich in their turn, would reciprocate. Thus, whoever was lucky that year would share the wealth with the unlucky, who would return the favor. This was seen (by Suttles, at least) as one side function, not necessarily intended, of an institution that clearly had other purposes as well.

This explanation was proposed with proper caution, qualifications, limitations, and admissions that evidence was not conclusive (Suttles [1985] discusses the whole controversy). Unfortunately, overenthusiastic writers (notably Marvin Harris [1974, 1985]) picked it up, extended it to all potlatches everywhere, and treated it as "the" cause of the potlatch. Harris may have oversimplified and overextended, but at least he discussed other explanations and said some extremely perceptive things about the whole institution, its complexities, and its evolution. For instance, he pointed out that the potlatch expanded beyond all practical value under the stress of oppression and demographic collapse in the late nineteenth century (Harris 1985). In later popularized versions, all this was also brushed aside. Finally, we come to the modern textbook forms (Beardsworth and Keil 1997:101; Kottak 2003:212–214). Here all subtlety and qualifications have gone by the board, and the potlatch—everywhere—has "the latent and manifest functions of . . . sharing of current food surpluses (particularly of perishable foods) and the provision of a virtual guarantee that [the hosts], in turn, would benefit from feasts with others when their own supplies were short" (Beardsworth and Keil [1997:101], citing popular sources rather than scholarly ones). This exemplifies a point made repeatedly by Stephen Jay Gould (esp. in Gould [2002]) that textbooks routinely oversimplify theories to the point of distorting them.

In fact, research findings have not been too kind to the hypothesis. Martin Orans (1975) pointed out the total lack of direct evidence for it. John Pritchard showed that in the northern Northwest Coast (far from Suttles's lands), resources were so uncertain and potlatches took so much advance planning (many years) that no one could target a potlatch to help the poor; potlatches were randomly related to hard times. People who were suddenly faced with shortages could not rely on having a potlatch nearby; instead, they scattered out to stay with kinfolk in other areas (Pritchard 1977, and personal communication, 1984).

Most important of all, veteran Northwest Coast expert Philip Drucker provided the real explanation of the potlatch (Drucker and Heizer 1967). Drucker, who had worked with the Nuu-chah-nulth when they still remembered old times, established conclusively that the potlatch validated the title of a chief and solidified support for him in war. The Northwest Coast peoples were among the more warlike groups in history, fighting to take over land and fishing spots or to take slaves. A chief needed all the followers he could get. Since any dissatisfied individual could easily travel to another chief's domain and serve him instead, a chief had to do everything possible to validate his title and hold his followers' loyalty. Generous giving was about the only thing he could do.

An appealing aspect of this explanation is that it fits with other "merit feasts" around the world. In many chiefdom-type societies, competitive generosity, specifically in the form of feasts with gift giving, is the standard way to acquire followers for raiding and warfare. The most dramatic examples are found in the old epics, from *The Iliad* to *The Tain* (the Irish national epic; see *The Tain* 1970). The best ethnographic study is probably D. G. Robertson's study of eastern Afghanistan (Robertson 1896) because Robertson was there when the institution was in full glory, warfare and all.

Today, the potlatch still serves to validate title and to mark and validate life changes (coming of age, marriage, and so on). It does have the incidental function of helping some poor individuals, but invitations are accorded on the basis of personal importance. In my experience, the people one invites first and foremost are one's fellow chiefs and leaders.

So, 40 years after Suttles and Piddocke, we still have no evidence for their hypothesis (even in its original, local, highly qualified form). Instead, we have a counterhypothesis proven beyond reasonable doubt.

The success of that hypothesis at explaining the institution does not rule out other functions, be they ecological, social, or psychological; people often figure out ways to get multiple uses out of an institution. In fact, I still think Suttles and Piddocke were onto something, if only for the small, highly localized, resource-rich groups of the Sound and Straits area. But the potlatch in general is fundamentally a typical case of a worldwide phenomenon: competitive feasting and gift giving, among chiefs, for the purpose of holding onto followers. As such, it is still a neat example of an institution that uses food for directly functional ends—specifically, in this case, economic and military goals.

6 FOOD AND TRADITIONAL MEDICINE

Humoral Medicine

One very important area for the meaning and significance of food is in medical use. Diet therapy is performed everywhere in the world. Food is so obviously related to health that no culture has missed it, and all seem to have some form of nutritional therapy. However, since vitamins and mineral nutrients are hard to discover without modern laboratories, cultural groups before 1900 had to do the best they could with observation and induction. This led to theories that were wonderfully creative and by no means always wrong. Some relationships, like the success of fresh foods in preventing scurvy, were easier to observe than others. Folk nutrition theories are fascinating to study, since they reveal much about the abilities of humans to infer accurate facts from limited evidence. We must also remember that nutritional science today is far from settled, and we are still learning from folk and traditional observations.

Typically, folk science, and indeed all science, is based on good observation and generalization but falls increasingly into error as it infers more and more hard-to-observe black-box mediating variables. An ideal case study is provided by the most widespread traditional nutrition theory: humoral medicine.

I have been especially interested in this very widespread belief system, which in its most general form holds that some foods are "heating," others "cooling" to the body, while still others are "balanced" or "neutral" (Anderson 1987, 1988, 1996; Foster 1994; Laderman 1981). This has nothing to do with actual food temperature. The belief can be traced back to Hippocrates, and he says he got it from earlier sources (see Hippocrates [ascribed] 1978; see also Dalby 1997).

His later disciple, Galen, is the one who really popularized it (Galen 2000, 2003). Galen was a born salesman and promoter. Scathing in his denunciation of other systems, he tirelessly advocated his own. He was bright enough to provide value for money; his elaboration of Hippocrates is sensible, orderly, well worked out, and thorough. If it does not always accord with modern diet therapy, it at least comes close to following Hippocrates' wisest cautionary note: "First, do no harm."

The full system, as worked out by Galen, involves four conditions: hot, cold, wet, and dry. Each is associated with the four elements of classic Greek science: fire, air, water, and earth.

Their interaction produces four body fluids, called "humors." The hot and dry humor is blood. Hot and wet make phlegm. Cold and wet make bile. Cold and dry make black bile. There is no such thing as black bile, which was thought to cause melancholy, but early accounts make it clear that the term refers to the breakdown products of blood that clog the bile duct, liver, and sometimes the intestines in cases of malaria and liver disease.

These humors were thought to influence personality. We still refer to sanguine (*sanguinis,* "of blood"), phlegmatic, bilious or choleric, and melancholy people. Modern psychology has partially confirmed Galen; people do fall into a few broad personality types that have a strong hereditary component and that share a good deal with the humoral personality types.

Sanguine people are much like the extraverts of modern psychology—in fact, Carl Jung developed the concept of "extraversion" by modernizing the old humoral category in the light of modern clinical knowledge. Melancholic people are introverted. Excessively melancholic people are now called "depressed," "paranoid," or "schizophrenic" (cf. Robert Burton's classic *Anatomy of Melancholy*; Burton 1932 [1638]). Choleric people are aggressive (low in agreeability), phlegmatic people are sluggish and inactive (to a modern psychologist, low in openness and conscientiousness). Food was much used in treating these conditions in ancient and medieval times.

Foods can heat, cool, dry, or wet the body. Spicy and oily foods are heating. Water is cooling—not wetting, because if you fall into water you get chilled but your internal organs don't get any wetter. Wetting foods are those that cause retention of fluids. Drying foods, in general, make your mouth or throat feel dry. Later writers established a system of degrees, from first degree (very mild) to third or fourth degree (fatal). A food could be heating to the third degree and drying to the first degree.

For Hippocrates, thin barley broth was the great cure-all. Sick people were usually put on a regimen—a lifestyle or routine—of barley broth and bed rest. The worldwide use of pearl barley in healthful soups owes its origin to this. Pearl barley seems to be losing its spell now, but when I was young it was universal in both Euro-American and Chinese healing soups.

Galen wrote much about different sorts of breads, beans, waters, meats, and other foods. He had extremely sharp and penetrating comments on these, especially on their digestibility, though he was prone to exaggerate their medical importance.

More complex systems developed. The great Arab, Persian, and Jewish physicians of the Near East and Muslim Spain, from Avicenna to Maimonides, added their contributions. Pasta, for instance, appeared in the Mediterranean world well after Galen's time. The great medieval Arab scholar al-Bīrunī noted—correctly—that it is slow to digest and can be aided in this regard by almond oil and pepper (al-Bīrunī 1973). Similar recommendations on pasta and other foods were found in a popular class of work, based on Galen, called *Taqwim* (Arabic: "disposition, arrangement"; see Serventi and Sabban 2002 [2000]:57). This became wildly popular in Europe, when it was translated into Latin; the Salerno school's *Tacuinum Sanitatis* went through countless editions. The highly prestigious medical school in Salerno, Italy, drew almost entirely on Near Eastern Galenism. The *Tacuinum* is *still* in print, in fact—in several translations (that of Luisa Arano [*The Medieval Health Handbook* 1976] being notable among the English versions). Today it sells more copies to historians and lovers of its artistic illustrations than to suffering patients. This is rather a pity, for, however much more we now know about specific foods, the book's more general advice is actually quite good. Its most famous passage, which has become proverbial in the verse translation of Sir John Harington (1966 [ca. 1600]), wisely advises us:

> "Use three physicians: Doctor Diet,
> Doctor Merryman, and Doctor Quiet."

In fact, the quality of Galenic practice always ran ahead of the theory. Galen's theory was good as a first approximation, but its long reign of 1,800 years is a sorry commentary on the progress of nutritional science. Hippocrates and Galen seem to have practiced better than they theorized. By the Middle Ages, after dozens of brilliant Near Eastern scholars had worked on the system, the theory was a rather threadbare net holding together a rich collection of more or less accurate and reasonable clinical observations on foods and nutrition. Much of the knowledge was wrong, mostly when it was deduced from the theory. But much was right and useful.

Many modern foods were evolved along Galenic lines. In Europe, salads balance cooling greens with salt and oil, pork is balanced by mustard, and heavy foods for workers balance light foods for the nonactive (Albala 2000:206). In China, the influence is far greater, because the four environmental influences fused with indigenous ideas of yin and yang. Almost all self-consciously health-related food combinations are influenced by hot/cold theories (Anderson 1988).

The Galenic system spread throughout Europe and the Middle East. It influenced medicine throughout South, Southeast, and East Asia. With European expansion it spread around the world. By the mid-twentieth century it was unquestionably the most widespread belief system on earth, far outrunning any single religion.

In Europe, it continued to be state of the art until replaced by modern nutritional science in the late nineteenth and early twentieth centuries. It was believed by educated biologists well into the twentieth

Food as Art: Market in Venice, Italy, beautifully arranged. Photo by E. N. Anderson, 2003.

century. It survives robustly throughout the Middle East and in much of Latin America.

Several different cultures seem to have come up with rather similar theories: yin and yang in China, hot and cold in native America (Ortiz de Montellano 1990), and an independent heating/cooling system in Malaysia (Laderman 1981). It is a fairly obvious thing to think. A person who is too hot (feverish) is sick, and a person who is too cold (hypothermic) is in trouble. A characteristic syndrome of fever, pain, and diarrhea follows consumption of poorly kept food. A feast with much alcohol produces headache and indigestion later. Nothing could be more natural and easy than to assume that food affects all of health.

Humoral medicine spread to China along with Buddhism around 400 CE and fused with the Chinese yin-yang theory. In modern Chinese medicine, high-calorie foods are regarded as heating, low-calorie foods as cooling. This is indeed a way of expressing a truth that the Chinese know perfectly well: you get more metabolic heat out of the former. The Chinese have had enough experience with hunger and famine to know which foods maintain body heat in cold weather.

The perfectly balanced and temperate food is cooked grain, around 500 calories per pound. Everywhere in the world, the balanced food is the local staple: cooked rice in China, bread in the Near East, tortillas in Mexico.

Foods that feel burning are, of course, heating: ginger, alcohol, chile, black pepper. Foods that are bitter tend to be heating; sour, cooling. Foods that are "hot" colors (red, bright yellow, etc.) are heating; foods that are pallid and greenish are cooling. Foods that cause a burn-like reaction (reddening, swelling, irritation) are heating; thus if you are allergic to a "cold" food and get a rash from it, it's "heating" for you, even though "cooling" to most people.

Foods that treat such burn-like conditions are cooling, while foods that treat "cold" conditions are heating. Herein lies the real value of the system. Lacks of vitamins A and C are classic "hot" conditions (reddening, sores, dry skin, etc.), and vegetables are the cure. It works. Anemia is the classic "cold" condition (pallor, weakness, etc.), and gently warming meat, especially organ meats and blood, is the standard cure.

In short, the ancient Greeks, medieval Arabs, and Chinese throughout history observed cause and effect quite accurately. But they then inferred an incorrect or overgeneralized intervening variable—a mystic internal "heat" or "coolness" in this case. They then logically extended the system in inaccurate ways, as when (in China) red-bean soup is used to "heat" and dried-green-bean soup to "cool" people, just because the former has a hot color, the latter a cool color. Nutritionally they are identical.

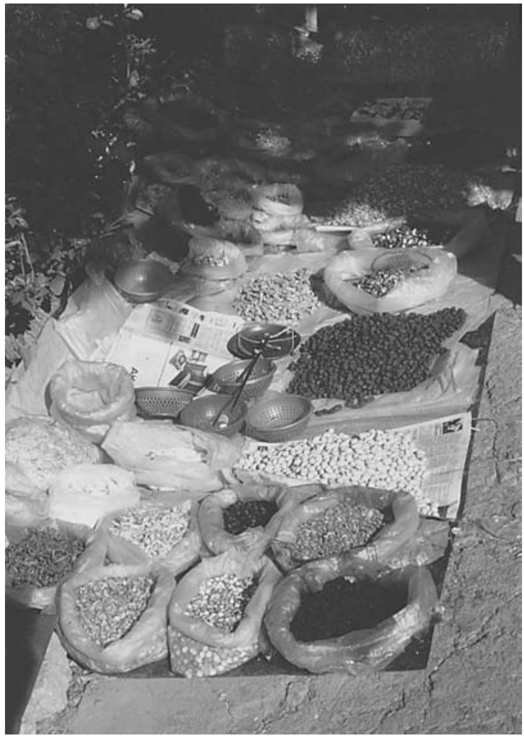
This is exactly the way scientists develop theories. The Chinese were even aware of the need to test theories and developed the case/control experiment more than 2,000 years ago (but in agricultural, not dietary, research; see Anderson 1988). They had a superb nutritional establishment. The court nutritionist was the leading medical officer in China in the Zhou Dynasty (ca. 1000 to 221 BCE) and remained so in most subsequent dynasties. They recognized beriberi and realized that fresh foods could treat it; they developed oral rehydration theory centuries ahead of the West. Both are in Zhang Zhongjing's *Shang Han Lun*, ca. 100 CE but revised subsequently; it developed a quite different hot/cold system from Galen's (Chang 1981 [second century CE]).

However, China did not have an adequate research-and-publication system. Nor did the Chinese have an advanced chemical science that could isolate vitamins and mineral nutrients. They did not have journals that made new findings widely available. Thus, though Chinese nutritional science remained important well into the twentieth century, it was supplanted by international biomedicine.

Still, Asia remained a leader even in the latter field—which is why I do not refer to "Western" medicine here. The first vitamin (B1) was discovered in what is now Indonesia (around 1900). Chinese and other East Asian scientists were involved in modern nutritional science from the beginning. The old hot/cold theory, which lasted in both China and the West well into the twentieth century, was soon supplanted by newer concepts that stood up better under experimental testing. Yet its successes, most of all the recognition that nutrition was really important, have led to Asian scientists remaining in the forefront, continuing a tradition that has lasted for 2,500 years.

Other Traditional Belief Systems

Most cultures have belief systems of this sort concerning their foods. China, in addition to the Galenic system, has a whole series of beliefs connected with cleanness, dangerous food combinations, poison-potentiating foods, tonic foods, strengthening foods, energy foods, and so on (Anderson 1988). This has led to the extermination or near-extermination of hundreds of species of plants and animals; believed to be tonic foods (*bu pin*, "supplementing things"), they have been hunted into extinction. India has a quite different but equally rich and complex system of beliefs (Achaya 1994). The taboos of Leviticus and Deuteronomy seem often related to health beliefs, now obscure. Ancient Egypt had a complex and intricate series of beliefs about food, known today only from a few medical papyri (Darby et al. 1977; Nunn 1996). Most Western traditions—European or Islamic—are based on the Galenic tradition, but they added a great deal from their own experiences, modifying and changing; the results are often very different from each other. Nutritional beliefs of smaller societies are less well known, but they exist and deserve further attention.



Food and medicine, Hong Kong. Medicinal food for sale by roving peddler. Such roving peddlers have long vanished. This one's wares include red jujubes (for blood), black jujubes (for flesh), lily bulb scales (to harmonize foods), ginkgo nuts (for sore throat), dried daylily buds (warming), and many other medicinal foods. Photo by E. N. Anderson, 1966.

Modern nutrition and health face threats from a quite different direction. Health, status, and pricing all influence each other. On the one hand, formerly very expensive foods like white bread and white sugar are today very cheap, thanks to industrial-processing techniques. But, on the other hand, formerly very cheap foods are now very expensive or totally unavailable because of environmental devastation. Not only are game and caviar depleted, but we are also now facing the loss of ordinary vegetables, which require good soil and a lot of work and fertilizer. They are getting rapidly more expensive in the First World and are often completely unavailable in Third World cities. Similarly, local staple starches are losing out to processed grains. Fruits, ever more expensive, are losing out to white sugar.

In former times, when white bread and rice were more expensive and thus were markers of higher status, they were believed to be the healthy foods. Today, with the brown forms more expensive, the nutritional beliefs have shifted; brown is good. In fact, white is less rich in nutrients but is more digestible. When white was expensive, digestibility counted for much (see, e.g., Galen 2000). Today, with brown more expensive, vitamin content gets featured.

Health concerns inevitably lead us to chicken soup, traditionally the health food of the Jewish world but equally popular as a health stew in China, India, and most other old civilizations. It conveys messages far beyond mere disease control. It is associated with family, with caring, with love and tenderness. The scent of a good chicken soup is intensely evocative to a very large share of humanity.

Here, and in many similar cases, we see that foodways hallowed by tradition and by family are inseparably bound with love, with feeling, and with life itself. Philosophers have spent much time discoursing on the phenomenology of food (Heldtke 1988). What is seen as "healthy" thus often seems more a matter of the familiar or—perhaps more often—the opposite of the familiar.

Many people in all lands and times have assumed that familiar foods kill. The Chinese early concluded that grain was associated with death—everyone subsisted on it and everyone eventually died—and thus eating items ranging from pine seeds to wild asparagus might make one live forever (Buell et al. 2010; Campany 2002). In China, countless foods are eaten for this reason, from wild duck to goji (wolfthorn) berries. Medicinal value is the only real reason for the cultivation of the wolfthorn, whose leaves and fruits are nearly tasteless but incredibly rich in antioxidants, vitamins, and minerals. The nutritional value was known long before vitamins were discovered. Goji berries have recently spread from Chinese medicine to worldwide use and now are found in ordinary American grocery stores.

Similarly, in old India, vegetarian and dairy foods were regarded as ideal; meat and grain were worrisome. Only the Near East, safeguarded by solid Galenic tradition, recognized that a varied, clean, nutrient-rich, easily digestible diet always beat the fads and extremes. Even there, some odd ideas (such as a widespread belief in aphrodisiac foods) propagated on the fringes of medicine.

The Aztecs thought their ancestors, living in the desert on cactus and lizards, had a natural and pure diet that kept them alive for centuries (Ortiz de Montellano 1990). My Maya friends often tell me the same basic story: their ancestors lived long on simple diets of maize, vegetables, and cactus. Their stories—like similar stories everywhere—owe much to the memories of centenarians, who survive exceptionally long and who remember the bad old days when there was little else to eat. The countless people who died young from such diets are not around to contradict.

Others have sought foods correlated with longevity in particular regions. We have noted Elie Metchnikoff's advocacy of yogurt.

Interestingly, relatively few connect food health with actual germs and contagion. The Chinese early learned to boil water and cook almost everything thoroughly and were quite aware that failure to do these things led often to illness. Almost all cultures, as we have seen, found preservative spices and herbs, as well as fermentation and salting techniques that kept foods from spoiling. Yet ideas of contagion varied all over the map, without much resolution until modern science, with its microscopes and labs, cleared up the mysteries (Stearns 2011). Even today, in the United States, an estimated 76 million people a year (a quarter of the population) get sick from foodborne infections, and 5,000 of them die, yet very little attention is paid to this by governments or individuals (*Nature* 2007).

Today, health and food interact in other ways. Starting around the end of the eighteenth century, western Europeans began to react against processed foods. The movement reached the United States in the early nineteenth century and found its natural home. Americans disturbed by rapid urbanization and immigration were especially prone to adopt the gospel of whole grains and simple country foods.

Sylvester Graham, inventor of the graham cracker, was the first preacher of this gospel to win fame (Nissenbaum 1980; Smith 2009). He inveighed against white sugar, white flour, and other processed foods. They were not only poor in nutrition (which is true enough), they were also signs of the degenerate life associated with the cities. He taught that people should live largely on Graham flour: the whole wheat grain, bran and all, ground into meal. This and pure water were close to an adequate diet. His disciples were desperately short of vitamins. Ironically, the graham cracker is now mostly sugar and white flour—the very things he hated.

Health foods achieved religious status with the Seventh-Day Adventists. Sister Ellen White, founder of the sect, was close to the health food movement (Smith 2009). The Mormons, less extreme, taught abstinence from alcohol and caffeine and advocated a generally healthful diet. Utah, founded by Mormons, today has one of the lowest death rates of any state and is particularly low in heart disease and similar food-related problems. Nationally, anti-alcohol sentiments became widespread, leading to the brief experiment with near-absolute prohibition in the twentieth century.

American food of the nineteenth century was about as it is today, and the more sour and puritanical judgments were the same, too. Consider this if you believe that everything has changed in the last generation: Thomas Low Nichols wrote in 1864 to condemn the fact that "butter and lard are so cheap that they are used with great profusion. . . . Hot bread made with lard and strong alkalies, and soaked with butter; hot griddle cakes covered with butter and syriup [*sic*]; meats fried in fat or baked in it; potatoes dripping with grease; ham and eggs fried in grease into a leathery indigestibility—all washed down with many cups of strong Brazil coffee'" (Smith 2009:142). This is far from the only such description, and recipe books also reveal that American diet, then as now, ran heavily to white flour, white sugar, meat, and fried foods. The health advocates had a point—but rarely got far enough from the sugar-and-starch diet to do much good.

Tradition Transformed: Modern Health Food Lore

By the mid-twentieth century, the "health food" movement remained largely committed to whole grains and vegetarianism. Unprocessed nuts, fruits, and vegetables were advocated. From Graham onward, the concept of "naturalness" was critically important—hard to define, to be sure, but always valued (as it still is).

The resulting diet was not, however, either very natural or very healthy (Deutsch 1977; Gardner 1957). Far too much highly processed brown sugar, oil, and starch got into it. Lack of full understanding of the role of iron and of vitamins A, C, and E and the minor B vitamins led to far too little advocacy of fresh vegetables. Health-food eaters tended to be elderly and either strongly religious Seventh-Day Adventists or strongly conservative white Americans in the old anti-urban, anti-immigrant tradition.

Clearly, what defined "health food" was more a matter of opposition than of health. The category was established long before vitamins and minerals were known to be nutritionally significant; vitamins were not even discovered until almost 80 years after Graham's first work. Instead, the issue was unprocessed versus processed food: whole grain versus white flour, brown sugar versus white sugar, and so on. Also, such urban or imported items as alcohol, tea, and coffee were anathema.

Whole grain is indeed a nutritionally valuable commodity, but brown sugar and even honey are not significantly different from regular sugar. Blackstrap molasses has much iron—but it comes from the processing machinery! Vegetarianism has its points, but only if one is very careful about vitamins B12, B6, and so on. Opposition to change is not always a perfect way to pick a diet. As of mid-century, health food users tended to get their vitamins from pills (if at all). Both health-conscious and health-unconscious Americans, even those who knew about vitamins and minerals, did not often take them very seriously as dietary concerns.

Into this mix came, quite suddenly, two dramatic new factors. First, Ancel Keys's findings on heart disease implicated animal fats and gave the vegetarians a new lease on life (see Keys 1980). Keys's findings unleashed a whole new field in nutrition studies.

Second, the 1960s counterculturals took up the cause of health food with a vengeance—but they were far more concerned with fruits and vegetables, and they consumed a number of plant substances that were far from acceptable to the older health food consumers! The result could be most entertaining. I well remember the expressions of small-town health-store owners—solid far-rightists, often members of extremist patriot groups—when their stores were invaded by hordes of flower children.

Over the rest of the century, concerns with healthy eating grew rapidly. Fads grew and died; alfalfa sprouts were considered magically potent, then eventually faded. Tofu became a trademark of the urban healthy eater, and then of Californians in general. Far more nutritious foods like chiles and turnip greens were notably absent from the roster. Chiles were associated not only with pain but also with Mexicans. Turnip greens, similarly, were associated with African Americans. Even in the liberal and hippie days, health foods remained white folks' foods, and the foods of the minorities were almost by definition unhealthy.

Soon the far-right-wing eaters had totally changed their ways. Propaganda from food-processing companies told them that real Americans ate processed foods and that these were the healthy foods. Meanwhile, it was clear that "healthy eating" was becoming a trademark of hippies, yuppies, and other enemies. The defining marks of the American Right became white bread, beef, barbecue, mass-produced beer, and hamburgers. The very phrase "white bread" was used in the late twentieth century as a disparaging way to refer to conservative Americans, a typical example of using food to symbolize and mark particular groups.

Vegetarianism received added impetus from other liberal causes, from animal rights concerns to fears that too much grain was going to animals rather than humans. (See, e.g., *Diet for a Small Planet* [Lappé 1971] and *Beyond Beef* [Rifkin 1992].) Most food animals worldwide are raised on grass and other things that that humans can't eat, not on grain, and all could easily be so raised, but facts did not slow the movement down.

Meanwhile, even the most unaware could not remain totally ignorant of new findings. Beef and whole-fat dairy products suffered a massive decline in popularity. Consumption of beef and of full-fat milk declined by about a third in the period from 1960 to 1990. Yet gourmet ice cream bucked the trend, becoming popular to the point of near universality just as full-fat milk and cream were becoming rare commodities in many markets. Organ meats almost disappeared, being considered disgusting as well as unhealthy—in spite of the fact that they are the best of all sources of vitamins and minerals (see, e.g., McGee 2004). Fish, considered healthy in spite of its frequently high levels of toxins and mercury, became far more abundant and expensive.

Similar changes, meanwhile, were taking place in Europe and elsewhere. In all these cases, the common theme is clear: "healthy" eating often has a great deal more to do with image than with health. What is unhealthy turns out to be what is associated with those whom one does not like. Health foods are defined in opposition: they are the opposite of what The Enemy eats. Anti-alcohol agitators claimed that alcohol produced nothing but violent drunks. Vegetarians have often condemned meat for making people act wild, savage, and vicious, like carnivorous animals. (This is a very ancient charge, already implicit or explicit in early writings; see Albala 2009 and Porphyry 2000. It is a slander not only of meat eaters but also of wolves and bears, but that is another story.) Liberals and conservatives structure their foodways to insult each other.

By the start of the twenty-first century, the health-food movement had fragmented into many streams. Some people depended heavily on pills ("dietary supplements"). Others had taken up Mediterranean diets, known to be associated with longevity. Others were still devouring sprout-and-avocado sandwiches on whole-grain bread. Still others seek out "nutraceuticals" like goji berries and açaí palm fruit. Most simply tried to abstain from high-fat foods, especially animal fats. Salad and yogurt had exploded in popularity—in spite of the exceedingly high-fat dressings on the one and the heavy sweetening usually found in the other (for much current thinking, see Pollan 2005).

Much of this really is healthy, but sellers of fads know how to manipulate images and tend to get the ears of Hollywood stars and other highly visible beings. They thus often sell their messages more successfully than real nutritionists do.

This fact has led to a contrarian, denialist literature, dedicated to the proposition that "our" food (whoever "we" are) is ideal as it is and that claims of healthier possibilities are nonsense. Much of this literature has been generated by large food-processing and tobacco corporations and their spokespersons. The latest in the sequence (*not* a company creation, so far as I am aware) is *Fear of Food,* by Harvey Levenstein (2012). He debunks the Metchnikoffs and Kelloggs of the past but unfortunately maintains that *all* nutritional science is equally silly and thus argues that we might as well eat anything. He even belittles vitamins. Levenstein's points are dangerously wrong in a world of hunger and malnutrition.

Readers are advised to cast a fishy eye on fads but to recognize that there are well-proven huge differences in the values of foods. The Greeks and Arabs were right: a reasonable middle ground is the only sensible position. Eat moderately, listen to well-tested advice, ignore ill-tested advice, and keep those three physicians that John Harington used.

The healthiest-eating areas of the world have begun to fall from medical grace. The "Mediterranean diet" has been held up as a model of health. As Serventi and Sabban point out (2002 [2000]:162), we may really be speaking of "the . . . invention of the Mediterranean diet by the Americans"—there are countless Mediterranean diets. However, many of them are based on complex carbohydrates supplemented by olive oil, herbs, vegetables, fruits, and small amounts of dairy products—a healthy diet indeed. In Cyprus and other modernizing areas of the Mediterranean world, a massive shift away from this diet and toward the international processed-food diet has sent rates of degenerative diseases skyrocketing, according to recent studies (Matalas et al. 2001). An anonymous reader of my manuscript noted that rural Cyprus clings to its older foodways, and I have seen the same thing in many Mediterranean areas, but Matalas's figures speak for themselves, and one sees much to worry about in the urban Mediterranean today. Similar trends are reported from east Asia (Watson 1997). I see the same thing happening in Mexico, even in the remote villages where I work.

The rise of fast food and highly processed food has a long and complex history, involving a great deal of political manipulation. This story has been so well told by Marion Nestle (2002) and Eric Schlosser (2001) that it would be superfluous to discuss it here. They note "revolving doors" between government regulatory agencies and food corporation directorates: today's food corporate manager sometimes reappears as tomorrow's regulatory agency director, and vice versa.

To show that health does sometimes sell, peanut butter is a case of a successful health food. Invented by an employee of John Harvey Kellogg (originator of Kellogg's Cereals), it was propagated by people such as Ellen White, his associate, who founded the Seventh-Day Adventist Church and dedicated it to healthy eating (Smith 2002). Popular with children, cheap, and easy to use, peanut butter succeeded with little difficulty, though it too has sometimes suffered from adulteration with sugar and cheap oil.

In Guatemala, the famine relief agency INCAP (Instituto de Nutrición de Centroamérica y Panamá) developed a nutritional supplement, called "Incaparina," for the desperately malnourished poor in the late 1940s. It was sold or given away as a food for the poor. Of course, no one would touch it. Anthropologically sophisticated nutritionists Nevin and Mary Scrimshaw took over the program. Immediately, they promoted Incaparina as an elite food. They persuaded Guatemalan stars and celebrities to consume it with (apparent) relish and delight on public media. Incaparina succeeded brilliantly.

The most common problems of healthy-eating campaigns are four. First, such campaigns are usually preachy. Young people everywhere hate to be preached to, yet young people are the ones who most need the message. Second, such campaigns are usually phrased strictly in terms of health—especially the health of old people. They do not address the fact that people choose foods for many other reasons. Third, the campaigns tend to nest in health and social-welfare agencies, not in food markets or shopping areas. And fourth, the campaigns are rarely very visible in the schools. Even if they are taught in the classrooms, they do not affect the actual foodways of the school. As parents know, school lunches and other foods found in schools are often among the lowest in nutritional terms. Corporations have also placed vending machines selling candy, cakes, chips, and soft drinks in many schools, often providing some of the profits to the school for band uniforms, sports facilities, and the like; this makes it hard for the schools to control the machines. Schools are now working to change all this.

Improving: Real Health Education

Since the first edition of this book, this fourth problem has begun to change; schools are rapidly moving to ban "junk food" and improve their lunch offerings. This does not always succeed—children avoid the lunches and sneak in candy bars—but such is to be expected at the beginning of a campaign, and there is hope for the future if this movement continues. Particularly hopeful is the rise of school gardens, promoted by the great restaurateur Alice Waters (2008), among others.

What should be done instead—what is, in fact, being done by many successful campaigns?

- Nutritional educators should target their campaigns toward active people between 10 and 40, unless they are specifically concerned with older folk.
- They should do everything possible to make good food and nutrition the prestigious, stylish, with-it option.
- They should brand junk food[1] as the choice of fools—people who are neither with-it nor health conscious, people who are gullible and out of date.
- They should talk about health in positive terms: this will improve your looks, your performance, your sex life, your whole body.

Doña Elsi Ramirez making a chicken pie for baking in earth oven, Chunhuhub, Quintana Roo, Mexico. Photo used by kind permission of Sra. Ramirez.

Earth oven cooking, Maya villagers in Quintana Roo, Mexico. Photo by E. N. Anderson, 2012.

Earth oven, with foods for the day buried within. Photo used by kind permission of the Dzib family, Presidente Juarez, Quintana Roo, Mexico.

People at the age and stage when they are forming their lifelong food habits are far more concerned with these positive matters than with dark thoughts about the far future.

- However, scare stories about heart disease, cancer, and diabetes are also appropriate. These problems can start early, and lifelong food habits are laid down early. On the other hand, heavy-duty campaigns *focused* on these issues should be directed mainly at people old enough to be directly and immediately concerned with those conditions.
- Especially in the Third World, campaigns should make *some* effort to be adapted to local conditions. In Chunhuhub, my Maya town, the nutrition posters at the local clinic are excellent, except for one thing: Mexico being a highly centralized country, the posters are composed in Mexico City. They reflect Mexico City realities. Most of the fruits and vegetables they recommend cannot be found in Chunhuhub. Conversely, Chunhuhub's superb and unfailing workhorse producers of vitamins and minerals, the chaya plant (a green vegetable) and the mamey (a fruit), are not listed on the posters. Such lack of attention to local reality is almost universal. I have seen similarly ill-adapted posters in small towns from rural America to China and Malaysia.
- Campaigns about infant nutrition should, again, be directed at real-life mothers: young, often confused, concerned about everything from survival to maintaining their looks. In the Third World, they are usually poorly educated, impoverished, and forced to work 12–16-hour days to survive. Even in the First World, the luxury of staying at home with the baby is simply not possible in many cases. Yet nutrition campaigns still often talk as if there is a full-time mother and homemaker on the receiving end. Long, difficult routines are recommended. Shortcuts are not suggested.
- Above all, all nutritional campaigns should be based as much as possible on direct word of mouth. This is not to say there should be any cutback on media use. Media are wonderful things. However, people rely—still—on what they hear from their friends and from trusted health providers in their communities. This is especially true of the Third World people and impoverished First World people that we most want to reach.

The beginning and root of all good is the pleasure of the stomach.
—*Epicurus (2011:409)*

Eat till you burst, drink till you pass out; anything more is excess!
—*Mexican saying (my translation)*

7 FOOD AS PLEASURE

Enjoying Food

We eat largely to stay alive. Most people in the world, most of the time, have to take whatever they can get—usually dull, inadequate, depressing fare. But almost everyone gets to celebrate occasionally, and good food is almost always at the core of good times. For the lucky 25% of the world's citizens who can eat when and what they want or at least have *some* breadth of choice, daily fare can be diverse and tasty. Even among the other 75%, people often find ways to spice up their stodgy diets by using wild herbs, simple fermentation processes, varied cooking methods, and other clever but inexpensive tactics.

The ancient Egyptians, Mesopotamians, and their neighbors all concerned themselves about good food. The Bible refers to spices, olive oil, fat meat, fruits, and other goods. The ancient Greeks had an extensive gourmet literature, much of it surviving only in quotations in other works (Dalby 1997). In particular, the ancient Greek author Athenaeus wrote, or compiled, a monumental book, *The Deipnosophists* ("dinner wise ones"), consisting of a vast dialogue in which diners vie to quote everything in all Greek literature connected with the delights or sorrows of eating (the classic translation is by Charles Burton Gulick [Athenaeus 1927–1941], but there is a new translation, *The Learned Banqueters,* by S. Douglas Olson [Athenaeus 2006–2011]). The Chinese, of course, are famous for good eating (Anderson 1988; Chang 1977); Yuan Mei in the eighteenth century was probably the most famous Chinese food writer (Waley 1956), as well as being a feminist far ahead of his time. The French gourmet tradition was old before Jean Anthelme Brillat-Savarin set his seal on it in *The Physiology of Taste* (1925 [1825]). This book became the great work for gourmets—or, as he called them, gourmands, the words having differentiated in meaning only since his time.

It is the nature of humans to take delight in satisfying survival needs. Indeed, any higher animal must find deprivation of food and drink uncomfortable and satisfaction of the need at least somewhat pleasant. Hunger hurts. Satiation is a neutral state; it feels neither good nor bad (unless one is overstuffed to the point of sickness). The enjoyment comes in the process of moving from state A (hunger) to state B (comfortable fullness). Almost every culture seems to have a saying equivalent to the common English-language proverb "hunger is the best sauce."

It is the same with most simple pleasures. Warmth is not experienced as special unless one is coming in from winter weather. A cool drink of water is heaven when one is truly thirsty; otherwise it is uninteresting. Sex feels wonderful after long abstinence, but usually less so after an abstinence of only a few hours. Evolution has done this to us (Diamond 1997).

We eat to survive, not to sacrifice our interests for our children. Still, to motivate an animal to eat and eat well, not only must hunger hurt but the reward and pleasure centers in the brain must also fire up when good food is eaten. All animals choose some foods over others; evolution guarantees that the chosen ones will be the more nutritious, other things being equal. Most or all mammals have inborn taste preferences; this can easily be observed in cattle, dogs, and other familiar animals. Humans have learned to trick nature by making non-nutritious foods taste good, just as we have learned to trick nature by making sex fun when it has no reproductive possibilities.

People almost always eat as a social act. Lonely individuals often lose the desire to eat. They simply do not feel hungry. They often starve to death. The charitable organization Meals on Wheels, which takes food to shut-ins, has learned that the delivery person often has to sit with the recipient; otherwise the food goes uneaten (personal communication, Meals on Wheels volunteers, 1980s).

Under natural circumstances, we would eat merely to socialize and survive. Food would be merely a means to those two ends. Humans are perverse enough, however, to change a means into an end. Food, like sex, is cultivated for pure pleasure. Nature is often derailed—dismissed outright—from the process. Contraceptives derail the reproductive process. The ancient Romans ate, vomited, and ate again. Today, this behavior is again common. We now judge it harshly, under the name of "bulimia."

The Romans did it simply to maximize pleasure; bulimics today have more troubled and conflicted reasons for their behavior and are often driven by desperate desire to be thin or by darker psychological forces. Others deliberately seek out foods with minimal caloric value—a less drastic way of accomplishing the same goal of eating for pleasure rather than for nutrition.

We have seen that the human organism is born with some degree of fondness for the sweet, sweet-sour, salty, and fat, as well as for spices. Meat, fish, nuts, and seeds, nutritious and popular almost everywhere, evidently touch some sort of inner chord.

Flavors developed in vegetables and meats by cooking, and in fruit by ripening, seem inherently pleasing (see Harold McGee's classic *On Food and Cooking* [1984, 2004]). Preferring ripe fruit makes good sense in terms of primate and plant evolution; the fruit develops good flavors when ripe, so that we will eat it and scatter the mature seeds around. The plant uses nutritional value to lure dispersal agents. It is harder to understand how we came to like cooked food, but perhaps cooking was discovered so long ago that we have had time to evolve a preference. Cooked food tends to be healthier and safer than the raw sort, so there would be selective advantage for this.

Beyond this, however, experience appears more important than genetics. We build on natural tastes, but then our actual foodways are based on growing up with particular families, friends, societies, cultures, advertising campaigns, markets, travels, and media influences (Prescott 2012). This, too, makes sense in evolutionary terms. Many of us have watched parent mice or coyotes or monkeys or horses teaching their young what to eat and what to avoid. Smart animals all fine-tune their instincts on the basis of experience and social learning.

Foods we were raised with are typically our favorites. This goes right back to mother's milk. Not only do babies learn to love soft, sweet, milky things; they also learn to love flavors such as garlic and onions, and even the hotness of chile, all of which print through in the milk. Some mothers have told my wife and me that they self-consciously eat their ethnic foods when nursing their babies, so the children will grow up with the right tastes.

Even without such imprinting, children learn to love the foods their parents and older peers prefer. In this, again, we resemble other mammals, which learn their proper foods partly by hanging around with parents and watching what they eat. For many people, "good food" is simply the food they are used to. Americans love white bread, hamburgers, and ketchup, while rural Zambians love mopane caterpillars, millet mush, and hippo meat, because these are "what everyone eats."

Children are most prone to love foods that are used as treats, rewards, and markers of special events (Conner and Armitage 2002). More interesting is the universal tendency to loathe foods identified with poverty and bad times. Children learn with striking swiftness and thoroughness that they should hate such foods. Sweet potatoes are a delicacy in many areas of the world, but they are abominated in China and in parts of the American South because they were poverty foods there. Many of us who remember rationing in World War II cannot imagine how anyone can actually *like* the processed meat product known as Spam, which made frequent appearance on wartime tables in place of rationed meat and thus became stigmatized. Yet Hawaiians, among others, love Spam and use it creatively (Laudan 1998).

It often happens, through such taste development, that a familiar, everyday food becomes a luxury as times change. Recently, this has been particularly evident in the case of cured fish products because overfishing has made them rare where they were once the cheapest of protein foods. Salt cod in the Mediterranean, caviar in Russia and Iran, pickled herrings in north Europe, and smoked salmon in Scotland and Scandinavia got into the diet because they were cheap, but they now

Sweet potatoes, Goroka, Papua-New Guinea. The people of highland Papua-New Guinea are famous for their recognition and maintenance of hundreds of varieties of sweet potatoes, a staple food they have had for several centuries. Photo by E. N. Anderson.

remain important as luxury items in the diets of those who became used to them. As brown bread has become more expensive than white, it has become more prestigious, at least in many quarters; when white was more expensive, it was the rich people's choice. The Voltaire character who exemplifies nasty snobbery by saying "there must be white bread for the masters and wholemeal for the servants" (Voltaire 2004 [1764]:214) would now say exactly the reverse!

One obvious question, but one with no well-understood answer, is, When do we want the familiar, and when do we want the new? We know that Mom's chicken soup is comforting when we are sick and miserable, while exotic restaurant fare is usually most appealing when we are excited and cheerful and when we are out with adventurous friends. Also, "openness" is a basic factor in personality. Some people (and some monkeys, dogs, and even bees; see Seeley and Robinson 2012) are just more adventurous than others. Often these are the young adults; the old and the very young are more conservative. But, beyond that, people simply differ. The individual who can't wait to try a new ethnic cuisine and the one who would never dream of eating anything but familiar home meals stand at opposite ends of the openness scale.

Someone growing up in London or Los Angeles will have much more chance and encouragement to try new foods than someone growing up in a small, isolated farm town. Someone growing up in a family that values food and tries many new items will be more apt to value good food than one raised on a steady diet of white bread and frozen dinners. (Two of my children rebelled against the "weird" food in our home—but they grew up to be lovers of fine and varied foods. To modify one of the countless proverbs that use food as symbol: even if the apple rolls away from the tree, eventually it rolls back.)

Aesthetics has much to do with pattern, order, and symmetry. The most basic aesthetic sense is the pleasure derived from recognizing, understanding, and enjoying a pattern that stands out from surrounding chaos. This is probably yet another evolutionary matter: we evolved an ability not only to pick out the fruit from the leaves, the snake from the grass, and the flower from the brush but also to enjoy the search and the recognition (Gombrich 1984). So our foraging career may be the foundation of our love for geometric patterns, just as music is based on recurrent themes and rhythms, which must have something to do with heartbeat, breathing, and sex (*pace* Robert Jourdain's [1997] claim to the contrary).

In all these patterns, we like subtle surprises. We want the pattern to be varied just a bit, in systematic but exciting ways. Simple mindless repetition is all very well, but complex, understated variations on the theme are much preferred. This is why "keyboard" and "synthesizer" music set to produce an automatically repeated sequence sounds so dull and boring.

So familiar tastes and familiar combinations are reassuring and become inherently lovable, but the exact same meal, over and over again, becomes deadly. Good home-baked, or at least human-baked, bread is never dull, not only because it has a complex and rich taste but because the taste is also never quite the same from bite to bite. By contrast, nothing is duller than factory bread because it is the same simple stuff time after time.

Yet, we expect uniformity in apple juice, peanut butter, and many other everyday foods and are disturbed if there is even the least variation. Here, the appeal appears not to be so much an aesthetic one as a

Varieties of potatoes, Cuzco, Peru. Thousands of varieties of potatoes exist in the Andean region, and a single market stall may offer twenty different ones, differing in size and color. Other tuber crops, such as oca and ulluco, are also common; they are little known outside the Andes but could potentially revolutionize the world as much as potatoes have done. Photo by E. N. Anderson, 1997.

matter of familiarity and reliability. We drink fine wines to savor their subtle variations, but we drink apple juice to put something familiar and sugary in our stomachs. Wine is beloved of adults; children, more innocent and more well supplied with taste buds (and therefore more easily overstimulated), prefer the apple juice.

A good meal is like a symphony: familiar and exotic tastes are combined in constantly varying and intricate ways, but the whole should add up to a unified creation. This explains the worldwide importance of rules for service (appetizers, soup, main dish, dessert, in the classic American setting) and for canonical combinations (meat with green beans and potatoes for some cultures, chicken with apricots and cinnamon for others.)

Food is often made visually beautiful. Preferences in food spectacle range from the wildly lush table sculptures of the Baroque to the

Tomatoes for sale, Istanbul. This Mexican crop came to the Mediterranean in the sixteenth century but did not spread until the seventeenth and eighteenth centuries. Along with other New World foods, notably chile peppers and maize, it has been wildly successful in Turkey. Photo by E. N. Anderson, 2000.

wondrously *shibui*—subtle and low-key—art of Japanese Zen cooking (Ishige 2001; Yoneda 1982). Obviously, wider cultural aesthetic rules lie behind these differences.

Feasting is often accompanied by music in virtually all cultures that make the slightest claim to elegance. The music may range from trumpets to didjeridoos, from plainchant to rap; the point is that a great meal is not just an appeal to taste but an appeal to all the senses.[1] Wine is classically paired with women and song, and feast poetry goes back to the dawn of time. Whole anthologies of food poetry and food songs have been compiled (e.g., Cheng and Collet 1998).

In traditional China, feasting was often a total sensory experience, with music for the ears, beautifully prepared and arranged dishes for the eyes, incense as well as the food fragrances for the nose, and various forms of spicing for the touch. The slight numbness caused by Chinese brown pepper balanced the hotness of other peppers; the cool drinks balanced hot food. The Western world is not unaware of these refinements but makes less a fetish of them; in particular, the music played in most restaurants today is—at best—not calculated to produce delight and often seems to this writer to be designed to make the clients suffer.

The effects of alcohol on the psyche obviously have much to do with its popularity; even bad booze can be enjoyed. But good booze is better. Therefore, around the world, cults of wine and beer have arisen, and superb-tasting brews have developed. Not only Europeans make a fetish of alcohol. The Chinese adored their *jiu* (a general term for all alcoholic drinks), as shown in this poem about a Taoist adept:

> . . . The Master . . .
> Holds up his jar
> And goes on with his wine,
> Cherishing his cup
> To the last lees.
> With ruffled whiskers he sits,
> Legs spread indecently apart;
> The yeast becomes his pillow,
> The sediments his mat.
> —Kohn (1993:301; her translation from an early medieval poem)

> Everything can be made acceptable if you know how to prepare it, and it is not yet twenty years since a famous caterer served to some gentlemen (for the lack of other meats) an old pair of water-buffalo leather gloves, shredded and stewed, with onions, mustard, and vinegar, which they found excellent as long as they did not know what they were eating.
> —François Marin, mid-eighteenth century

In New York and Los Angeles, there is considerable snob value to trying exotic new restaurants. One learns to cultivate a wide taste because it is often necessary if one wishes to keep up with one's peer group. In the Midwest, in contrast, cultural pressures were and sometimes still are diverted toward everyone eating the same familiar dishes day after day and year after year.

Throughout history, elites and merchants have found it expedient to cultivate varied and rich tastes. They have to entertain. Lavish feasts have been based on dull food, especially in simple cultures (Goody 1982), but usually the pressure of competitive feasting forces elites to cultivate variety as well as quantity. This is most true in the great old courtly traditions, from China and India to the Aztec and Maya courts. However, it is true also among the traditional native peoples of the Northwest Coast. The famous potlatches and feasts of that region led to a spectacularly varied and wonderfully subtle cuisine. They are among the few non-agricultural people with a genuine gourmet tradition, though all groups, agricultural or no, have some preferred and special foods.

The pleasures of the table have been celebrated in all lands and time periods; they are already well known and well attested in the earliest historical documents, from Mesopotamia and ancient Egypt. Fancy recipes occur among the Babylonic cuneiform texts (Bottéro 1995). Ancient texts in these areas and in ancient China tell of delicacies, royal feast foods, and choice grades of ale or beer (usually mistranslated "wine" in the Chinese case). The European medieval period, lampooned as a time of gorging and throwing bones to dogs under the table, was actually a time of highly refined, mannerly, complex dining (even in England; see the superb history by Peter Brears [2008]). Norbert Elias's (1978) claim that the "civilizing process" began from essentially nowhere in the Middle Ages and progressed in a steady upward sweep is quite wrong, being based on highly selective evidence. In Mexico, the Aztec kings had elaborate gourmet fare at their feasts, including frogs, lake salamanders, and "Mexican caviar"—eggs of water bugs (Coe 1994; Duran 1994 [sixteenth century]; Parsons 2008; Sahagun 1950–1982 [mid-sixteenth century]). All these were considered such delicacies that one city allegedly surrendered to the Aztecs when the latter besieged the place and then cooked these delicacies, upwind. The aroma drove the citizens wild (Duran 1994 [sixteenth century]:92).

Of course, gourmetship is traditionally associated with France; the very words "gourmet" and "gourmand" are French, as are a very large percentage of food words in western European languages. Brillat-Savarin (1925 [1825]) popularized gourmandship and food writing in the nineteenth century, but the French were setting standards even before (see, e.g., Fabre-Vassas 1997 [1994]). But Italy has a comparably varied and considerably longer tradition, and the ancient Greeks and Romans as well as the early and medieval Arabs were famous foodies. Everywhere this sort of elaboration tracks the rise of a prosperous middle class based on trade and commerce: they have access to goods, the need to impress, and do not have the money to impress with the sheer quantity and rarity of ingredients. They have to be creative to stand out. Thus, in China, gourmetship has always been concentrated in the mercantile and economic heart of the country, the middle and lower Yangzi Valley (more recently also the Pearl River area of Guangdong). The centers of power, usually in the dry north, have had less commerce and much less gourmetship.

Connoisseurship often reaches slightly surreal levels. Wine experts can supposedly tell from one sip the origin of the wine, often down to a fraction of a vineyard. (There is a vineyard in northern California that produces three different wines because it has three different soil types, and each soil imparts a different flavor to the wine; see Howell and Swinchatt 2000.) In the Pacific Northwest, I have encountered many salmon connoisseurs, most of them Native Americans, who could tell what river a salmon came from and—they claimed—even which month it ran up the stream. Melons from Green River, Utah, and Hami, China, are deservedly famous (the hot, dry days and cool, dry nights cause maximal flavor development). Similar levels of expertise exist locally for coffee, tea, ducks, apples, and other luxuries and indulgents. Monet spent his last years alternating between painting his garden and breeding the perfect duck; he is said to have created a duck never excelled for roasting (Joyes 1989). Gourmetship in tomatoes flourishes, with heirloom breeds rapidly becoming more available in markets, nurseries, and seed packets (my wife Barbara's true gourmetship is in this area; and see Smith 1994).

There is also, famously, a huge gourmetship in chile peppers, which involves preference for stinging quality as well as for taste. It seems as if the tastiest chiles are the hottest—at least habaneros and rocotos are really amazingly good and almost unbearably hot to the uninitiated. (My Mexican friends munch them like apples, but they are used to them.) The "hotness" of chiles is due to capsaicin, a vanilloid oleoresin that exists in several forms—some mild, some hot but fading fast,

Fruit vendor artistically sculpturing a pineapple, Jamaica. Fruits are critically important to nutrition in much of the world. Mangoes, visible here with other fruit, are a particularly valuable source of vitamin A in many regions otherwise short of that essential nutrient. Photo by Barbara Anderson, 1989.

some hot and long-lasting (Caterina 2007; Caterina et al. 2000). The plant makes this stuff to kill fungi—chile is one of those spices that is an excellent antifungal and rather antiseptic, and thus a fine preservative. The capsaicin also keeps mammals from eating a fruit that is "meant" to be distributed by birds (Friese et al. 2011; Nabhan 2004). It works on humans by directly stimulating pain and heat receptors. It is, however, harmless, unless very hot forms are actually rubbed into the skin, mouth or eyes—they can cause blistering and burn-like reddening. In habitual chile eaters, the receptors quickly learn that the stuff is relatively harmless and desensitize to it. Thus those countless claims in the English food literature that chile eaters "love pain" are simply silly. Chile eaters don't feel much, if any, pain, depending on what they are used to. What seems agonizing to a greenhorn is as pleasant as a back rub or massage to a veteran. My Maya friends are almost completely insensitive. I can handle ordinary high-spice food but can't deal with full Maya or South Indian hotness. Others situate themselves along a continuum. However, a macho one-upmanship in bearing chile pain has developed, and perhaps that is "pleasure" of a sort. The hottest peppers in the world, the "ghost peppers" of northeast India, are now available in sauces and powdered form; the sauces are bearable one drop at a time, but the powder is probably usable only for throwing in the eyes of attackers (a venerable Native American way of fighting). Or one could dilute it; John Evelyn in 1699 recommended baking chile in bread and then powdering the bread (Evelyn 2012 [1699]).

Class, rank, and status are particularly influential. The identification of quality and variety with the elite usually produces middle-class emulation and often creative adaptation; often it is the middle class that produces the best cuisine (Goody 1982).

Not Enjoying Food

However, also possible is a middle-class reaction in the form of puritanism or reverse snobbism. Dull food is idealized as "simple and plain," while the luxuries of the fortunate are viewed as alien and evil. The poor rarely share in this attitude; they are too worried about getting any food at all. They are abstemious, but not by choice. Reverse snobbism is perhaps especially common in island and frontier societies, where obtaining a varied, high-quality diet is particularly difficult and thus particularly prone to separate the rich from the middle class. Long-established, well-off farming regions allow everyone but the poorest to have some variety and quality and are thus the natural home of cuisine that is varied and tasty even among the relatively poor. (These generalizations emerge from my research; full documentation must await another occasion.)

In the Midwest of my childhood, strange or different food was feared and hated, both because it was "foreign" and because it was an indulgence. This was, at base, a religious attitude. It traces back to the Puritan and Calvinist rejection of "things of the flesh" and "pleasures of the flesh," which were considered to be distractions from contemplation of Heaven. These attitudes in turn develop from Neo-Platonist hatred of fleshly things, very influential in early Christianity (Coates 1998). On the American frontier, the realities of life on good food became identified with the idle rich. When pizza came to Lincoln, Nebraska, where I was raised, there were letters to the papers denouncing it as "foreign" and therefore "Communist." One person proposed banning it. The Midwest's puritanical society distrusted anything "of the flesh": sex, dancing, booze, good food, and even non-erotic massages. Sex and dancing flourished anyway (how could they not?), but good food was effectively banished. Indeed, the failure of the puritans to stop sex and dancing made many people all the more eager to do penance at the table. The sinners felt redeemed, and the puritans felt triumphant. My Calvinist father and my more lenient, worldly mother disagreed on this issue, which made me very conscious of it all. (Raised on my mother's cooking, I made the obvious choice.)

Food puritanism and reverse snobbism have now become allies of the giant food corporations. Rush Limbaugh and Fox News authorities have gone on long and well-financed campaigns in favor of industrial low-nutrient food and against healthy eating. They dismiss health advocates as "food Nazis" and "elite snobs" and promote fast food as the proper food for the stalwart ordinary person.

Food puritanism—the idea that enjoying good food is sinful—flourishes in many cultures around the world. It failed in China, in spite of much early support. China had its puritan in Mo Di (Mozi), a sage of the fourth century BCE who taught extreme economy in feasting, funerals, clothing, and life in general (Mo Di 2010 [ca. 300 BCE]). He failed dismally. The reason was social: elders, superiors, and ancestors could not be insulted by being served bad food (Anderson 1988). This idea—quite explicit at the time—spread to ritual sacrifices, which fed even higher beings. Chinese religion produced food fit for gods. Even Buddhism, inherently puritanical about food (monks are directed not to enjoy it), has not stopped gourmetship in Asia. All Buddhist countries have developed excellent cuisine that satisfies the letter of the law by being vegetarian and thinly spiced, but does not satisfy the spirit of the law, being refined, expensive, and luxurious. Zen temple cuisine is one of the highlights of Japanese fare. This Buddhist cuisine is simple and rigidly vegetarian, but exquisite in its refined and subtle flavors and no bargain economically. Rather than celebrating the abstemious, it celebrates the full, rich flavor of ingredients that purport to be simple and straightforward but are actually exceedingly expensive and difficult to obtain. This would seem to be rather a mockery of puritanism. More directly mocking is the Chinese dish of mixed meats, including organ meats, known as "Buddha jumped over the wall." It smells so wonderful cooking that it supposedly entices even the bodhisattvas to escape their vegetarian confines.

Puritanism has had a very up-and-down course in Islam, where the war between spoilsports and gourmets has been a self-conscious and hotly debated battle since Muhammad (van Gelder 2000). Muhammad's own words, preserved as *hadith,* reveal him as a basically abstemious man, but one able to enjoy good, solid cooking. Thus, he can be, and is, quoted by both sides. His favorite food was said to be *tharid*—meat stock thickened with bread. His followers naturally imitated his taste. The *migas* ("crumbs"—soups thickened with bread) dishes so popular in the formerly Moorish parts of Spain, and their equivalents in formerly Moorish parts of Italy, have been influenced by *tharid.* Later Muslim society often adored good food and immortalized it in fine poetry. Whole books of Arab poetry about food exist. The famous Persian quatrain that begins "a book of verses underneath the bough" (as translated by Edward FitzGerald in *The Rubaiyat of Omar Khayyam* [Khayyam 1942:125]) has a variant in which the book is forthrightly replaced by a leg of mutton (Arberry 1959:121). Both versions of this verse, along with literally millions of other Muslim poems, also pay homage to wine—in spite of the Quranic prohibition.

Judaism has a similar mixed heritage, but the consensus of rabbis seems to be that one should not be ostentatious but should enjoy (Cooper 1993; Rosner 1997). Life is something to celebrate, not to deny; the same sources hold that a married man has an obligation under Jewish law to provide sexual pleasure to his wife. This worthy religious charge is implied in Islamic tradition as well (misrepresentation of Islam by the likes of the Taliban notwithstanding), but absent from Christian tradition.

In Christianity, food puritanism has had a field day. Jesus, good Jew that he was, fed the multitudes well, and made wine for them. His example has been neglected in this, as in much else. By about 200 CE, Clement of Alexandria was writing, "For neither is food our business, nor is

Breakfast, Kunming, Yunnan, China. These toasted wheat cakes are definitely breakfast foods, not eaten at other times. Photo by E. N. Anderson, 1991.

pleasure our aim. . . . Food . . . must be plain, truly simple . . . ministering to life not to luxury" (quoted in Clifton and Spencer 1993:194). Since the days of Clement and the desert fathers, the more dour of Christians have hated and distrusted good food.

This attitude did not prevent said desert fathers from eating much better than they said they did; recent excavations have revealed a rich and varied diet, with plenty of spices and choice vegetables, in the very monasteries where the monks claimed to live on dry bread (Harlow and Smith 2001). It did not prevent the monasteries and nunneries of the Middle Ages and Renaissance from being homes of good living and laboratories for the development of culinary arts. The "fat abbot" remains proverbial.

However, abstemiousness to the point of "holy anorexia" (see Bell 1985; St. Catherine of Siena provides a good example) was valued then and later, as was self-mortification in all things. The saints piously refrained from good food, as well as from bathing. (As recently as the sixteenth century, bathing was enough to get one in trouble with the Inquisition on suspicion of infidelism; see, e.g., Weckmann 1992

[1984]:456–457. Part of the reason was the promiscuity associated with public baths in the Middle Ages.)

The Reformation and Counter-Reformation brought (to some quarters, at least) a new and even more extreme hatred of all things aesthetic. The extreme-puritan tradition has mercifully become attenuated in Europe, but one recalls that Charles Dickens's "Christmas Carol" was written to *revive* Christmas and the Christmas feast in England. Christmas had been virtually eliminated by the Puritans, who regarded it as a pagan holiday. (It does, of course, have pagan roots.) Dickens's contention—that puritanism was a hypocritical cover for selfish greed—seemed accurate to the people of his time, and seems accurate today. Ebenezer Scrooge has left a legacy in the continued opposition to feeding the hungry worldwide. Selfish cruelty, masquerading as opposition to "giveaways," remains very much with us. In short, puritanism nests in religion, but it is a wider social phenomenon; religions can take it up or not, and not all puritanical traditions are really religious in origin.

If you learn to be honest with food, it spills over into your whole life.
—Liane Kuony (chef)

8 FOOD CLASSIFICATION AND COMMUNICATION

Structures of Food

We are all aware of the value of food as a mark or badge of ethnicity, religion, class, and other social groupings. The bald statement of this obvious fact is fairly banal. In fact, there is more to food talk.

I did a small bit of fieldwork in Tahiti, decades ago. People would often greet me by wordlessly offering a piece of fruit or a sip of a drink. I learned that this substituted for a verbal greeting. One could say "*ia orana*" ("hello"), or one could offer a piece of food. I learned that constant exchanges of food, from a chance sharing of fruit to a major feast, were the social threads that bound Tahitian society.

Communication often provides the fine-tuning—the actual specification—of foodways. Biology and economics set limits, and personal preferences and tastes matter, but cultural foodways are specified largely by the needs of communication.

One can read food as a text and decode what people were saying, or trying to say, when they managed food. Claude Lévi-Strauss and Mary Douglas have written magisterial works on the subject (see, e.g., Douglas 1966, 1970; Lévi-Strauss 1964–1972), and a generation of interpretive writers has followed (see, e.g., Counihan and van Esterik 2007).

Lévi-Strauss attempted to analyze foodways in terms of grammar. This was a major part of his life project: finding the deep structures of all cultural activities. He held that foodways would have such structures, just as grammar does, and that one could isolate rules just as one can state rules for changing an English verb into past, future, or perfect tense forms.

Up to a point, this worked well. Douglas, following up the idea, pointed out that the English formal dinner is sentence-like in its exact order: appetizers, soup, fish, and so on to dessert. One can point also to the equivalence of ingredients and phonemes (meaningful linguistic sound units) and the similarity of a complex dish to a word made up of phonemes. A dinner made up of such dishes is rather like a sentence; a feast is a paragraph; an individual's whole food system might be likened to a book; and so on.

Clearly, this analogy can be pushed too far. Sometimes Lévi-Strauss's own application of linguistics was purely metaphoric, as when he rather cuttingly described French food as "marked" and English food as "non-marked." The parallel is with the linguists' distinction between the "unmarked" form of a word (in English, forms like "go" and "run," which can be used as "general" forms of the verb) and the "marked" forms ("went," "gone," "ran," "was running"—words that specify a time or other definite conditions). Obviously, the parallel isn't a good one, as English anthropologists immediately pointed out.

Food is, indeed, rather like language, but one can be more free with food. It is not so tightly structured as the elements of language are. Consider the simplest case: the similarity of combining phonemes into a word and ingredients into a dish. "Tree" has three phonemes: /t/, /r/, and /i/ (/i/ is used to write the "ee" sound in standard linguistic transcriptions). A minimal sort of Texas chile might have three ingredients: beans, chile, and meat. (No, I don't make it that way either, but bear with me.) With the word, if you mispronounce it (dree), drag out one sound (treeee), write it, yell it, or otherwise mangle it, it is still "the same word" to an English speaker. With a food dish, tripling the chile, or using a different type of bean, changes the dish materially and provides a quite different experience. To that extent, food is less tightly structured. One does not automatically reduce a range of different experiences to "the same thing."

A meal is even more variable. If it is like a sentence, it is like a sentence in a language much less grammatically constrained than any real language on earth.

In fact, cultures manage food as art, not as (ordinary) language. Food is closer to visual art or to music than to poetry, for poetry must depend on the strict rules of language, while food, like painting, can play practice games at all levels.

Lévi-Strauss came to see this. His magnum opus, *Mythologiques* (in four huge volumes, 1964–1972), analyzes myths and mythmaking in terms of language, food, and music. Interested always in structures, he sought common structures in all the four realms (myth, language, food, and music) and pushed as hard as he could to find in food, music, and myth the tight, formal rules that characterize linguistic analysis. To do this, he had to infer "deep structures," unstated patterns underlying these arts. The intuition of the anthropologist was needed to discover such structures.

Naturally, this approach produced a reaction. Poststructuralists not only doubted the validity of deep-structure analysis of myth and food, they challenged formal analysis itself. Practice theories, such as those of Pierre Bourdieu (a Lévi-Straussian at first; see Bourdieu 1977, 1990 [1980]), privileged the flexible, improvised quality of practice and action over the formal structures inferred by analysis. Even language itself was analyzed from a "practice" standpoint, as in the brilliant work of William Hanks (1990).

The dust has somewhat cleared from the battlefield, and one can now take a rather dispassionate view. Practice is everywhere important, but rules exist. They can be very strict, or they can be mere vague guidelines.

Some communities—orthodox Jews, caste Hindus, and devout Seventh-Day Adventists, for instance—do structure their foodways tightly enough to make them easy to analyze in a formal, Lévi-Straussian way. Others, however, are riotously improvisational. It would be challenging to set structural rules for the foodways of typical Los Angelenos or San Franciscans.

Anthropologists describing foodways are usually seeking for rules, generalizations, and guiding principles, rather than trying to cover the whole kaleidoscope of practice. This makes anthropological accounts read far more like formal linguistics than the reality warrants. One cannot really escape this—anthropologists, like ordinary cookbook writers, are in the business of giving general accounts. Such accounts tell people what to expect if they go to live and eat among the X People. Novelists and chefs are, usually, the ones who write individual practice. The chef can write down her unique recipe for truffled lobster; the anthropologist's job is to describe daily bread. Yet cultural foodways have to be predictable and comprehensible if they are to have any communicative value.

Moreover, foodways are under technological and biological constraints. Pie crusts can differ only so much; there are functional constraints on them. Mayonnaise, Chinese stir-fry, and Japanese sushi have to be made just right to be recognizable. A practice theorist who sets out to make mayonnaise by slowly stirring up some oil, egg, and water, instead of whipping them in with perfect timing, will not make anything even remotely recognizable as a mayonnaise relative.

The conscientious describer of foodways, then, gives all the rules possible, in the most clear and concise way. After that, said describer can specify "rules for breaking rules"—acceptable variants of a dish, acceptable shortcuts in making it, acceptable substitutions of ingredients, and so on.

Cooks learn this sort of thing just as children learn their language: by inferring guidelines from practice. A cook soon learns what can be varied in making a dish and what cannot. A normal chile con carne recipe must (by definition) be a stew of meat and chile, normally with salt and pepper. Typical additions include beans, cumin, and oregano. Improvisers routinely add beer or even whiskey, various spices and herbs, and various kinds of chile pepper. Adding maple sugar produces something that might raise the hair of a purist, but I know chile cooks who have done it. Using fish instead of meat would seem to push the dish beyond the limit; no one (I think) would call it "chile" any more. (One might get away—barely—with calling it "fish chile.")

Cooks also learn when they can use shortcuts and when they cannot. Many a dish is ruined in the process, but that is the price of learning.

Eating has its own rules; politeness and etiquette are concepts everywhere, though the "polite" thing to do can vary from throwing bones to the dogs under the table to knowing when to use which of four or five forks. Renaissance Europe had a vast set of rules, deserving a modern book (Albala 2002). Naturally, most of them are different from those of, say, highland New Guinea—or from those of modern Europe. The manners were different from Norbert Elias's twentieth-century ones, but that does not mean they were not there.

Manners, of course, can be used in several ways. They may mark one as a proper citizen who knows decent behavior, or they may be used in a "gotcha!" game, in which gossips scan for any "mistake" and trumpet it all over town. The "improper" behavior can be failure to imitate the elite, or it can be too much imitation of the elite—losing touch with one's roots. Many a political candidate has found it expedient to be present at down-home barbecues and avoid being seen in four-star restaurants.

Therefore, food, like every other art, can convey subtle and complex messages. Many of these are emotional—matters of mood, feeling, and tone—rather than precise and specific. Language is often about being exact, but food is usually about being warm, homey, religious—anything broad and deep, but little that is narrow and defined.

Even when religion or custom enforces a peculiar discipline, there are countless variations: For example, Jewish cooking has hardly become monotonous! Most American Jewish food, in my childhood, was structured not only by religion but also by nostalgia for East Europe. Lox and bagels, knishes, potato latkes, pastrami sandwiches, and many other characteristic foods were universal in Jewish delicatessens and were pretty much the same everywhere. None of these were Near Eastern or Holy Land foods; they were ordinary East European dishes, not especially "Jewish." With the passing of the generation that remembers the pre-Holocaust world, this cuisine is dying out. It is being replaced by a cuisine that is recognizably a descendant, but that has been influenced by recent Sephardic immigration from the Mediterranean and Israel, by American gourmet trends, by French restaurant cuisine, and much else. One now enters a deli with little idea what to expect. Knishes stuffed with chop suey are not unthinkable.

This means that a whole set of messages that American Jewish food used to carry—messages of ethnic identity, of bonds with the *shtetl,* of memory and home and family—are gone. It now carries messages of

The Dzib family, Maya of Quintana Roo, socializing around the kitchen shed.
Photo used by kind permission of the Dzib family.

sophistication, experiment, cosmopolitan living, and openness to the new. If one feels nostalgic, one can seek out the last few traditional delis (if there are any). If one is feeling cosmopolitan, one can try the newer places. Where once the old-fashioned deli communicated familiar messages of home and ethnicity, it now communicates powerful nostalgia. It is now a voice from a vanished world.

Impassioned Classification

Humans classify their world in order to simplify it. Treating each new stimulus as a totally new, unprecedented event would make life impossible. We thus rely on the simple rules noted by Immanuel Kant (1978 [1798]) long ago: the principle of aggregation and the principle of differentiation. We lump together things we find it convenient to think similar. We separate, very sharply, things we find it convenient to think different.

Classification research has blossomed in recent years, and what follows is based on—and is meant to exemplify—ideas from the work of Scott Atran (1990), Brent Berlin (1992), Cecil Brown (1984), David Kronenfeld (1996), and others. These scholars have shown that naming is a complex and structured practice. Every language has an extensive system of names—precise when needed, general when generalizations will do. Every culture has taxonomies of plants and other life forms, including edibles. Special-purpose classifications such as "edible" and "taboo" cut across the taxonomic systems that identify items as "tomatoes," "potatoes," or "salmon." Names can be extended, either directly ("chicken" to "prairie chicken") or metaphorically ("chicken" as coward). Study of names turns out to unlock many secrets of thought, about food or about anything else.

The world thus gets classified into food and non-food.

This is not merely a cognitive matter. We now realize that cognition and emotion are inextricably intertwined (Anderson 1996; Damasio 1994). Nothing we know is emotionally neutral; we are involved, as living and feeling persons, with all our knowledge.

Often, one culture's choicest delicacy is another culture's abomination. The ancient Israelites loathed shellfish but recognized grasshoppers and locusts as excellent eating (see Lev. 11:10, 21–22); modern Anglo-Americans have the opposite reaction. Conversely, the same ancient Israelites loathed the pig, as do modern Jews and Muslims. Yet the pig is favored to the point of culinary adoration in America and most of Europe. The "Islamic Center of America" is in my wife's home town of Plainfield, Indiana. My wife's comment, as we passed the Center after eating in Plainfield's wonderful, popular, and thoroughly pork-centered Kristy's Café, was, "They won't make many converts here."

Things that violate neat pigeonholes—especially pigeonholes sanctioned by sacred writ—are often regarded as uncanny (Douglas 1966, 1970; Lévi-Strauss 1962, 1964). Thus, items that are obviously food, but are not *our* food, get seen as horrifying, disgusting, or unclean.

Ideas of disgust change. Fifty years ago, organ meats were prized in the United States. Liver was universal on menus. Kidneys, tongue, and sweetbreads were commonly eaten. Chitlins—intestines—were locally popular, as were tripes. Today, these have been banished from stores and menus, except where recent immigrants from organ-eating cultures are concentrated. Vegetarianism, animal rights, health findings (liver is high in cholesterol), and other factors played into this change, but it remains poorly understood. Marshall Sahlins (1976) theorized that anything called by its right name is avoided: tongue, liver, and tail are out, but pork, beef, and steak are in. Presumably, if we called pork "pig meat" and beef "steer meat," nobody would eat them. However, this theory does not work; we use honest and forthright terms for rump roast, lamb, chicken, and turkey. Conversely, squeamishness is not much diluted by using special food-market terms for chitlins, tripe (ruminant stomachs), and sweetbreads (thymus gland). The prohibition is one of identifiable innards (whatever they are called) versus undifferentiated skeletal muscles. Even things like chicken necks are now being avoided by some eaters.

A similar change in foodways occurred in Tasmania long ago. When European settlers reached Tasmania, they were surprised to find that the Tasmanian aborigines had no concept of eating fish. The native Tasmanians were surprised and intrigued to see the newcomers catch and eat such creatures. Archeology has since revealed that this state of affairs was the result of a sudden, dramatic change about 4,000 years ago. The only possible explanation is a massive, long-continued outbreak of poisoning by fish that had been eating toxic organisms. Small outbreaks of this type are common in the Pacific world. No such massive outbreak is known in recent history, but recent environmental degradation is causing larger outbreaks, and some strange environmental change probably caused a big, ancient one.

Paul Rozin and his students have demonstrated that squeamishness and disgust are learned (see Chapter 4). Young children eat anything; they learn from their parents and peers what to like and dislike. Rozin may overstate the general case, but clearly the dislike of organ meats is learned. These foods are prime delicacies in other cultures. The Plains Indians ate the tongue and liver of the buffalo even if they had to leave all the rest.

Insects are widely eaten in Mexico; hundreds of species are consumed. Yet the Yucatec Maya are almost as limited as Americans in their animal choices. Unlike other Mexican indigenous peoples, they eat few insects, though they relish wasp and bee larvae. They do not eat mushrooms, which they find disgusting. They avoid reptiles and all small animals. They do, however, consume all parts of the animals they eat. Brains, blood sausage, and liver are notably popular.

Food to some, not to others, Cambodia. Deep-fried tarantulas are sold on the roadside. Photo by E. N. Anderson, 1998.

Much ink has been spilled on why pigs, dogs, and the like are tabooed as food in many cultures. Such items are seen as edible but inedible, and thus strange. Most taboo animals seem to be similarly anomalous in other ways: they are both human and inhuman, or they are cloven-hoofed but do not chew the cud, or they chew the cud but are not truly cloven-hoofed. Dogs appear to be both human and non-human—they live with us, but they are four-footed and don't talk. Thus they are uncanny (Douglas 1966, 1970; Leach 1964). They are even considered poisonous in some cultures. Where they are just another outdoor livestock animal, as in much of China and Korea, they are just another food. (We will pick up this subject again in Chapter 11.)

Of course, to vegetarians, all animals are out of the food category. The Jains of India sometimes go on to avoid even milk (taking it might starve the calf) and seeds (they are living plant propagules). Very strict Jain priests may live entirely on fruit, since fruit is clearly offered by the plant as food, for the purpose of getting the seed distributed. *Very* devout Jains, in fact, may feel called upon to plant the seeds after eating the fruit—a good idea in this age of global warming and deforestation.

One does not usually see moral attitudes toward plant foods. Almost everyone, except the strictest Jains, eats any and all plant foods. Mushrooms and algae—not really plants in the strict biological sense—are, however, often avoided. The reasons that some plants are eaten in one culture and avoided in another must then be buried in history. Americans, disliking strong flavors in vegetable foods, avoid many greens that are greatly relished by Greeks, who love bitter herbs such as wild lettuce, wild fennel, wild radish, and other acrid greens (Gray 1997). The French use chervil and marjoram, the Mediterranean countries use coriander greens and oregano; this has much to do with climate—chervil does not grow in hot, dry zones.

The tender young leaves of manioc (tapioca, cassava) are prized delicacies in parts of Indonesia and Africa, seen as famine food or inferior food in other areas, and viewed as inedible in other parts of Africa and in most of Latin America (this from my personal research). This is largely a matter of sheer habit. There is, however, a biological trade-off behind it: older leaves are somewhat toxic, and thus the leaves tend to be avoided except in places where lack of vitamin-rich foods makes the trade-off worthwhile.

Why did the Spanish enthusiastically adopt maize, tomatoes, and vanilla in Mexico, but not chia seeds, tomatillos (green tomato-like fruit), or the large, anise-flavored leaves of *Piper auritum*? At least we know why the Spanish suppressed the cultivation of that excellent food, amaranth seeds: these were used to make cakes with the blood of sacrificed captives, and Spanish Catholics saw in this a satanic parody of the communion host.

More complex than taboos are the detailed classifications of how the things that are fit to eat manage to fit together. Some cultures view sweets as natural accompaniments to meat; Morocco and Algeria, for instance, cook chicken, lamb, and even fish with honey, sugar, and fruit. Others, including most Anglo-Americans, would never think of such a combination. The English traditionally found the combination of meat and sweet repellent in general, but made exceptions for lamb with mint jelly, game with Cumberland sauce, and roast pork with applesauce. In medieval times, fish with mustard and rose petals was popular in Europe; it would be a virtually unthinkable combination now (though the medieval recipe is, in fact, very good).

Food classifications usually make sense, but many are simply the fossilized record of past fads or historical accidents. One cannot hope to explain everything. But one can try, and the attempt is always amusing.

People often classify foods in hierarchies, much as botanists classify plants. The "sandwich" category includes turkey sandwiches, Denver sandwiches, and so on. At one level, "sandwich" includes hamburgers, but at another level it contrasts; for example, "Do you want a hamburger or a sandwich?" (Frake 1980:5–8). The "fish" category can include shellfish (as in the "fish" section of menus) or exclude them (as in "fish and shellfish" cookbooks). When whale meat was served in restaurants, it posed a problem: was it a fish dish or a meat dish? A New York court ruling in 1818 concluded that whales were fish, at least from the point of view of the food industry, whatever they may have been biologically (Burnett 2007).

Most English speakers know that the folk and botanical definitions of "vegetable" and "fruit" differ. To the botanist, all plants are "vegetable" productions, and all structures that enclose a seed in a flower-derived covering are "fruits." To the folk, "vegetables" are edible non-sweet plant tissues, and "fruits" are sweet ones. Thus, many items are vegetables to the folk but fruits to the expert: eggplants, tomatoes, red and green peppers, and so on. Conversely, some items that are fruits to the folk are not fruits to the biologist. The "fruit" of the cashew plant, for instance, is a swollen stem. (The nut grows at the tip of it, not inside it.) Many "fruits" are actually aggregations of many tiny fruits grown together: pineapples, blackberries, and the like. We think of a pineapple as a single fruit, but it is actually a whole cluster of fruits that grow together into a single mass.

"Berry" in folk English refers to any small, seedy fruit, but in botany it refers only to single soft fruits with many seeds per fruit. Thus, botanically, the category does not include such familiar "berries" as strawberries (small, hard, true fruits on the outside of a swollen stem base) or blackberries (lots of little one-seeded fruits stuck together). Conversely, tomatoes and eggplants are berries to the botanist but not to the diner.

Similar problems occur in other languages. In parts of Mexico, *fruta* even includes sugar cane and sweet potatoes—because they are eaten as snacks and are sweet. In Chinese, no distinction is made between fruits and nuts, both being *guo,* but fresh soft fruits are separated off in a subcategory: *shui guo,* "juicy fruits." Squash and melons are combined in a quite different category, *gua*; Chinese realize that these are "fruits" of a sort, but do not think of them as *guo.*

Virtually all cultures differentiate between animal and vegetable foods. Probably all differentiate fish from land flesh. Most distinguish leaves from root foods. Beyond these obvious distinctions, classification and terminology can be confusing. One need only recall the Norman French food terms in English: "beef," "pork," "venison," and "mutton" for the meat of cattle, pigs, deer, and sheep, respectively (yet "lamb" remains recalcitrant).

Or consider "herb"—from the Latin *herba,* meaning any small plant. In English we now use it to mean fresh or dried flavoring-plant leaves used in very small quantities, like spices. In French, *herbe* is usually used this way, too, especially in the combination *fines herbes.* Chinese has no equivalent to this, because the Chinese don't usually use plants this way. Maya, too, lacks any comparable category. "Herb" took on its modern English use quite late, as the spices of medieval cooking were supplemented and then replaced by these aromatic plants, in the seventeenth and eighteenth centuries. The usage crystallized slowly. It has still not lost its medicinal applications. Until the nineteenth century, "herb" in English carried strong medical overtones. Today its prime focus is culinary, but "herbal medicine" is making a comeback, and "herb" may be regaining its earlier reference.

"Spices" are normally differentiated from "herb" by being seeds, hard, dry fruits, or bark rather than leaves. As usual, we should not expect comparable terms in other languages. Most European languages have an equivalent, dating from spice-trade centuries. But Chinese does not; the nearest equivalent means "flavoring things" or "aromatics."

Terms thus change as uses of foodstuffs change. Of course, they do not always perfectly mirror changing foodways. A term may get stuck, frozen in the language long after its world has changed. "Sweetmeat" recalls a day when "meat" in English meant any food, not animal meat per se. "Steak" was once the cut of meat that was broiled on a stake, like a large kabob; the name persists, under an odd spelling, long after the cooking method has changed. Changes sometimes begin and never progress; "tart" has replaced "pie" for some specialized usages, but "pie" remains the standard.

The negotiation of meanings can involve negotiation about class, about locality, about specialization. Prized foods like caviar, Camembert, Stilton, and burgundy are subject to militant name defense when imitated. The last three are now legally protected (to varying degrees in different countries). Caviar remains vulnerable; lumpfish and salmon eggs pass under the name, the edible eggs of insects breeding on the lakes of central Mexico have been called "Mexican caviar," and, at the extreme, a Turkish and Armenian eggplant dish is known in some quarters as "eggplant caviar."

Huge battles over the right to use a prized name are routine in the courts and legislatures of Europe. Thousands of pages of legal codes list and describe, precisely, the exact regions and exact artisanal processes that produce true Roquefort, champagne, and so forth. The French (of course!) developed this system of *appellations controlées,* and (of course!) first used it for wines, but over time the system spread to other foods and other lands. The Japanese independently developed something similar. The idea of *appellations controlées* has spread to other countries recently, especially in wine labeling but also—increasingly—for cheeses and other local foods. Ethiopia has attempted to enforce it for Yergacheffe coffee, a superior product whose name is not infrequently taken in vain.

Serious conflict developed in the 1990s over the attempt to patent the name "basmati," a word used heretofore as a general description for aromatic rice varieties of northwest India and neighboring Pakistan. An American firm attempted (unsuccessfully, in the end) to patent the word as a name for a rice variety it grew. Ironically, the variety was not, in fact, a basmati. This became an international scandal and has led to intense investigation of the whole issue (Shiva 1997).

In short, food classification and nomenclature are not obscure and irrelevant issues. Food names can be fighting words. Nomenclatural food fights can be serious courtroom battles that go on for years.

Nomenclature for particular dishes and recipes is far too complex to discuss in a general book. Everyone has a favorite list of odd dish names: bubble-and-squeak, toad-in-a-hole, and so forth. More serious is the tendency of humans to consider anything classed together to be truly, deeply similar. We expect "vegetables" to be uniformly good nutrition sources and are surprised to find that some are incomparably

Coffee ritual, Addis Ababa, Ethiopia. The coffee has been freshly roasted and ground and is being poured from a traditional pot. Photo by E. N. Anderson.

better than others. We see a logic to the use of the term "pepper" for various unrelated plants; they are alike in that all of them are piquant, or "peppery."

But words grow organically, like plants, and similar words can cover very dissimilar things. In addition to the miscellaneous "peppers," we have a range of "potatoes," from white to sweet to air (the "air potato" is a yam that bears small tubers on its aerial vines). "Lettuce" extends to lamb's lettuce, which is not much like lettuce but can be used in salad, and even to sea lettuce, an alga with a superficially lettuce-like appearance. "Spinach" has become a general term for a boiled green-leaf vegetable; Malabar spinach and New Zealand spinach are not much like the familiar species, though they cook up similarly. From the days when every land creature was believed to have its sea-creature equivalent, we have dogfish, catfish, rabbitfish, sea cucumbers (which are animals), sea urchins (an "urchin" was a hedgehog—originally), and so on.

The French words for "twice cooked," *bis cuit*, became the name for bread that was baked, sliced, and rebaked into a rock-hard commodity for ships to carry on long voyages. This idea, and the word, were borrowed into English ("ship's biscuit") but the commodity evolved in America into a small, soft bread item, often leavened with baking powder instead of yeast. Meanwhile, the word came to cover cookies in England and, for twice-baked bread, was borrowed as far as Turkey (*beksemat,* later *peksimet*) and Egypt (*buqsumāt*; see Mikhail 2011:101–102). Finally, the Germans, always committed to coining their own words from their own roots, translated *biscuit* into *Zwieback*, and made it different enough to spin that off as a separate concept.

In short, words extend from an original focus. The way a word extends is not always predictable. Words also get misapplied over time, shifting their meaning. Nobody knows what the original "cardamom" (Greek *kardamon,* probably a type of thistle) and "cinnamon" (*kinnamon*) were. The Greeks used them for local Mediterranean foods. The terms were misapplied at some point early in the spice trade (Crone 1987). Similarly, *kaktos,* a Greek word for a kind of thistle, was misapplied to a group of New World plants that the ancient Greeks never saw.

"Corn" is a familiar example of name use and misuse. In England, it means any grain, or even any seed ("acorn" is "oak corn," "aik" being a local variant of "oak"). When the English settled America, they naturally referred to maize as "Indian corn." But maize soon became so familiar that the "Indian" was usually left off, producing monumental confusion to this day. In some specialized usages, it was the "corn" that was left off. "Rye an' Injun" was rye-and-maize-meal bread. "Indian pudding" is made of Indian-corn meal, but is a thoroughly English recipe—not a Native American one.

Other languages change in similar ways. Most American crops, when they came to China, were called "barbarian X" or "western X," "X" being the name of whatever Chinese plant looked like the new one. Thus, tomatoes became "barbarian eggplants." Winter squash is "barbarian melon." Pineapple is "barbarian jackfruit." Pomegranate came to China from the West in medieval times (Laufer 1919) and was called "seedy willow"; then, when guavas came, their fruits looked enough like pomegranates to earn them the name of "barbarian seedy willow." Maize was lumped with millet, asparagus with a native grass eaten as shoots. Spinach is called "Persian vegetable," leaving us in no doubt as to its origin point. Over time, the "barbarian" or "foreign" component is apt to drop, leaving people confused over whether (for example) guavas or pomegranates are being mentioned. Some have assumed that American foods like pineapples and maize were pre-Columbian in China because of this problem.

The white potato received various local Chinese names: "Dutch yam," "horse bell yam" (Chinese horse bells are round and small-potato sized), and so forth. Sweet potatoes, when not "barbarian yams," are "sweet yams" or "golden yams."

Maya expanded the name of the native mamey fruit to cover the introduced banana. Several North American native languages use the word for the native plum to label introduced peaches or apples; whichever fruit was most familiar got the name "white man's plum" (Brown 1996).

In Indonesia, a rabbit is a "Dutch cat," a turkey a "Dutch chicken," both names commemorating the people who introduced these edible animals to Southeast Asia.

Such coined names are often wildly wrong. White potatoes, which come from Peru and Chile, are "Irish potatoes" to many English speakers—leading to geographical confusion about the plant's origin. We call a Mexican bird a "turkey." In Turkey, it is called a "chicken of India." (Presumably they heard it came "from the Indies.") The Chinese name, "fire chicken," seems much better—at least it is creative. Maize, another Mexican plant, used to be called "Turkey corn" in Europe; in Turkey it is "Egyptian corn." The Jerusalem artichoke is only somewhat like an artichoke and has nothing to do with Jerusalem. (The geographic label is said, not very believably, to be a corruption of *girasole,* the Italian for "sunflower," but the etymology of the name remains controversial; see Heiser 1976:183–184.) And how the Peruvian cavy became a "guinea pig," when it is neither African nor pig-like, remains a mystery.

Word usage grows like a vine. It starts from a root but then takes its own way, according to the lay of the land and the opportunities for climbing and extending. The principles of aggregation and differentiation are applied ad hoc, often according to historical accident.

In contrast, no one lumps dogs and apples or potatoes and wheat. No one even goes so far as to lump blackberries and strawberries, except that both are "berries" (in folk naming if not in botany). Things must seem truly basically similar in *some* important way to be lumped under one name.

The most extreme extensions are metaphoric ones. Calling a yam with an aerial tuber an "air potato" is one thing; calling a lazy TV addict a "couch potato" is quite another. "Corn" can refer not to grain but to bad art—the sort of stuff that supposedly appeals only to eaters of America's most rustic grain food.

Most widespread (and outrageous) of all are the sexual metaphors. Every cultural group revels in teasing out parallels between humanity's two favorite realms of experience. From the blues singer's "candy stick" and "jelly roll" to the Chinese poet's "brown pepper" and the indigenous Mexican's "chile," the male genitalia find comparisons with similar-looking local edibles—mostly sweet or spicy ones. Nor does the female escape. South Mexico seems downright obsessed with such matters. The relevant item of female anatomy is variously referred to as "cheese," "meat," "tripe," "papaya," "brown sugar," and a dozen other edibles, providing enough material for a legion of Freudian interpreters. Nor are food preparation vessels neglected. A South Chinese equivalent is "wok," as in "large frying pan." In the southern United States, in my childhood, semen was "sugar"; thus sex in general was "sugar." The red-light district of town was Sugar Hill. Poets from Shakespeare to Delta bluesmen constantly draw on such metaphoric language.

Classification is, at base, an attempt to simplify and make sense of the world. Metaphor plays against this. It is the art of using classification to make the world more unpredictable and striking and, therefore, more interesting. It is the art of playing with language so as to bring out pointed, unusual, or funny comparisons. It uses the principles of aggregation and differentiation, not as tools to get a handle on the world and render it manageable, but as tools to play with the world and make it more entertaining and exciting (Lakoff and Johnson 2003).

I distinguish between true metaphor and mere extension of a term, contra Lakoff and Johnson in *Philosophy in the Flesh* (1999). Metaphor deserves to be retained in its original meaning: a striking parallel between two dissimilar things that can be seen, with the eye of a poet, as having something in common. A mountain lion is not really a lion, but neither is it a metaphoric lion. A social lion is.

We classify to understand, but we humans can never let anything rest. Once we understand something, we feel a compulsion to make it mysterious. A world of clearly labeled foods becomes a world of mysterious poetic symbols.

I love to eat fish, and I also love to eat bears' paws, but if I can't have both, I will leave the fish and take the bears' paws. I love life, and I love doing right, but if I can't have both, I will give up life to do what's right. . . .

Here's a basket of grain and a plate of soup. Getting them means life, lacking them means death. But if you offer them with a harsh insulting voice, even a traveler won't accept them, and if you step on them, even a starving beggar won't accept them. Here is a salary of ten thousand, but offered without concern for the right. What is that ten thousand to me?

—Mencius (1960:book 6, passage 10; my translation)[1]

9 ME, MYSELF, AND THE OTHERS
Food as Social Marker

Food as Message

Food as communication finds most of its applications in the process of defining one's individuality and one's place in society. Food communicates class, ethnic group, lifestyle affiliation, and other social positions. Eating is usually a social matter, and people eat every day. Thus, food is available for management as a way of showing the world many things about the eater. It may be second only to language as a social communication system.

Elaborate social messages are carried in feast behavior. In Chinese formal hospitality, honor and respect are showed by the host using his own chopsticks to serve the guest, by hosts serving chicken and wine rather than salt fish and boiled water, or by literally thousands of other gestures. Weddings are supposed to include shark-fin soup. Lotus rhizomes may be served at a wedding, too, because when you break a cooked lotus rhizome the starch forms long strings that hold the two pieces together no matter how far apart they are pulled. The symbolism is obvious. At birthday parties, long noodles mean "may you live long."

More generally, food has its own meanings. Everywhere, food is associated with home, family, and security.

At a deeper level, food may become a real part of one's identity. Rice is so important in Japanese culture that Emiko Ohnuki-Tierney wrote a brilliant study of Japanese character and food with the significant title *Rice as Self* (1993). This book explains in detail the cultural reasons behind our poetic guide Ryokan's use of a phrase like "everyone eats rice." Ryokan was indeed speaking not only of food but also of self—that interpersonal construction that is regarded by Buddhists as an illusion. Rice is, of course, almost as important in much of China and in southeast Asia. Bread filled a similar role in parts of old Europe; it went beyond "identity" and was life itself, a god or a divine blessing.

One main message of food, everywhere, is *solidarity.* Eating together means sharing and participating. Families traditionally unite around the table, and this remains deeply important in most of the world. Carole Counihan's studies of food in Italy are particularly sensitive and can stand for many others; she shows in detail how complex and emotional are the roles and interactions "around the Tuscan table" (Counihan 2004) and elsewhere in Italy and the world (Counihan 1999). The word "companion" means "bread sharer" (Latin *cum panis*). Buying dinner, or otherwise feeding a prospect, is so universal in courtship, business, and politics that it is almost certainly grounded in inborn tendencies; we evolved as food sharers and feel a natural link between sharing food and being personally close and involved. Such venues as cafés, coffee shops, coffee houses, cafeterias, bars, neighborhood restaurants, and other eateries are vital to social life. Ray Oldenburg, in a very important book, showed that such "third places" were almost as important as home and work (the other two places) in people's lives (Oldenburg 1989). Note that several of these types of eateries have names based on coffee; caffeine has been the stimulant of sociability for centuries, more so even than alcohol (Anderson 2003; Hattox 1985).

The other main message is *separation.* Food marks social class, ethnicity, and so on. Food transactions define families, networks, friendship groups, religions, and virtually every other socially institutionalized group. Naturally, one group can try to use food to separate itself, while another is trying to use food to eliminate that separation.

Clearly, humans are social feeders. There are some obvious benefits, such as the creation of social alliances, or the possibility of combining to defend the food. However, the immediate reason for most social feeding is that people simply like to eat with others. A big feed almost inevitably becomes a party, and a party almost always involves food—and drink. The importance of family mealtime continues to be recognized, even in the contemporary United States, where the average nuclear family sits down together for only three meals a week. Major holidays are occasions for family reunions, inevitably defined and structured by food.

In cultural contexts that require polite formulas rather than honest words, language may lose almost all its communicative function, and here food often takes over the role. In formal dinners around the world, it is not usually appropriate to send the important social messages verbally. Words are bland and carefully chosen. More information about the actual social transactions going on at the dinner is transmitted by food choice and distribution. The most valued guest often gets the choicest portion, and so on down. Other aspects of the ritual may communicate even more. Everyone carefully observes who sits next to the host, who sits at the host's table, who is the first one to be greeted, who is served first, who gets the best piece of meat, or who is urged to have seconds.

The whole purpose of a feast is usually to bring people together and affirm their solidarity (Dietler and Hayden 2001; Jones 2007). Alliances are formed, deals are struck. Visiting dignitaries are feted. In Chinese society, no important deal can be concluded without food and drink. A major contract signed necessitates a lunch or dinner. The more important the contract, the larger and more expensive the meal.

Often a feast has the purpose of affirming the host's generosity. From the feasts of ancient Ireland (*The Tain* 1970) to the potlatches of the Northwest Coast, a leader earned the loyalty of his followers by feasting them and giving them lavish gifts at or after the feast. A reputation for generosity was life, and the opposite was death. This is the most important reason for the extreme power of the bards of old Ireland and the griots of west Africa. They can literally destroy a man by publicizing his stinginess.

Michael Dietler and Brian Hayden (2001) collected many papers on feasting across cultures. The papers confirm that feasts show generosity,

Local tastes, Venice. Fresh mushrooms—six out of a good dozen local species for sale. Mushrooms were feared and avoided as "toadstools" in the English-speaking world through much of history, but in Italy they are a veritable cult, and one can see bankers and lawyers on their lunch hours foraging for mushrooms in public parks. Photo by E. N. Anderson, 2002.

recruit followers, and mark major events of all sorts. Dietler and Hayden theorize that feasting may have been a major spur of progress, leading to developments of agriculture, trade, and political sophistication. Alcohol is often notable, receiving special attention (Dietler 2006).

In Merovingian Gaul, food could mean separation or inclusion (Effros 2002; see also Woolgar [2007] for a superior account of medieval feasting in general). On the one hand, the well-named hermit Ingenuus cooked his simple vegetables over an open fire on a wooden dish—the dish being miraculously unburnt. On the other hand, a heretic with a proper orthodox wife tried to hog all the food and cut his wife's people out by having a heretical priest bless the food, thus making it unacceptable to the orthodox Catholics, but the food burned the priest's mouth and he died, thus showing that God prefers inclusion, at least at noble feasts.

We say someone is "below the salt" because in medieval and Renaissance Europe the salt was set in the middle of the table, separating the higher-ranked people near the table's head from the lower ones near the foot (Scully 1995). According to scurrilous (but dubious) history-student folklore, at a family dinner the legitimate children would sit above the salt, the bastards below it.

Politics and Kin

> When you sit at the table with others, sit long, for it is a time that is not counted against you as part of [the ordained span of] your lives.
> —Ja'far al-Sadiq (medieval Shi'a Muslim leader; Waines 2011:198)

This Arabic proverb is almost literally true: good company (which almost invariably involves food and drink) does actually lengthen your life.

Socialized food is always structured along particular lines. Perhaps most frequently, it conveys messages about group identification. Regions are defined by preferred staple: rice, bread, potatoes. Religions are defined by food taboos (see following chapter). Some religions have entire food cultures of their own; the Hindus (Khare 1976a, 1976b, 1992) and Seventh-Day Adventists are notable among these. Foods can convey a rich symbolic mix of religion, philosophy, lifestyle, and identity in a complex, shifting, exquisitely fine-tuned pattern (Curtin and Heldke 1992). The phenomenology of food and eating would require many volumes to survey.

Even political ideologies have their food cultures. Conservative Americans cling to beefsteak, baked potatoes, and pre-sliced white bread. The upper south and neighboring Midwest has a heart disease rate far higher than that of the rest of the nation, partly because of obesity and high cholesterol levels. By contrast, liberal urban sophisticates seek out the trendiest Europeanoid restaurant. Vegetarian cuisine defines yet other political factions. Health devotees express political as well as medical conviction when they seek out greens and tofu. Lifestyle—that most protean and most important of concepts—results from political identity, from regional identity, from association with friends, from status, and from other factors.

Kin and family structure food in important ways. This has been the focus of much food research, especially since Audrey Richards's pioneering studies in Africa in the 1930s (Richards 1939, 1948 [1932]). Every family has its traditions. These get passed on indefinitely. There is an old joke or urban folktale of a girl who was learning how to cook a roast. Her mother was teaching her to cut the ends off the roast. The girl asked why. Answered the mother, "That's the way my mother did it." The girl then sought out her grandmother and got the same answer. Fortunately, the great-grandmother was still alive, and revealed that when she was first married she had a small pan, and had to trim the ends off the large roasts of those days to get them to fit! This story appears to be purely legendary, but, as the Italians say, *si non e vero, e ben trovato* (loosely: if it isn't true, well, it's a good story). The point is made.

Identity

Food studies have followed other research into the forests and thickets of identity, gender, and ethnicity. These are the three classic topics of cultural anthropology—now important to all social sciences. Foodways are powerfully structured by considerations of personal and group identity. Identity is often constructed and communicated with regard to foods: "I'm a dry martini person, myself."

Vegetarians make up a special food subculture in the United States. Seventh-Day Adventists and Buddhists make up subsets within the vegetarian world. More loosely defined are the groups of vegetarians who abstain from meat simply because they hate the thought of killing animals or because they simply don't like meat.[2]

Similarly, food fights have erupted over the frenetic huckstering of junk food that passes for "modernization" in the modern world. Some of my friends are active in the Slow Food movement, a political cause that started in Italy and has spread widely. It was started in Bra, Italy, by local food merchant Carlo Petrini and has spread like wildfire. It was rather snobbish at first (Laudan 2004) but has broadened to take in many activists who want to save traditional and local foods, small farms, indigenous cultural ways, and other more grassroots causes (Nabhan 2008a).

People identify themselves in terms of locality, also. American regional cooking is less differentiated than European or Chinese, but Americans still stereotype "Boston" baked beans, Kansas City barbecue, and New Orleans gumbo. In France, every village or rural region has

Dinnertime, India. The family gathers round to cook dinner. Photo by Barbara Anderson, 1996.

(or used to have) its own distinctive cheese, wine, baked goods, and—often—sausage and other preserved meat specialties (cf. Root 1958). Italy seems to have a truly different cuisine in each town (Root 1971; my personal observation). China has regional specialties ranging from the melons of the far west to the vinegar of Jiankang in the east.

These mark identity; people from the place in question often make a point of eating their specialty. Even if they do not, their "sense of place" (Feld and Basso 1996) is very much involved with the sense of taste. We are "consuming geographies," as food geographers David Bell and Gill Valentine put it (1997).

In China and especially in Japan a traveler visiting a place has to bring back samples of its specialty foods for his family and friends. The Chinese phrase is *xianpin,* "local products." This social rule explains the Japanese-labeled, high-priced packages of smoked salmon one sees in Northwest Coast airports, the similarly overpriced steaks in Denver airports, and so on around the world. Japanese travelers who have put off buying the "local products" till the last minute are held hostage; they have to buy something, at any price, for the folks they are returning to.

Gourmets and foodies do not form true subcultures but are still defined by their tastes. Individual taste has something to do with all this, but much of it is driven by the need of individuals to communicate something special, distinctive, and personal about themselves.

Eating Own or Eating Enemies

> One might recall . . . an anecdote of Darius. When he was king of Persia, he summoned the Greeks who happened to be present at his court, and asked them what they would take to eat the dead bodies of their fathers. They replied that they would not do it for any money in the world. Later, in the presence of the Greeks, and through an interpreter, so that they could understand what was said, he asked some Indians, of the tribe called Callatiae, who do in fact eat their parents' dead bodies, what they would take to burn them [the Greeks cremated their dead]. They uttered a cry of horror and forbade him to mention such a dreadful thing. One can see by this what custom can do.
>
> —Herodotus, *The Histories* (1954 [fifth century BCE])

Darius was making a point: "Custom is king." He was making it to confound the Greek claim that there is a natural law grounded in human sentiment—a human ethical sense. His story is also interesting to nutritional anthropology. One way that people define group identity is through cannibalism. There are endocannibals who eat their own dead as a means of burial, and exocannibals who eat their enemies, almost always as an act of revenge. (Lurid travelers' tales to the contrary notwithstanding, no one eats people just as food, except in cases of extreme starvation.) Claude Lévi-Strauss (1964) suggested that endocannibals should boil their relatives, since this transforms the food more than roasting does—exocannibals should roast. This turns out to be untrue; cannibals boil or roast indifferently (Shankman 1969).

Everybody loves a good cannibal story. Thus, travelers being what they are, cannibal tales are usually exaggerated. William Arens subjected cannibal stories to a devastating critique (Arens 1979), showing that almost all of them were clearly travelers' fabrications. Arens argued that cannibalism occurs only when people are desperate for food (as

Food as communication, rural China near Loyang. Hospitality by production brigade head, serving superb fried pasta she has made. Photo by E. N. Anderson, 1978.

in the cases of the Donner party or the soccer team marooned in the Andes in 1972). Arens was partly correct. Cannibalism usually happens because of famine (as in China; see Chong 1990). (The prehistoric Pueblo cannibalism ascribed by Turner and Turner [1998] to ritual seems to have been due to famine.)

However, Arens was overstating the facts; cannibalism often does occur for purely cultural reasons (Brown and Tuzin 1983). Burial of loved ones by endocannibalism used to be common in New Guinea, and exocannibalism was widespread. Consuming parts of war captives was a well-nigh universal practice in many parts of the New World before contact, rising to a peak among the Aztecs. Among them it was definitely done for religious reasons (associated with warfare), not for protein (contra the incorrect theory of Harner [1977]; see Isaac 2005; Ortiz de Montellano 1990). Some South Americans are more willing to eat people from enemy tribes than animals from nearby forests; the animals are socially closer than the far-off humans (Fausto 2007). This is especially true since the animals may be reincarnated humans; some groups hold that people are reincarnated as peccaries, which then sacrifice their lives to hunters and are thus eaten by their relatives. Eating a peccary can thus be serious cannibalism. Similar beliefs in Asia lie—to some rather obscure degree—behind Buddhist vegetarianism; one does not eat an animal if it might be a reincarnated human. Some Pacific islanders refuse to eat sharks because the sharks might have eaten humans and thus be partly made of human flesh—a different sort of concern, since direct incorporation, not reincarnation, is involved.

Arens (and others) did establish that the scale of cannibalism was vastly exaggerated by European accounts, particularly after the pope banned enslavement of New World indigenes *unless they were cannibals*—a clause that guaranteed endless attempts by conquistadors to label everyone they met as sure-enough man-eaters.

Herodotus's story is well taken, but natural law does seem to surface in the human tendency to eat *either* one's own or one's enemies and to do it as an act of ritual, in spite of felt disgust.

Food and Status

Individuals fit into the social structure in terms of status and role. Role is perhaps the less important of the two. Particular roles (father, fisherman, homemaker, teenager) may be signaled by food, but this is usually a minor part of a culture's foodways. Fishermen have their own foods because of their occupation—it makes mixed seafood readily available while making land products harder to get. Often, they develop a gourmetship based on the small and less saleable products of their catch. The result may taste better than the "good" products and thus wind up commanding a higher price in the end; San Francisco cioppino is an example (or was, before it became debased for the tourist trade).

Chop suey, created by southeast Chinese vegetable growers as a way to use up small, unsaleable shoots, has had a mixed fate. On its home turf, it is an excellent dish. Unfortunately, in California, it became ever more debased by oil, flour, and canned vegetables. It became synonymous with "bad Chinese food" and even spawned several urban legends about its origin; according to these, it was invented by a restaurateur forced to prepare food when he had nothing left but the day's scraps. The fact that the name means "miscellaneous leftovers" (*tsap* *seui* in Cantonese) did nothing to disprove the myths. Andrew Coe has written a history of it (Coe 2009).

Many other role identities are stated through food. Police are identified with doughnut shops, which are ideal places to gather information on a neighborhood. Still, most occupations and stations are less clearly labeled. There seems to be no signature dish for computer scientists or astronomers or sales clerks.

By contrast, status, class, and prestige constitute probably the most important area signaled by food. Jack Goody (1982) has shown systematically and in detail what many of us had more or less suspected: fancy cuisine is a product of social differentiation. Societies divided up into elites and commoners have a corresponding division of food (Wiessner and Schiefenhövel 1996). This was already true in ancient Mesopotamia (Damerow 1996). Really elaborate cuisine, such as that of modern France, Italy, or China, apparently depends on the rise of a middle class and of *regional* elites and middle classes. The interaction between class and region, and between central and regional societies, gives us fancy cooking.

In the modern world—and for centuries before—we all know the social roles of fancy restaurants, champagne, and so on. Taking one's date to Chez Snob not only shows off wealth, it also shows off personal power and authority—particularly if one addresses the maitre d' by first name, know the fanciest wine to order, and so forth. Cross-cultural comparison shows that women almost everywhere are particularly impressed by male ability to feed them. (See Buss 2003. This is true not only of other cultures, but even of other animals, ranging from storks to wolves.) Human females respond especially to high-status food. Bringing home large amounts of meat made sense in the days of hunting and gathering; a girl really needed to know her boyfriend could do that. Today, it may be little more than an evolutionary relic for most of us—but taking one's enamored out for dinner remains the commonest and most successful type of date. And it still has the old meaning in a few places. The Ache of Paraguay still live by hunting, and a man who brings home a large game animal has many an opportunity (see Chapter 2).

Traditionally, men are impressed by women feeding them home-cooked meals. This may have a more recent, historic origin, being subsequent to the consignment of women to home and kitchen—a relatively new thing in human history. Women were told that "the way to a man's heart is through his stomach." But women cook less today than they used to, and many men have also learned to cook, which tells us something.

This is not the only way in which gender structures food. Anna Meigs (1984, 1997) has described the complex rules for men and women in New Guinea. A whole series of foods is reserved for men; another whole series is strictly women's share. This is all grounded in an elaborate belief system about the inner reality of gender, bodily strength, and sexuality. (To the cynical outsider, though, it looks suspiciously as if the men hogged all the goodies and then came up with a justification.) When I first talked to Dr. Meigs about all this, many years ago, I commented that the same thing existed in my childhood in the midwestern United States. She was most surprised; she had no idea that such a thing existed in America (she is German). But, when my wife and I were young in the Midwest, men were regarded as more like brute beasts. Barbecue, rare steak, beer, whiskey, and the like were purely men's foods. Women were refined and cultured and ate jellied salads, creamed chicken, yogurt, and other pale, bland, soft foods. Needless to say, no proper man would eat such things, any more than a "decent" woman would gnaw on a barbecued rib. In Scotland about the same time, boys refused to drink milk because it was "girls' food"(Richards 1939); girls avoided it because it was "fattening."

Such stereotypes persist among "liberated" women who deny gender differences in such matters. Deborah McPhail and coworkers found that among contemporary Canadians, women who thought themselves free of gender stereotypy had no trouble classifying "light" and "pretty" foods as female linked, big hunks of meat and starch as male (McPhail et al. 2012).

Lévi-Strauss (1962) pointed out that such equations of respective genders with nature and culture are common in the world. In the Midwest, men were "nature" and women were "culture." In New Guinea and many other places, men are seen as the cultured ones, women as the "nature"-like.

A common experiment (beloved of introductory anthropology and sociology classes) is to get a student couple, male and female, to go into a restaurant, and have the woman order a double whiskey and the man a glass of white wine, or for the woman to order steak and the man fish. The waiters almost always reverse the orders.

Children are assigned special foodways everywhere. (The whole question of food in the life cycle requires an entire book; see Goody 1982). Children throughout the world were breastfed until recently. Breastfeeding is supplemented with some sort of weaning food, usually a soft, tasteless mush, at around 6–9 months. Solid foods are gradually increased, and nursing tapers off. Children tend to stop nursing, spontaneously, at around 2–3 years. Some go on indefinitely, especially in societies whose food is uncertain and scarce. Nursing till the age of 5 or 6 is not uncommon in many societies. Weaning age, and the foods considered acceptable, are thus highly subject to cultural manipulation.

Hyping milk as "the perfect food" has its own checkered history (Dupuis 2002). Foods suitable for children have changed a great deal over the last century. In the early days thereof, when infant mortality was still high, there was a genuine fear of giving children food that was "hard to digest." Nursery foods in much of the world were extremely soft and bland: rice pudding or gruel, soft grain gruel, custard, boiled eggs, and the like. Some of these—things like rice gruel—did not offer much in the way of vitamins and minerals, but most cultures had ways to compensate for this. For instance, in China, jujubes and other fruits with at least some vitamin and mineral value are now added to the rice gruel—though in the 1960s I heard a Chinese doctor say that rice gruel was a perfectly adequate food by itself, and that "Chinese babies don't need vitamins, they eat rice."

Vegetables and fruits are now far more prevalent. Yet the old ways persist, widely.

Dr. John Ho of Queen Elizabeth Hospital in Hong Kong, whose specialty is cancer epidemiology, found that the risk of nasopharyngeal cancer was greatly increased by infant malnutrition, especially lack of vitamin C, a common problem at the time (early 1970s). One problem was that Chinese parents believed fruits and vegetables were cooling to the baby and could be dangerous; the baby could get chills (see below). Dr. Ho was able to transform Hong Kong child-rearing patterns, persuading doctors all over the region to make sure that babies got their orange juice (this story is based on my work with Dr. Ho; see Anderson et al. 1978).

Elite groups *always* try to mark themselves off by consumption of special-status or prestige foods (caviar, champagne, goat cheese, etc.), and upwardly mobile people try to rise in respect by being seen eating those foods (Goody 1982; Mintz 1985). Food snobbism is perhaps the most widely remarked bit of pop food sociology; the ancient Greeks, Romans, and Chinese (e.g. Mo Di 2010 [ca. 300 BCE]) all held forth at length on it. The Aztecs had it, and then found themselves on the receiving end after the Spanish conquest, when Aztec pottery and food was low status, while Spanish was high (Rodríguez-Alegría 2005; cf. Duran 1994 [sixteenth century]:esp. 406).

Status emulation leads, inevitably, to an endless progression. The foods and restaurants of the "in" crowd are quickly discovered and patronized by people who yearn to be "in." Of course, when there are too many of these "outs," the "in" people go somewhere else—and the cycle starts again. Los Angeles restaurant guides even specifically mention the "celebrity-watching" potential of restaurants, sometimes listing "stars" to be seen there. This is apt to become a self-unfulfilling prophecy, when celebrities—knowing that they are being stared at—change watering holes. However, the guide writers persist, knowing that many celebrities *like* being stared at, while others will tolerate staring if the food is good.

Foods as class markers are so important that elites have often resorted to "sumptuary laws" to protect themselves from status emulation. Such laws ban the "lower orders" from eating elite foods, wearing elite clothes, riding elite horses, and so on. This was intended to stop the vulgar masses from buying status by imitating the elite lifestyle.

Of course, such laws rarely work well. There is just too much pressure. Not only do people naturally want to imitate the high class; they also derive benefit from doing so because people tend to treat anyone who acts elite as a real elite.

One of the original duties of the coroner, in medieval England, was to see that ordinary people did not eat porpoises or sturgeons they caught—those fish were reserved for the court. No doubt many a peasant ate the sturgeon he caught and that the coroner claimed he never heard a word about it . . . even if (*especially* if) the coroner was there at the dinner.

Even without sumptuary laws, status associations of foods can be strong. There is a traditional blues verse that says

> I asked for water and she gave me gasoline,
> I asked for cabbage and she gave me turnip greens.

The low-status turnip greens are just as disgusting as the gasoline, evidently.

Many other blues singers (and Black Muslims) denigrate the lowly turnip greens, though they are not really very different from cabbage (except in being more nutritious). Such is status. There is one old song glorifying "greasy greens" (turnip or collard greens cooked with bacon), but it is suspected of using the phrase with an obscene double entendre.

However, the status of foods can change for symbolic reasons. Collards and turnip greens saw their status rise spectacularly with the Black Power movement of the 1960s and 1970s. Black Power activists consciously sought to reevaluate the symbols of African American culture, notably including "soul food": the old-time food of the impoverished rural South. Collard greens, chitlins (chitterlings: hog intestines), barbecued pork, corn pone, sweet potato pie (a.k.a. 'tato pone), and other such foods suddenly became the food of the African American elite. White elites tried them and usually loved them—except for the chitlins. This trend leveled off, but African American restaurants still often serve these wonderful and nutritious foods.

So, with the self-conscious revitalization of Black identity and the revalorization of Black culture by African Americans, soul food took on great prestige and was served in the best restaurants—not just African American ones, either. This led to a minor culture war, since southern whites and Native Americans could lay equal claim to the food; it is a joint production. Interestingly, the most clearly African of southern cuisines—Carolina rice cookery (Hess 1992)—was *not* revalorized. It had become too popular with whites.

But African Americans pointed out that they had certainly set their distinctive and creative stamp on it, and above all they were the main consumers of such food in the late twentieth century. As African American culture has become more mainstreamed into American culture, soul food has declined—though it remains popular and continues to be a minor but real point of ethnic identification.

Parallel phenomena occur everywhere. Polenta, once fare for the poorest, is now on gourmet regional menus in Italy. In Portugal I found that *couve tronchuda,* the collard-like food of the poor, is revalued as a nostalgic ethnic marker. The traditional Portuguese "green soup" of finely chopped *couve* greens and pureed potatoes is found in virtually every Portuguese restaurant. It is gourmet fare now. Crayfish and gumbo were revalorized in Louisiana, as the Cajuns rose from a downtrodden minority to an important ethnic group. Cajun food is a fascinating mix of French, Native American, and African foods. Beignet and roux, for instance, are French; alligator tails and muskrats are Native American contributions; jambalaya (as noted), the original "gumbo" (okra), and many other dishes are African. All mix harmoniously in dishes like gumbo.

Conversely, foods can fall in status. Foods can fall in and out of popularity, and pepper and saffron did in western Europe: they were popular in the Renaissance, banished in the Baroque, and rehabilitated (only locally for saffron) in the twentieth century.

Whole cuisines can be local fads. In Los Angeles since the 1980s, there were jokes about the "cuisine of the year." Thai, Cajun, North Italian, and other cuisines went in and out of fashion with dizzying speed. Ferrán Adrià's strange techno-Catalan recipes, with their foams and molecular manipulations, had the inevitable brief vogue. A recent fad that seems to be the limiting case of how far food faddism can go is a fad for "sensory incongruity" (Piqueras-Fiszman and Spence 2012). This involves use of exotic technology to produce surprise foods: blue strawberries, orange beet preparations, and other foods that contradict expectations. These include a range of ice creams that are savory rather than sweet: garlic, mushroom, salmon, and the like. One notes that all these tastes have characterized *hot* cream dishes for centuries, so there seems no reason not to make cold ones. A wise restaurateur will invest in the fad of the year, but expect it to fade rapidly, and thus reinvest her windfall profits in a new line of dishes after a year or so.

Fad chasing is characteristic of societies in which economic dynamism has created a situation in which a rich "in" group feels itself "threatened" by a vast number of newly rich "outs" trying to break in. The "ins" have to show their superiority by public eating, as elites do everywhere. But, wherever they go, they are chased by the "outs"—often with the enthusiastic collaboration of the local newspaper.

The definitive study of food fads and wild changes is Claude Fischler's *L'homnivore* (1990); this book seems to be untranslated into English—possibly because it depends on a series of horrible and untranslatable puns, starting with the title. My favorite Fischler word is *gastroanomie*—punning off "gastronomy" and "anomie."

Climbing the social pyramid with one's mouth is no new phenomenon. It has been the subject of hilarious remark in China for at least a thousand years. The rich merchants of the Yangzi Delta, in particular, were considered mere vulgar upstarts by the old landed power structure and were consequently desperate to establish themselves as sophisticates.

All these social matters can be discussed in a remote, clinical way, but they are desperately important to the individuals who do the eating. Food study requires a phenomenology, a study of how individuals perceive and experience their world. It is easy to speak in clinical terms of the ability of all mammals to form an instant aversion to a food that has made them sick and to comment learnedly on the rarity of such one-trial learning. It is quite another thing for me to experience nausea, more than 60 years later, at the very thought of ill-fated Christmas candies. There is a vast difference between my learning that caffeine acts by preempting adenosine receptors in the brain and thus interfering with the body's innate sleepiness mechanism and experiencing the indescribably heavenly bliss of my first sip of morning coffee. My wife lives in a world of tomato gourmetship that I can barely imagine. She discerns differences comparable to those I find between a superb wine and a dollar-a-gallon product.

Social scientists are only beginning to investigate such matters (see, e.g., Counihan 1999); there is a great field to explore. Of course, novelists, food writers, and poets have been there long before, recording the shifting tides of snobbism, convenience, economics, custom, and worry—often with an ironic or sarcastic vision.

10 FOOD AND RELIGION

Sacred Food

Any proper deity will, at the very least, feed his or her people. Prayers for rain and fertility, for sustenance and support, or for blessing the food at hand are universal or nearly so. Yet, dissatisfaction with what the deities provide seems as old as religion. The first recorded complaint about the food was not in the army, or at summer camp, or at the school cafeteria, but in the Sinai Desert, when Moses' people got tired of manna: "We remember the fish, which we did eat in Egypt freely; the cucumbers, and the melons, and the leeks, and the onions, and the garlic; but now our soul is dried away; there is nothing at all, beside this manna, before our eyes" (Num. 11:5–6). The Lord sent flocks of migrant quails, which fell all round the Israelites, providing them with a relief from the desert plant gums—the manna—they had been reduced to eating. Such quail flocks occurred within fairly recent times, but now quails are disappearing.

Foodways are perhaps at their most complex when they become involved in religion. Some religions order the eating of meat, when sacrifices are shared out (Smith 1894). Others ban the eating of meat, at least for holy devotees; meat is seen as involving the killing of animals, a violent and antispiritual thing. The religions based in India—Hinduism, Buddhism, and Jainism—share this commitment to what is called in Sanskrit *ahimsa,* "non-violence." As noted above, the most devout Jains eat only fruit (see Chapple 1998).

Robertson Smith's studies (see Smith 1894) of food sharing as the classic, basic religious act among ancient and modern Near Eastern peoples were among the earliest works to discuss this in scientific detail (Mintz 2002). His work led, in part, to Emile Durkheim's studies of religion as "collective representation" of the social group (Durkheim 1995 [1912]). Durkheim showed that—whatever truth, awe, reverence, or mystical experience individuals may find in religion—the real basis of religion is society. Religion was, for Durkheim, the way a society could hold itself together and "sell" its ethics and standards to the rising generation. To accomplish its goals, a social group embraces everyone in the powerfully emotional activities of ritual, ceremony, and celebration. Supernatural beings tend to resemble humans very closely, typically liking the same foods and sharing them in families in the same way. Inevitably, such intense and all-involving action involves food. Food is a basic and universal human concern. It is central to religion—as symbol, as subject of prayers, as marker of sharing and unsharing, and as communion.

It is all very well for religious studies professors to speak of awe, of abstruse theology, and of transcendent experience. It is all very well for agnostics to see religion as failed science—as a set of foolish guesses about how the world began and how humans wound up where they are. But in the real world, virtually everybody comes into his or her faith as a young child learning it from parents or as an older child and young adult learning it from peers. The social-emotional bonds come first. Philosophy, mythology, and mystical experiences follow later, if at all. For the vast majority of human beings, religion remains a matter of sociability, festivals, and personal faith rather than formal theological or cosmological speculation.

Food is a daily reverence. The child, the hardheaded worker, and the mystic theologian all join for the ritual repast—whether they kneel to take communion together or come together in the temple for Buddhist vegetarian food. It is food sharing, not solely dogma and creed, that unites them all. We are reminded of Glynn Isaac's argument that food sharing made us human (Chapter 2). Isaac's "origin myth" may be as deep and religiously powerful as any—and it is probably at least part of the sober truth.

The group that prays together stays together—especially if its members share religious feasts. Holy Communion in Christian churches is a form of this sharing. Sikh temples insist that the worshipers share a sweet food, made of substances acceptable to all the Indian religions. The worshipers have to eat together, thus publicly renouncing the widespread Indian restrictions on dining with members of other occupations and groups. More impressive feasts that bring people together around religious themes include Thanksgiving and Christmas in standard American Christian traditions, Passover and Hanukkah in Judaism, Buddhist temple feasts throughout East and Southeast Asia, and the countless sacrificial or hunting-related feasts of indigenous peoples. In Bolivia and Peru, Corpus Christi Day was once important, with the whole family sitting down at table to the great feast of the year—a single guinea pig. This tiny animal would be divided among as many as ten people—and that was the best meal of the year (Bolton 1979). Fortunately, this level of hunger has almost disappeared now in the Andes. Chinese sacrifices are eaten by the humans; the gods get the intangible essence of the food.

Vietnam has a whole range of festivals, most of them Chinese, in spite of Vietnam's historic rivalry with China. The same foods are eaten as in China. Vietnam's New Year feast goes with rice cakes, a simple food with an elaborate lore in Vietnam and China; the dragon boat day has the same sticky rice dumplings; the moon festival has its moon cakes (Avieli 2005, 2012). This contrasts with other Vietnamese foods, which are distinctive, especially in their large content of raw herbs and vegetables (Avieli 2012). As in the Western world, religious festivals tend to unite vast regions, while ethnicity divides; even small towns in Vietnam have their signature dishes (as does Hoi An, where Avieli studied).

In thinking about American religion, which is often highly individualistic, we tend to forget how very social religion usually is. Working in another culture can be a very dramatic experience; one learns that social rituals that involve entire communities (or even nations) are frequent and vitally important.

Food and religion, Hong Kong. Dividing up sacrificial pigs at a temple fair. The god has consumed the spiritual essence of the food; the worshipers now get the material remains. A group of women banded together to provide these pigs, so the meat is now divided among group members. Photo by E. N. Anderson, 1966.

One's familiar food can insidiously come to be seen as proper to one's religion. A wonderful study by Jennifer Fish examined food ideas among the earliest American missionaries to Hawaii, back in the early nineteenth century. Many of them felt that the Hawaiians would have to start eating bread, pies, crackers, and other American foods of the day to be properly "converted"—never reflecting that the ancient Israelites and early Christians ate nothing like nineteenth-century American food. One missionary's wife, Lucia Holman, wrote in 1820 that "the fruits and vegetables, and everything that these Islands produce, taste *heathenish*" (Fish 1993:20). She went home to New England. I have encountered similar attitudes among missionaries from China to the Native American communities of British Columbia. Often, local nutritious foods are disparaged, and low-nutrient imported foods made of white flour and

Maya *hmeen* (ceremonial leader) with ritual breads baked in the earth oven, chicken stew, citrus fruits, and tropical dogwood leaves decorating the altar; a ceremony for good harvest. Chumnhuhub, Quintana Roo, Mexico. Photo used by kind permission of Don Duyo.

sugar are promoted. Religious change may thus seriously harm nutrition, unless missionaries are careful to promote nutrition and downplay cultural shifts that have nothing to do with actual faith.

Mainstream Protestant American churches stand at one extreme, managing food very little. At the other extreme are the Orthodox Jewish rules and the complex food rules of Hinduism (Khare 1976a, 1976b, 1992). Of the 613 rules in Leviticus and Deuteronomy, the biggest chunk consists of rules related to food. Some of these rules are related to sanitation, some to kindness to animals (Feeley-Harnik 1994), some to symbolism and logic (see below), and some simply forbid usages typical of the religions of enemy tribes. For instance, "Thou shalt not seethe a kid in its mother's milk" is traditionally (and almost certainly correctly) explained as a prohibition against a sacred dish of an opponent group, as pointed out by Moses Maimonides (quoted in Rosner 1997:243). The phrase "kid seethed in mother's milk" continues in use today, in the Middle East, as a rather morbid name for meat cooked with milk.

Shrine to Saint Expedit, Reunion Island. Saint Expedit began his shadowy existence when a cargo of religious items, labeled *expedito* (to be expedited), was delivered to a religious site in France; stories differ greatly as to where and when this happened! In any case, the local people decided there was a Saint Expedit, and though he was rapidly dropped in France, he developed a major vodun-related cult in Haiti. This apparently spread to Reunion with Haitian workers. He acquired a legend as a Roman martyr. His shrines are red; offerings of rum and candles are made to him. The local rum earns him a place in this book. Photo by E. N. Anderson.

Religious speculation can get rather arcane. Medieval Christian theologians wondered how food could become incorporated into the body (Reynolds 1999). How could the body rise at the Resurrection if it was made of non-human matter? And didn't the seed of Adam have to grow by itself, from semen? (Women were typically assumed to be mere growth chambers.) But the hardest question of all was how the food could change from looking like bread, fish, and olives into being part of a human being, looking as if it had always been so. Yet obviously children needed food to grow, and everyone died quickly without it. Finally, in a rather brilliant bit of speculation, St. Thomas Aquinas resurrected Aristotle's perception that semen must carry, not some mystic growth potential, but rather a "form," a plan, that provides the information on how the body should transform food to incorporate it. Aristotle and

Aquinas thus figured out the basics of genetics, centuries before Darwin or Crick and Watson. Pure theological speculation can be right!

Taboos Explained

Not very long ago, belief in the supper natural was quite commonplace.
—from a less-than-stellar student paper

This rule introduces us to the favorite subject for speculation in nutritional anthropology: taboo. Taboos are found in most societies. Technically, we distinguish *taboo* (a *religious* law) from simple *avoidance.* American Christians have no real taboos, except in some sects (such as the Seventh-Day Adventists) that observe Old Testament rules. But Americans have many avoidances, including insects, dogs, and horses.

Our avoidance of horsemeat (Harris 1985) is, in fact, a religious taboo, but we have forgotten that. The horse sacrifice was the greatest and most important sacrificial rite in ancient European religion, and recent converts tended to backslide, so Pope Gregory the Great explicitly banned horse eating by Catholics in the early Middle Ages. The modern eating of horses by the French is a new custom, arising from desperation during sieges in the nineteenth century (Gade 1976). In the United States, the Harvard College faculty club serves horse meat, because of urging by anthropologists during World War II when food security was looking dicey (at least this is what I was told at the club). The custom persisted long after the war, as a slightly macabre bit of fun.

Our avoidance of insects has not even that excuse, since certain insects are explicitly said to be good food in the Bible (see above). Countless modern nutritionists have counseled eating them. They are an excellent, cheap source of nutrients, widely eaten around the world (see Ramos-Elorduy 1998; Ramos-Elorduy de Conconi 1991; Ramos-Elorduy and Pino 1989; Schwabe 1979; Sutton 1988; there was even a *Food Insects Newsletter,* started by entomologist Gene DeFoliart). Yet most English-language books on food insects concentrate on the shock value rather than the nutritional value (see, e.g., Hopkins 1999; Menzel and D'Aluisio 1998). Anthropologists hate these exoticism-as-shock books. They appear to ridicule behavior that is actually much more sensible and intelligent than that of the intended readership. However, I have to confess a soft spot for Peter Menzel and Faith D'Aluisio's book because the cover shows a Cambodian eating a fried tarantula; she appears to be the same girl who sold me a tarantula I ate when in Cambodia and whose photograph (by myself, with thanks) appears in the present book.

Avoidances remain very difficult to explain. It has been argued that insects are not worth the bother (Harris 1985), but this is clearly not the case; edible insects abound in vast quantities in many areas (Ramos-Elorduy de Conconi 1991; Sutton 1988).

Taboos seem much more straightforward, though still confusing. They are often used as rules for sharing. Among the Inuit and many other hunters, adult women get one part of the game animal, girls get another part, the hunter gets yet another, other adult males get still another (details are exceedingly complicated; see Boas 1888:390–669; Rasmussen 1927, 1931). In Polynesia, chiefs impose sacred taboos to prevent overfishing (a fish species is tabooed till its population recovers from heavy fishing), protect fruit so that it may ripen, and save leaf crops from destructive overharvesting (see, e.g., Firth 1936, 1959). In many places, scarce but well-liked food is "sacred" to the people who make the rules! Chickens and eggs go to the senior men in much of East Africa (Simoons 1994). Sometimes there is symbolism here: the top of a fish's head is sacred to the chief in some Pacific Northwest groups, and in southeast Asia the head of the sacrificial buffalo goes to the local headman (these examples are from my own field experience). Sometimes purity is a factor. The highest, most sacred Hindu castes and Buddhist religious devotees must avoid all bloodshed and thus all meat (Simoons 1994; Doniger and Smith 1991). Eating meat necessarily involves bloodshed, even if one does not do one's own butchering, and is thus contaminating and violent.

Most ink has been spilled on the pig taboo in Judaism, Islam, Hinduism, and several minor religions (particularly good reviews of Jewish rules are found in Cooper [1993] and Feeley-Harnik [1994]). It is known that the pig was *not* banned because it carries diseases (e.g., trichinosis), contrary to the myth still occasionally found in the popular press (on this and other issues, see Simoons 1994). A theory started by Carleton Coon (1958:24) and recently upheld by Marvin Harris (1985,

1987) maintains that the pig was banned because it is a bad long-term economic risk in the Middle East. For one thing, it is not an "all-purpose animal" (Coon 1958:24); it is not a source of milk, wool, or traction power. But, less believably, it is said to do poorly under conditions there and is hard to herd. This is untrue; wild pigs abound in the less desert parts of the Middle East, and pig keeping was a common and very successful occupation of other religious groups, including Christians. Paul Diener and Eugene Robkin (1978) proposed a theory that the state wished to divert grain from pig feeding to state coffers; this is unlikely, since pigs were fed on acorns and garbage rather than grain. Mary Douglas (1966; cf. Douglas 1970, 1975) showed that the animals tabooed in Leviticus and Deuteronomy are mostly anomalous—cloven hoofed but not cud chewing, in the pig case; anomalous animals, violating category boundaries, are taboo or sacred in most religions. Finally, Eugene Hunn (1979) showed beyond reasonable doubt that the pig is banned because it eats blood and animals and carrion. Almost all the creatures banned in the Old Testament are carnivores or scavengers, and all the carnivores and scavengers in the Near East are banned. The animals specifically listed as clean are those that are clearly vegetarian. The Bible actually says this explicitly.

Other Near Eastern and south Asian religious groups share some or most of these prohibitions. The Muslims simply picked up the Jewish taboo. The Hindus, as one would expect from their non-violent ethic, also look with disfavor on animals that eat blood and carrion. Even Hindus of "low" castes, who eat a variety of meats, avoid such flesh. The same is true of the Jains (Chapple 1998). Buddhists, too, are supposed to be vegetarian; in practice, only the monks usually are, but lay Buddhists usually avoid carnivorous animals (though they often eat pork in some Buddhist countries).

The cow taboo in India is a different matter. The medieval Muslim al-Biruni (1971 [eleventh century]) thought the Hindus banned cow killing and cow eating because the cow was so useful alive—it is a plow animal, cart puller, source of fertilizer, source of milk, and even a source of warmth (the peasants took in the cows on cold nights). Marvin Harris (1966, 1985, 1987) has argued for a modern version of this idea. There is clearly much truth in it. However, other cultures that use the cow do not worship it or need to make it sacred as a conservation measure. We of the European and American world do not worship our dairy cows.

Actually, the cow was sacred before modern Indian society arose. It may even have been sacred before it was domesticated. It was at first a sacrificial animal in India, the most sacred of all, along with the horse. When non-violence came into Indian religion, apparently at least in part as a way of keeping people from rebelling against the state, the most sacred animals came to be protected along with people (Doniger and Smith 1991). Gradually the idea of non-violence was extended to more and more species, but the cow remained in first place. Its utility certainly has been important, perhaps instrumental, in protecting it. Frederick Simoons has shown, however, that neither this nor most other Indian taboos and protections can be adequately explained by utilitarian arguments (Simoons 1994). Wendy Doniger and Brian Smith (1991) point out that the logic of non-violence started from humans and extended to the most valuable animals, then outward from there; logic, practicality, and ritual (including priestly politics) were all involved.

Simoons's works set a seal on a long tradition. He has shown that using foods as religious symbols is not a mere reflex of utilitarian concerns. It cannot be predicted from nutrition or ecology, though it is often strongly influenced thereby. It has to be explained in terms of religious logic and history. Foods are perhaps the richest source of symbols. Because they are literally taken into the body and have all the associations of life, home, family, health, and embodied being, they are the ultimate "natural symbols" (Douglas 1966, 1970, 1975).

In short, the position that all long-established foodways were not only optimal in terms of obtaining calories from the environment but also were explained solely by that factor does not stand testing (Sahlins 1976; Simoons 1994, 1998).

Marvin Harris originally defended this theory as part of a research strategy. One should—he maintained—take the materialist-ecological theory as far as it could go, then successively invoke other explanations. Harris sometimes viewed his theory as the only one, which was unfortunate, but his arguments remain useful if they are taken as originally intended.

Ecological explanations, however, are only a beginning. History reveals too many cases in which food has been shaped by status, religion, ethnic rivalry, and other factors. It is not clear whether the sensible ones are the result of ecological rationality or of a group of people deciding on a foodway and *then* finding out how to make it do its best in their environment, as seems to have happened in the Hindu cow case.

American abstention from insects, for instance, is ecologically and economically foolish. Yet this avoidance not only persists, it has also been spread by missionaries to areas where it is genuinely dangerous. In Central Africa, missionaries often convinced local people that insect eating was disgusting—and thus persuaded them to abandon a valuable source of high-quality protein and mineral nutrition (as my wife and I observed in Zambia and have heard from other areas).

Religious foodways thus can be explained either on the basis of ecological sense or on the basis of religious and ritual logic. They are not blind immemorial tradition but pragmatic adaptations to community life.

11 CHANGE

Change and Unchanging

Leopold Bloom, in James Joyce's *Ulysses* (1961:55), expressed a fondness for organ meats, fish roe, and, in short, what we now sometimes call "variety meats." He was especially fond of kidneys, with their "tang of faintly scented urine," and was having them for breakfast on the day commemorated in the novel. The hundredth anniversary of the original publication of the work was recently celebrated in Dublin, and thousands of people ritually consumed grilled kidneys—cultural history in the making. Yet Bloom's delights are no longer acceptable to most English-speaking eaters—a pity, for they are indeed very good.

Foodways change. We all know this, yet we sometimes talk as if foodways were conservative or even changeless. All things change, though sometimes they change very slowly.

In this chapter I use European (largely Mediterranean) food as an example because it is the best studied; the history is well researched, and the documentation is available. The only other country with this kind of documentation is China, which I have covered elsewhere (Anderson

1988; Buell et al. 2010) and need not detail further. There are also excellent histories for some other regions (notably Achaya [1994] for India, Rodinson et al. [2001] for the Arab world, and Ishige [2001] for Japan) .Writings on food history have exploded since the first edition of this book, and there are now histories of everything from pancakes (Albala 2009) to doughnuts (Mullins 2008). The field has come of age; several whole encyclopedias now exist. A full account is obviously impossible here.

Fernand Braudel wrote of the *longue durée,* the long term (with slow change), in the Mediterranean world (Braudel 1973 [1966]). Recently, a book on Mediterranean history, *The Corrupting Sea,* challenged this, bringing forth evidence that the Mediterranean world had changed very quickly (Horden and Purcell 2000). I read this book as preparation for a research trip to Spain and Portugal; I was especially interested in the food history of Andalucía (Andalusia), so I spent a lot of time poking around that favored land.

Nothing could have been better calculated to vindicate Braudel and disprove his opponents. The food of Andalucía is about what it was in, or even before, Roman times: crusty bread, wine, olive oil, pork (especially cured as ham or sausage), cabbages, herbs, Mediterranean fruits and nuts (especially almonds), onions, garlic. The Arabs introduced a few foods: sugar, oranges, lemons, and minor items. From the New World came potatoes, tomatoes, green and red peppers, chocolate. None of these changed the basic diet, though potatoes and tomatoes have become locally common and popular. The staples are still bread, wine, oil, and meat.

The grain fields still occupy the broad plains, the grapevines the fertile slopes, and the olives the infertile hills, just as they did 2,000 years ago. The olive orchards in their neat rows extend up to a neat trim line on the mountains: the level at which nature says “no more” by freezing the young trees (olives cannot stand temperatures below about -10° Celsius). Above that, the same oak woodlands, usually degraded to scrub, produce the same wild boars and partridges they did for the Romans—though now the numbers of game animals are tiny fractions of what they were then.

I know and love a medieval Spanish song about Moorish girls picking olives in the Andalucían town of Jaén. I went to see the town, and found it still a center of the olive industry. “Moors”—migrant workers from Morocco—still did the picking.

The *longue durée* is real.

At the other extreme, oregano consumption in the United States increased 5,200% between 1948 and 1956, tracking the explosive growth in popularity of pizza and Italian sandwiches (Norman 1972:248; see Diner [2002] for the full story of Italian food in America, including the earlier days of rejection). Oregano was virtually unused before, except in Italian and Greek ethnic strongholds. It subsequently declined again because pizza and grinders succumbed to Americanization in taste. However, Mexican food followed Italian into the mainstream and saved oregano from oblivion. (Mexican oregano is a different species from Italian, but they are related, and the tastes are similar.)

Probably most change throughout time has occurred because of necessity, or at least economic pressure, not taste (Lentz 1999). Far too often, change is toward coarse, inferior, nutrition-poor rations, thanks to unfortunate political occurrences and policies (Sen 1984, 1992), economic vicissitudes (Lentz 1999), or local crop failures.

The brutal force of poverty and the still more brutal one of war routinely cause whole populations to stop eating their culturally preferred and nutritionally reasonable diets and live instead on coarse grains or, worse still, bark, weeds, husks, straw, and even the bodies of the dead (Li 2007; Mallory 1926). This is not really cultural change; it is response to immediate environmental necessity.

Far different is cultural change—voluntary, socially constructed alteration in the tastes of whole peoples. The worldwide spread not only of hamburgers and hot dogs but also of French fries, brand-name candy bars, and all the rest of the constellation needs no elaboration (see Schlosser 2001). Most universal of all are the sodas. The current Mexican expression for the most remote place imaginable is "where the Coca-Cola truck doesn't go." We often forget how much the healthier types of modern food have also spread. Breakfast cereal, frozen orange juice, non-fat milk, yogurt, and whole-grain products have gone worldwide along with the candy bars.

When foodways persist unchanged, the reason is often that they are identified with the old, the traditional, the time hallowed. This does not prevent change. Frequently, a traditional food is subject to drift over time. A traditional food that is not liked much will simply fade away. If it is liked, it will often be made more sophisticated: as time goes on, and people acquire new resources, they will add spices, new techniques, and other elaborations to it. This is happening to East European Jewish food today, and it has happened many times in the past, with the changes in Jewish foods tracking the economic situation of the Jewish community (Cooper 1993). The religiously valued traditional foods are made lower in fat and higher in spices and other flavorings, thanks to creative chefs like Judy Zeidler (1999).

Alternatively, a food may lose its old virtues and become a mere hollow shell of its former self. It is sometimes difficult to find slices of apple in the sugar-and-flour fillings of today's "apple" pies (cf. Schlosser 2001; on the decline of traditional American foods, see Sokolov 1981).

The apple pies were, themselves, one of the last bastions of English Renaissance cookery—a brilliant, sophisticated, elaborate cuisine that is not even a memory except to dedicated food historians. Once, the English board groaned with all sorts of pies spiced with the classic cinnamon-clove-ginger-nutmeg mix that survives (or did until recently) in these pies. This mix is now often sold as "pumpkin pie spice," and pumpkin pies certainly preserve a medieval aspect—a soft-filled pie with the characteristic spicing—but the pumpkin is a Native American squash, not the melon variety that was the Renaissance "pompion."

England preserves the tradition better than the United States; England even has real mince pies—made of minced meat and spiced fruit—and a few other ancient survivals. "Mince pie" in America is actually a sort of raisin-apple pie, with only some of the old flavorings.

Tamales—a ritual (and everyday) dish of the Aztecs (Sahagun 1950–1982 [mid-sixteenth century]), still ritually eaten at Christmas in the Mexican and Central American world—have been elaborated beyond belief in El Salvador, reduced to vestiges in parts of the U.S. Southwest (Peyton 1994; Pilcher 1998), and changed into a myriad of forms in the lands between. There is even a giant tamale, the *zacahuil,* in northeast Mexico; it can contain a whole turkey and weigh a hundred pounds. Like many other regional signature dishes of the world, it is immortalized in local folk songs. (The land of the *zacahuil* is also the home of Huasteca music, which, thanks to cross-fertilization of Spanish music by Anglo-American fiddling from the Texas frontier, has perhaps the wildest fiddling in the world. Hearing a Huasteca band belt out "Zacahuil!" is truly a unique foodlore experience.)

Easter eggs have hatched so many changes in their radiation that it takes a huge book to chronicle them (Newall 1971).

Consider this straightforward list of factors that affect food, and frequently change it.

ENVIRONMENT

Any environmental change will affect food economics, usually favoring some foods over others. Global warming will no doubt give us more hot-weather crops, fewer cold-weather ones.

HEALTH

Some foods become too associated with dangers of contamination. Herbs and health supplements are today sold in some countries (including the United States) as "food supplements" because the laws are less strict than those governing medicines. This exposes the public to risks that can be serious (Katan and de Roos 2003).

ECONOMICS

In addition to the brute force of poverty noted above, less dramatic price changes for inputs make huge differences. Plants that need heavy fertilizing will become more available as fertilizer does. Progress in biology has enormous effects and is in constant feedback with food economics. There are some superb histories of this—one thinks especially of Noel Kingsbury's *Hybrid* (2010) and Gary Nabhan's *Where Our Food Comes From* (2008b). These show an erratic and contingent history, depending often on very special circumstances in which a local economic need and a uniquely brilliant scientist come together.

In modern America, fruits, ever more expensive, have lost out to white sugar as its price has plummeted. Now white sugar is losing out in turn to high-fructose corn syrup, an industrial product that is now the cheapest sweetener of all.

WORK DYNAMICS

Coffee and tea came in with alarm clocks and time clocks. The rise of fast-food chains correlates with the rise in work hours and work "discipline" (Anderson 2003).

FAMILY AND FAMILY/WORK DYNAMICS

Fast foods also came in because no one is home to cook. This is only the latest stage in a long process. The breakdown of the extended family and its replacement by the nuclear family or single-person household, a process typical of the last few centuries in much of the world, has forced many changes in a similar direction. Food has become simpler and more often prepared by full-time experts such as bakers, brewers, and caterers.

POLITICS

Chinese avoid dairy products partly because of their association with "barbarian invaders," such as the Mongols. Americans drink coffee partly because of hatred for the colonial British tax on tea, made infamous by the Boston Tea Party. The tax was slight—not enough to be an economic barrier. Today, nationalism often shows itself at the dinner table throughout the world. This is especially true in new nations (Hungary in the early twentieth century, for instance) and would-be nations (e.g., Cataluña). In Hungary, Karoly Gundel created a gourmet Hungarian cuisine partly out of sheer national pride (Gundel 1964; Lang 1971).

RELIGION

Religion is, notoriously, a force for stasis. It makes people eat certain hallowed foods and follow hallowed traditions.

STATUS, ROLE, CLASS, AND PRESTIGE

See Chapter 9.

FAD AND STYLE

PERMANENT TASTE CHANGE

The rise of pizza in the United States was only the most obvious symptom of a major taste change, from the bland tastes of the early twentieth century to the exciting, potent ones of later times. It is no accident that the rise of pizza correlates perfectly with the rise of "sex, drugs, and rock 'n' roll." Rock rose at the expense of crooners and lullaby-like popular music. Stimulant drugs rose at the expense of tranquilizers like tobacco and alcohol. Political demonstrations, and, on a more elite plane, abstract expressionism, as well as other indications of a lively scene, appeared about the same time. The reason, I believe (from my own experience), is that the horrible events of the Great Depression and World War II had thoroughly traumatized the preceding generation, driving them to lullaby music and bland, soothing food and art. They raised their children in sheltered, low-stimulus homes. Breaking out into adolescence, these children were hungry for intense experiences of all kinds.

An earlier rapid but (so far) permanent change was the sudden disappearance of the highly spiced Renaissance cuisine from England and France as the Baroque waned (see below). England went toward blandness, France toward fresh vegetables and herbs.

Persistence

With all these forces of change, it is clear that we have to explain persistence. It is not the norm. It is not the null or unmarked case. It occurs only under special circumstances.

Consider the Andalucían case (most of what follows is my own research, but see also Grove and Rackham 2001). Wheat, olives, and grapevines are among the rather few things that grow well in Andalucía's hot, dry, Mediterranean climate. Most of the possible competitor crops—maize, potatoes, most vegetables, and so on—do not do well. Pigs flourish on the acorns produced in the oak scrub and forests that cover all uncultivated areas. Add to this a conservative social body. Almost everyone was desperately poor until recently, and the land is still far, far behind the rest of Spain in wealth. Poverty forced people to live on those few easiest things to grow and also made them afraid of change—especially in light of the fact that change, in Andalucía, has usually been of a less than pleasant sort. From the Vandals (who gave their name to a whole concept) to Franco's fascists, the conquerors of Andalucía have been such as would scare anyone away from change. The few changes that have occurred, most significantly, follow from Andalucía's two golden ages. The first of these was the peak centuries of Arab rule in the early Middle Ages. The second was the sixteenth century, the days of Spain's conquest and empire, when gold and silver as well as potatoes and tomatoes flowed through Cadiz and Sevilla.

South China, too, did not change its most basic foodways for a long time. Rice is simply too far ahead of any other staple, in productivity and nutritional value. The local vegetables have also been developed and perfected for millennia and outyield any competition. Once again, New World food crops came in to revolutionize the economy, but otherwise no important additions were made to South China's foodways in 2,000 years—since the days when north Chinese, and their foods such as wheat, invaded and genuinely transformed the region. A few plants from West Asia and Southeast Asia trickled in, but they are not common or important.

Personal conservatism is not a factor here, since the south Chinese are arguably the world's fastest people when it comes to taking up a challenge or pressing an advantage. And foodways have changed, quickly, in the last few decades. What mattered was the solid "lock-in" of ecology and the economy, caused by the creation of the paddy system. It is too good, and too tightly integrated, to change easily. China does change—for reasons of taste, class, and ethnic rivalry (Anderson 1988; Chang 1977) as well as ecology (Marks 1997). The "changeless China" stereotype had a kernel of truth; changes are slow, and basic patterns endure. However, in the last 10 or 20 years, explosive change has come to the region. Rising affluence and global influence have vastly altered the diet, bringing everything from McDonald's (Watson 1997) to fine European dining. The result has been, on the one hand, a sharp decline in the quality of local food and a sharp rise in obesity, diabetes, and heart disease but, on the other hand, better vitamin and mineral nutrition and more variety.

A final example of persistence is the victory of Mexican indigenous food over Spanish culinary culture. This was partly due to Spanish policy; the crown discouraged cultivation of our old friends wheat, grapes, and olives in Mexico so Spain could make money selling them there. However, wheat and olives did not do well in Mexico, anyway. Maize far outproduced wheat. Moreover, chiles were cheaper than imported spices. New World vegetables tasted better and produced better than Spanish ones. New World squashes were so superior to Old World equivalents that they replaced the latter rapidly even back in the Mediterranean world. Add to this the fact that most New World cooks were "Indians," and all is explained. The basis of Mexican food thus continued to be tortillas, tamales, chiles, Mexican frijol beans, squash, agaves, tomatoes, avocados, and other native foods, until the recent spread of junk food.

However, in this case, we are looking at stasis only in the most basic staples. Spanish cooking did not fail to establish itself; the fancy dishes, the stews, the breads, the ritual foods, and the feast foods were Spanish or were the wonderful Spanish-Arab-Mexican fusions that are now usually regarded as the highest achievements of Mexican food. Change was incremental, and often from the top down, but it was real, and it profoundly transformed Mexico over the centuries (Pilcher 1998). Moreover, the Spanish exiled many converted—but distrusted—Moors and Jews to Mexico, which is thus a museum of medieval Moorish cooking. The famous *mole poblana* is clearly a classic Moroccan dish with New World ingredients added. So is another Puebla specialty, *chiles en nogada*, a variant on Near Eastern stuffed vegetables that uses American peppers. It has completed the loop by going back to Extremadura in Spain, in a simplified form.

The Wilder Shores of Change

Foodway change is an age-old concern. Moses supposedly persuaded the Israelites to follow their hundreds of dietary rules. (Of the 613 rules, the vast majority apply to food or sex. Other religions, too, seem especially prone to make rules in these areas of life.) Muhammad simplified and changed these and succeeded in developing a dietary code that now affects over a billion people. More secular concerns of political economy moved crowned heads of Europe to popularize the potato by novel means. Catherine the Great supposedly wore wreaths of potato flowers. The chemist Antoine-Augustin Parmentier, according to legend, had soldiers guard royal potato patches to “prevent” peasants from stealing the potatoes; this, of course, got the peasants interested, and they stole all the plants—for the soldiers were instructed to look the other way (Lang 2001; Salaman 1985). By such means, stubborn, reactionary farmers came to grow potatoes all over Europe. Chinese are more amenable to adopting the new, but even China had its militant developers, popularizing sweet potatoes and maize (Anderson 1988).

The search for stability has led to some strange schemes. People in remote areas are growing apples, vegetable seeds, opium (not always with state cooperation), ducks, or llamas. Others are working to bring back the taste for wild foods. Started by the legendary Euell Gibbons (1962), this movement has taken on a life of its own. Leaders like Christopher Nyerges (1995) in my home area and John Kallas (2002) in Oregon live by teaching wilderness skills and wild food uses. A similar rehabilitation of Mediterranean gathering was spearheaded especially by Patience Gray in the mid- to late twentieth century (Gray 1997). Her enthusiasm was infectious and led to aristocratic European gourmets rubbing shoulders (metaphorically, at least) with destitute peasants in the gathering fields of Cyprus and Crete. In fact, at least in parts of south and east Europe, aristocratic gourmets were doing it long before; one can see men in expensive suits and ties hunting mushrooms in the woods along with local subsistence farmers. Hunting and gathering is fun! More seriously, though, in a world where resource limitations are ever more real, we can no longer afford to neglect anything. The foods of our hunter-gatherer and peasant ancestors are back in style.

Bread: A Case Study

Perhaps the best-known and longest-running case study of change is provided by the case of bread. Bread remains one of the greatest inventions of the human species. (Most of what follows comes from, or is influenced by, Jacob's great classic work, *Six Thousand Years of Bread* [1944]; most of what is not in Jacob is from my own research; see also Rubel 2011).

People were grinding seeds by 40,000 years ago, as indicated by milling stones. These, originally, were flat rocks on which seeds were ground with a smaller, rounded rock. Such rocks are called "saddle querns" in England. Here in southwestern North America, we call these "metates" and "manos"—metate from the Nahuatl ("Aztec") word *metlatl,* and mano from Spanish *piedra de mano,* "handstone." The Native American peoples all used them. The typical metate is a big flat slab, around a foot or two square. It weighs a great deal, but a good metate would often be carried for tens of miles. Often, seeds were ground on a convenient boulder, producing a "bedrock metate." Manos can be flat-bottomed or circular stones or longer, thinner cylindrical stones. They weigh a pound or more.

As with everything else, there is art and skill in metate making. The most important consideration is the rock. One hopes for a rock with largish or uneven-sized crystals that fall out under heavy pressure; such a metate is self-renewing. Rock that grinds down to a glassy polish, like fine-grained granite, is not useful for long; the glassy surface does not make grinding very feasible. Sandstone or rough volcanic stone is preferable. Bedrock metates on granite become smooth soon, but the rain eventually renews them. Rain is slightly acid (it picks up carbon dioxide as it falls, producing carbonic acid in the raindrops), and standing rainwater eats away the bonds between crystals, which gradually fall out, re-roughening the surface. In a pinch, one can always re-roughen the surface by pounding with a rock.

Mortars and pestles are useful for mashing seeds, but they do not produce fine flour; they produce a coarser grade.

Once one has flour, all one has to do is mix it with some water, cover it with ashes at the edge of the campfire, and let it bake an hour or so in the hot ashes. The ashes can be brushed off; a few of them on the bread add flavor and nutritive value. This makes the choice of firewood important, since some woods produce better-tasting ash. Alternatively, the bread can be wrapped in tough leaves and baked. Then it is the choice of leaf that affects the flavor.

The original bread was of this sort, and so things remained for thousands of years. Eventually, agriculture began, at first in the Near East. Grains were cultivated. Bread presumably became more elaborate.

Yeast, growing naturally on grain and fruit, came into the home. At some point, it was domesticated—turned from a wild contaminant into a domestic servant. Nothing in all history so thoroughly combines momentous importance and total obscurity as this event. Perhaps it was first used for brewing. The classic "just-so story," repeated thousands of times, is as good as any: someone left grape juice, or perhaps watery grain gruel, standing around for a few days. The result looked spoiled, but tasted surprisingly good. A few minutes later, much more substantial virtues made themselves known; the drinker became expansive, cheerful, and outgoing. (The prehistory of alcoholic drinks has been revealed by Patrick McGovern [2009], who has shown that surprisingly complex and tasty beers and wines were known in the ancient Near East and ancient China. He has worked with Dogfish Head Brewery to re-create several of them, including "Midas Touch" from King Midas' tomb—pots there held residue of an alcoholic brew of grapes, honey and barley that is truly excellent in its restored form.)

The origin in spoiled grape juice is likely because the natural habitat of *Saccharomyces cerevisiae* (now both bakers' and brewers' yeast, as well as wine yeast) is the smooth skin of the grape. However, a vast range of other yeasts and bacteria enter into sourdough cultures; the sourness usually comes from *Lactobacillus* bacteria of various species. The one that produces San Francisco sourdough was scientifically named *Lactobacillus sanfrancisco.*

The native rice beer (*tapai* or *tapeh*) of southeast Asia is a rice porridge inoculated with a batch from the last brewing; it looks like the proposed ancestral beer. Often it is so thick that one eats it with a spoon. It includes a vast and variable range of fermentation agents.

It is hard to imagine yeast finding its first use in bread making. First, wild grains and primitive domesticated grains do not leaven well. Second, people do not leave bread dough standing around. If they make dough, it is for baking, and they duly bake it. Abandoned bread dough is unlikely enough in itself, but if dough were abandoned, it would dry out or spoil instead of fermenting. Third, yeasts don't like flour. Even if they are on the grain, they will probably be discarded when it is winnowed, husked, cleaned, and ground. Yeast has to be deliberately added, somehow, to dough.

Thus, it seems reasonable to suppose that wine making and brewing came before leavening. (Baking of ashcakes and flat breads or cakes was, of course, already ancient.) Grapes have been cultivated for at least 6,000 and probably more like 8,000 years, and wine was almost certainly part of the picture right from the start (see McGovern et al. 1996). I would suspect that wine technology quickly spread to grain gruel when wine yeasts filled the air with spores and contaminated watery gruel left about. Beer was born. Thrifty people probably soon began to use beer lees to make bread.

Against this scenario, one can argue that early beer in ancient Egypt and Mesopotamia was made by crumbling up bread in water and adding a starter from the previous batch. Russian *kvas* is still made this way. So perhaps the bread came first and beer arose when someone's dinner of bread and water sat too long. I find this theory less credible, but it remains possible. It leaves us still wondering how the yeasts got into the bread. Then we must go back to the lees theory. Lees from brewing were still used as starters quite routinely in the nineteenth century (Rubel 2011:18).

The separation of “bread yeasts” and “beer yeasts” is a very new thing. They are artificially selected forms of *Saccharomyces cerevisiae.* Today countless subvarieties occur, especially in the brewing trade. Before the development of such selected strains, the same starters were often used for both bread and beer.

In the evolution of bread, another momentous discovery followed almost immediately. Some 8,000 years ago, just southwest of the Caspian Sea, one of those unsung geniuses who have shaped human history noticed that some odd wheat from the edges of the fields was producing astonishingly superior bread. Instead of making the familiar flat and solid loaf, this bread rose like a pregnant woman’s belly and became marvelously fluffy and soft. The discoverer—very probably a woman—must have become locally known for her special bread. Others tried to imitate and learned in the process that its qualities depended on seeking out that odd-looking wheat.

We do not know the names or even the ethnic identity of these women, or how long it actually took them to develop leavened loaves from flat breads, but we know where they were: in northwest Iran and Azerbaijan, roughly between Tabriz and Baku. We know this because that is the range of the subspecies of goat-face grass, *Aegilops tauschii,* that was actually responsible (personal communication over years with my colleague Giles Waines, gratefully acknowledged; see also Zohary 2007).

Goat-face grass is a common weed in Near Eastern fields, a wild plant whose seeds in their husks look like tiny goats’ heads. It hybridizes with wheat; hence my assumption that the first bread wheat came from around the edges of the fields, near the stands of wild grass. But perhaps the goat-face grass grew in among the cultivated stems, and whole fields may have become crossed.

Bread depends on gluten to hold it together. Leavened bread depends on gluten to trap the carbon dioxide particles that allow it to rise. Our familiar fluffy loaf is born when dough full of very strong, tough, elastic gluten is kneaded for 25 minutes or so. The combination of water,

Baking bread in a small village in central Turkey. Woman using a long peel-board to take her bread loaf out of the village oven. Wheat was first domesticated not far from where we took this picture. Photo by Barbara Anderson, 2000.

gluten, and constant stretching and pulling creates a sticky mass that traps carbon dioxide particles evolved by yeast. Yeast grows incredibly quickly, doubling in size every few minutes. It grows by converting carbohydrates into yeast tissue and energy. Carbon dioxide and alcohol are given off by this process. (Chemical leavening, with complex carbonates that break down under heating to release CO_2, came much later in history.) The amount of alcohol in bread is insignificant; it is the CO_2 we want. In brewing, of course, the alcohol is the target.

The gluten that is best for bread dough does not occur in ancestral wheat. Try making bread with semolina, which is made from durum wheat. Durum is a direct descendant of wild emmer wheat, genetically labeled AABB. The necessary gluten was introduced to wheat through hybridization with goat-face grass. Genetic studies have recently shown that the "D genome," the goat-face genes in wheat, come from the subspecies found in the range above noted (see McCorriston 2000;

Smartt and Simmonds 1995:184–91). Of all cultivated grains, only bread wheat—hexaploid wheat, AABBDD— makes the now-familiar leavened loaf. Rye, barley, and other bread ingredients produce hard, heavy loaves unless bread wheat flour is added. Corn bread can be made light by other means, but does not leaven well.

Modern works tend to sound very superior about discoveries such as the D genome. These "primitive" people discovered everything "by accident" or "by trial and error." They did no such thing. The development of bread is far too complex and specific a process to have taken place without conscious thought, planning, discussion, testing, evaluation, and trial. Every baker knows this; even with the technology totally routinized, years of self-conscious practice are required to learn baking. Think of figuring it out with no prior instruction. Villagers and traditional cultivators are no less intelligent and self-conscious than modern people; they have their brilliant scientists and their tireless experimenters. I have known and worked with many such. Surely, many great minds devoted countless years to the perfection of bread.

The origin of bread wheat in the Iran-Azerbaijan lands has had an odd and significant effect on history.

Durum wheat loves relatively warm, moist conditions. Like other wheats, it is usually sown in the fall, to come up in spring. Durum flourishes as a summer crop in Canada and the Dakotas but otherwise has not spread much beyond its ancestral Mediterranean lands because these have the mild winters and early springs that winter-sown durum prefers. Cold-tolerant forms exist, but durum still loves hot days and moist climates.

Bread wheat is hardier, preferring continental conditions. (After all, it originated in a cold upland.) Though it tolerates Mediterranean climates, it prefers to overwinter in conditions of more intense cold. Good bread wheats tolerant of warm climates have only recently been developed, after long and difficult breeding work. The truly favored homes of bread wheat have always been the montane Near East, north China, and the plains of Europe. With the expansion of European settlement, it succeeded in interior North America and Australia, and the pampas of Argentina. Until the recent breeding efforts, southerly bread wheats were often soft, better for cake than bread. The finest bread flour came from hard grains grown under truly horrific conditions, in such places as the northern Great Plains, mountain Afghanistan, and remote interior North China.

On the northern grasslands of China and America, even bread wheat kernels cannot overwinter, but conditions are ideal for summer production of both hard red bread wheats and durum. Superior, cold-tolerant, fungus-resistant wheats were introduced from Russia and the Ukraine by Mennonite farmers in the late nineteenth century to the northern plains of North America, making them the world's breadbasket. If Catherine the Great had not settled the Mennonites in those areas, and if subsequent tsars—and hard living conditions—forced them out, we might not have cheap bread today.

Most of Europe is not ideal wheat country. Wheat is native to the dry Mediterranean lands; it likes hot, dry weather. Bread wheat, with its home in the high Iranian plateaus, prefers continental conditions. Most of Europe is too cold and wet for optimum wheat production, or was until modern plant breeding developed strains adapted to cool, wet summers. Thus, in the old days, Europeans outside of the more favored Mediterranean lands had to eke out the wheat with rye, barley, oats, peas, beans, and even bark and chaff. Wheat was a luxury; the rich got it, and even they were often reduced to wheat/rye blends for daily fare, saving wheat for special occasions.

The poor—the vast majority—had no wheat at all and lived on rye, pulses, and the like. Even the pulses got into bread; pea bread is rock-like, but it was a staple. East Europeans have made a cult of black bread and rye bread, but those were "breads of affliction" in the old days. Scots lived on oatmeal and oat cake, nutritious but stodgy. Dr. Johnson's dictionary famously defines "oats" as "[a] grain, which in England is generally given to horses, but in Scotland supports the people" (Johnson 1963:268). (Scottish folklore, passed down to me from that side of my family, has it that a Scottish lady asked him, "And where else do you get such horses—and such men?" But I can't vouch for that story.)

Immanuel Wallerstein pointed out (1976) that Europe's commitment to low-yield wheat and China's to high-yield rice shaped history: Europeans had to seek new and productive lands to settle and farm, while the Chinese were better off simply intensifying their agriculture within China. This was one of the reasons for Europe's colonial expansion in the sixteenth through nineteenth centuries.

Long before civilization began, bread was perfected. One step was the invention of sourdough. Until recently, all leavening depended on saving a batch of dough from the last baking, or on using beer lees. Chemical leavening, cake yeast, and dried yeast now supply almost all our needs, but some bread—sourdough—still depends on saving a bit of the last batch to serve as a sourdough culture.

By definition, such cultures are not just yeast. The *Lactobacillus* bacteria metabolize lactose into lactic acid. They may have originally wandered in from yogurt; perhaps they were just in the air, or perhaps ancient bakers made up dough with yogurt. In any case, sourdough keeps reinventing itself, as people deprived of familiar leavening develop cultures from whatever is in their local environment. In San Francisco, Italian immigrants, making bread in bakeries full of cold fog, wound up with the peerless sourdough bread now so widespread in California restaurants. It depends on *Lactobacillus sanfrancisco,* a bacterium confined to the near-changeless temperatures and perpetual cold fog of the California coast. This bread cannot be made more than a few blocks from the ocean. Elsewhere, the sourdough culture changes in disappointing ways unless kept under special temperature and humidity controls. The proper bacterium is gradually replaced by wild, unpleasant-flavored ones. Of course, under industrially controlled conditions, one now can make the bread inland—but the good bakeries are still coastal, as of this writing.

Other lactobacilli produce other sourdough breads in other climates. The famous Alaska sourdough uses a starter mix that loves very cold, rather dry conditions. There are mountain sourdoughs around the world. The best breads I have ever had were in the remote mountains of Afghanistan and in a Zuni Indian hamlet in New Mexico. The Zuni learned bread making from the Spanish colonists in the seventeenth century and still use Mediterranean-style beehive ovens; presumably they got their sourdough starter from the Spanish, as well.

Such, then, was the origin of the world's most widespread and familiar food. The hybridization of bread wheat and the domestication of yeast and *Lactobacillus* stand among the greatest accomplishments of all time.

The progress of milling from metate to hand-turned millstones, then to water and windmills, and finally to huge metal rollers came next, and is somewhat outside the scope of the present book. The development of millstones turned by water and wind was a major industrial breakthrough, critical in the progress of civilization. This took place in the Near East; its history and spread remains controversial. These large millstones, like simple metates, have to be made of special hard, rough stone and have to be re-sharpened—usually grooved, rather than pecked—periodically.

Long before this, ancient civilizations saw the development of specialty breads and the rise of professional bakers. Chemical leavenings were discovered. Ancient Egyptian and Mesopotamian texts record many kinds of bread, and some of these have been preserved in tombs. Ancient Mesopotamia had huge state-run bread operations, involving integrated factories—*harhar* in Sumerian—where hundreds of people toiled to grind grain on metates, mix the dough, and bake the bread (Gregoire 1998). These industrial operations were staffed largely by slaves and impressed laborers, and working conditions were not of the best.

At the beginning of civilization, the great Old World centers used a great deal of bread wheat, but irrigation led to the buildup of salts in the soil and thus to a gradual shift toward barley. Wheat is extremely intolerant of salt, while barley is the most salt tolerant of major crops. This was particularly true in Mesopotamia, whose agriculture was dependent on irrigation by canals; by the end of the third millennium BCE, barley made up 80% of the cereal crop (Gregoire 1998:224). Similar events took place later in what is now Pakistan. For that matter, the same thing took place 5,000 years later in California, whose dry, low-lying valleys now produce barley where they once produced far more valuable vegetable crops (personal observation). Humans are not always quick learners. Egypt, irrigated by the Nile flood, was not prone to serious salinization, but even there barley became dominant. China and most of India have enough rainfall to wash the salts out of the soil, thus eliminating the problem.

In Mesopotamia and Egypt, the link between bread and beer was clear and direct. Bread was often made into beer; in any case, the same starters were often used. In the former area, Sumerian was supplanted by Babylonian (a Semitic language) around 2500–2000 BCE. Sumerian survived as a learned language, like Latin in medieval Europe. This led to the production of many dictionaries, fragments of which survive on cuneiform tablets. From these we know the terms for such esoterica as "beer of emmer, excellent ulushin-beer, reddish beer, . . . beer with a 'head,' beer without a 'head,'" beer for various offerings, and so forth. The same tablet refers to "beer-bread which has been crumbled, beer-bread which has been set out . . . flour for *siki*-bread, . . . flour of crushed barley," and various other flours and doughs (Hartman and Oppenheim 1950:23–29). Other tablets list countless kinds of bread. Beer had its goddess, Ninkasi, "she who sates the desires," who according to one myth was born to cure the pain of the mouth (Kramer 1955:11). Her name survives as the cognomen of an excellent microbrewery in Oregon.

Mesopotamian society saw the world as a set of auras, like the halos one's eye constructs around stars (Gregoire 1998:224). Each centered on a city. The city was the center of a little world. Around it was a ring of gardens and orchards. Around this was a wider ring of grainfields. Around that, in turn, was the steppe and desert land where shepherds herded their flocks.

Inevitably, then as now, there was not always peace between the grain farmers and the shepherds. The latter, for one thing, might occasionally let their flocks wander into the standing grain. Anyway, mountaineers and desert dwellers are a rough lot—satirized in *The Epic of Gilgamesh* in the figure of the wild and hairy Enkidu, who has to be tamed with wine, women, and song (literally; see the translation by Kovacs [1985]). Enkidu is the oldest known "savage," the wild, hairy, powerful, solitary "woods dweller" of legend; the medieval wodewose, the Hobbesian and Lockean "savage," and the modern Bigfoot, Yeti, and Sasquatch are effectively identical. Every culture I know has this figure in their folklore; he (gender intended) is the "natural" opposite of us cultured folk, and every society needs to invent him anew, to validate their cultured superiority. Gilgamesh tamed Enkidu and made him a good companion.

A revealing document tells of the rivalry of the farmer-god Enkimdu and the shepherd-god Dumuzi for the love of the great goddess Inanna (Kramer 1955). Inanna at first naturally prefers the higher-status farmer, but Dumuzi matches wits and genealogies with him and wins in the end. Among other things, they compare their products; Dumuzi matches his cheeses and yogurt against Enkimdu's bread and beer. This dialogue reflects patterns of trade and exchange as well as patterns of rivalry:

> The farmer more than I, the farmer more than I, the farmer what has he more than I? . . . Should he pour me his prime date wine I would pour him, the farmer, my yellow milk for it, [then several other kinds of wine follow, and then] Should he give me his good bread, I would give him, the farmer, my honey-cheese for it, Should he give me his small beans, I would give him, the farmer, my small cheeses for them. (Kramer 1955:13)

On the basis of these fair trades, Enkimdu and Dumuzi work out a mutually profitable friendship—not letting their rivalry for Inanna stand in their way. This, of course, is a religiously constructed reference to the real and the ideal in Sumerian society: farmer and shepherd depended on each other and ideally recognized it and dealt fairly and in friendship, in spite of the differences that all too often intruded. The need for such ideals is shown by some hard realities: the Babylonians (of steppe origin) conquered the Sumerians, just as, later, the nomadic herding Israelites conquered the farming Canaanites.

Grain and bread have provided us with many symbols. The wheat seed falls and is buried; after a winter in the earth, it grows in spring. Then the head of grain forms and is harvested. The grains are crushed and made into dough. The leavening is added, and then comes that most mysterious and wonderful of all processes: the swelling of the loaf, so unmistakably similar to the swelling of pregnancy. After decades of baking (I bake all my own bread) I still feel wonder and strangeness when I contemplate a rising loaf.

Ancient peoples naturally came to see the planting and growth of the seed as symbolic of—or consubstantial with—the death and rebirth of the vegetation god, or the grain goddess, or the divine spirit of food. This was especially true where grain is planted in fall, lies dormant in winter, and germinates in spring—the standard pattern in the Near East and Mediterranean. Their gods of grain and vegetation typically died and were reborn; Tammuz and Osiris are examples. Ceres, Roman goddess of grain, has to spend 6 months—the cold ones, of course—in the underworld, the other 6 in this world.

The mythic view was appropriated by Christianity in a symbolic sense: Jesus, dying and being resurrected, was following the pattern of the grain. Easter, the old pagan festival of the rebirth of vegetation in spring, became incorporated into Christianity. No one knows when Jesus was actually crucified—probably some time in late winter; Easter today is not set to a specific date, but takes place on the first Sunday after the first full moon in spring, following ancient pagan patterns.

The Maya's most important deity was the Maize God, and Jesus was naturally assimilated to him; Jesus is often called today by the Maize God's old name, Handsome Lord.

In the Bible, and in other early texts from the Near East, "bread" is equated with "food." It is the Bread of Life. In the New Testament, it is equated with Jesus, the Bread of Heaven. Bread remains a divine substance to many Christians, Muslims, and others throughout Europe and the Near East. Until very recently, people from traditional parts of this vast realm regarded bread with genuine reverence. Children were trained from the very beginning to sweep up crumbs of bread from floor or table and dispose of them properly. This was sometimes done by burning: the old pagan idea of the sacred purifying fire. In other areas, the crumbs were fed to the wild birds, a wonderfully life-affirming way to send the bread to the heavens. Children were warned that if they stepped on crumbs of bread the crumbs might sink with them into hell. At the very least, bad luck was sure to follow.[1]

Christianity, more than other Near Eastern religions, has preserved the sacredness of bread. Communion bread was once baked by the families of a parish, in rotation. This custom survived until recently among the Basques and was fascinating to observe. Sandra Ott, in her wonderful book *The Circle of Mountains* (1981), tells of the central importance to the community of this custom. The whole community was tightly and vitally integrated into church life by this activity. The stamp of the Cross was passed from family to family, in a set rotation, so that they could make the bread into the Host. This was good, solid, peasant bread, too, not the anemic wafer that has replaced it in modern churches.

The communion wafer, according to the Council of Trent and many authoritative statements since, especially by the Catholic Church, turns into the actual flesh of Jesus in the eater's body (see *Catholic*

Encyclopedia [1907–1912]). The Council of Trent is cited in the Catholic catechism (paragraph 1376): "By the consecration of the bread and wine there takes place a change in the whole substance of the bread into the whole substance of the body of Christ our Lord and the whole substance of the wine into the substance of His blood." Recently some sufferers from celiac sprue (a condition in which wheat gluten is toxic) were assured by the Catholic hierarchy, including the Boston archdiocese, that they could not be suffering from the wafer because it turns to flesh in the stomach (this case was studied by anthropologist Hilary Crane [2004]). The sufferers were not helped, which tends to reinforce a more symbolic interpretation.

An amazing variety of shapes, sizes, and forms of bread accumulated over time. Many excellent local histories detail the breads of their nations (e.g., Guerrero Guerrero [1987] for Mexico—a personal favorite of mine—Rubel [2011] for England and France, and Ünsal [2004] for Turkey). Cyril Robinson devoted years to researching the bagel (Robinson 1998), tracing it to possible central Asian origins. Like most foods that Americans think of as "Jewish," it is not Israelite or Near Eastern but East European; American "Jewish" foods are the foods of the old Pale of Settlement, not of Jews specifically. Ring breads in east Europe may go back to pre-Christian religion, in which the circle was sacred; the bagel may be derived from a pagan ritual bread! Its classic pairing with cream cheese and smoked salmon reminds us of a time when those were poverty foods in eastern Europe, and the word *lox* (or *lachs*) is not Hebrew but Proto-Indo-European for "salmon."

Throughout recorded history, bread has always been the staple food of Europe. Its importance to ancient Greece and Rome needs no elaboration. What is perhaps needed is a corrective in the other direction. Bread's religious overtones made it featured even beyond its very real importance. From ancient Greece onward throughout history, bread shared the table with porridges and gruels of various kinds. These were less visible: they were foods of the poor, or breakfast and quick-lunch foods, or minor accompaniments to other dishes. These could be made of any grain or of grains mixed with pulses. Thin barley porridge and barley water were the cure-alls of ancient Greek medical dietetics. The ancient Romans depended heavily on gruels such as *pulmentum* (whence came modern Italian polenta, now made from maize, a crop unknown to the Romans). Russians came to rely heavily on kasha, a thick porridge made from millet, buckwheat, or other minor seed crops.

Our English word "bread" is cognate with "brewed" and refers to leavening. The old English word was *hlaf,* which gives us "loaf." A "loaf" could theoretically be unleavened, but "bread" obviously implies leavening.

Hlaf, in turn, gave us our original words for the elite. The "lord" was the bread keeper, the *hlafweard* ("loaf ward," "loaf guard"). The "lady" was the *hlafdige,* "bread kneader" (see the *Oxford English Dictionary*; cf. Jacob 1944). She baked for the laborers (*hlaf-aeta,* "loaf eater"), and her husband doled the bread out. By the time lords and ladies enter history, they already had servants to do that, but etymology makes it clear that they once did the work themselves.

Finally, in the nineteenth century, technology for mass production of fine white flour was developed. Notable were the Hungarian steel rollers for breaking and flattening the wheat grain. This allowed separation of the seed coats and germ from the starch. Standard flour today includes only about 70% of the wheat "berry" (technically, the caryopsis). Very little besides starch is left. Many of us prefer the old-fashioned stone-ground flour, with most or all of the caryopsis in it, for quality bread. But good white bread remains far more common, and overwhelmingly so in bread-loving France, Spain, Italy, and most of the Mediterranean. Sourdough white bread remains unbeatable for flavor by any but the very finest whole-grain or rye.

In the twentieth century, more and more efficient methods have been developed to produce a more and more tasteless and textureless bread. This sold widely. At first, it had prestige value, as white bread always did in Europe. Later, it became the ordinary "daily bread," used for sandwiches and the like; it had no taste or texture to distract the eater. Like most cultural superfoods, it was made as unobtrusive as possible. One can get tired of any marked-tasting food if one eats it constantly.

More edifying than this sorry history is the rise of quality and specialty breads in the last 40 years, in both North America and Europe. Today, few cities are without at least one or two bakeries that produce handmade, slow-rising, good-quality bread. The perceived deterioration of French bread in France, in particular, led to the rise of the

Lionel Poilâne bakeries (Rubel 2011), which have in turn spawned many imitators.[2]

All this is well known to historians. Less well known is the fate of bread as it spread across Asia (Anderson 1988, and research in progress).

Bread is actually more important in the Middle East than in Europe. Over the vast dry parts of the Middle East, wheat does well, and the minor grains, except for barley, do not. (Maize, sorghum, and millets flourish in a few places with special conditions but remain ill adapted in most of the region.) Therefore, from Morocco to Afghanistan, wheat and barley breads rule the home. Usually, breads are round to oval, flat but leavened so that the small, flat loaf puffs up and can be split for sandwich making. One Arabic name for this is *pita,* which is cognate with Greek *pita* ("pie") and Italian *pizza.* The Iranian form of this bread is called *nan,* which is the same as the Romance root *pan-* (as in Latin *panis,* Spanish *pan,* French *pain*); Farsi tends to change initial *p* to *n.*

Farther afield, breads take a multitude of forms. *Nan* spread to India in medieval times, but the commoner Indian bread is the flat *chapati,* made of whole-grain hard wheat flour. In south India, fermented rice or millet dough is made into large sourdough pancakes called *dosa,* into dumplings (*idli*), or into other forms. In Sri Lanka they are made into small breads called *appa,* which the English heard as "hopper" (Cockney pronunciation: "appa"). One made of strands of dough thus became known as "stringhopper." Southeast Asia reveals forms too numerous to mention.

In China, *nan* penetrated in early times (certainly by the very early Middle Ages, probably even before that). It has been miniaturized in most of China, yielding the *shaobing* ("baked cake"). However, the full huge *nan* survives, under various names, in the far west, Xinjiang and Ningxia.

More traditionally Chinese—much older than the *nan* derivatives—are various steamed buns and steamed or boiled dumplings. These occur in such an incredible variety of forms and names that it would take a book to list them (see Anderson [1988] for a brief introduction). Some are leavened with yeast, others with ammonia salts; many are unleavened. *Mo* and *momo* are solid dough (see Liu [2000] for a great discussion of them). *Bao* are stuffed with meat or sweet fillings. *Mantou* are now solid wheat dough but were once stuffed; the word is cognate with words from stuffed dumplings used from Korea (*mantu*) to Greece (*manti*). No one seems to know where the word started. I think it's Turkic (*manty*), but it could be Chinese. *Mantou* literally means "filled heads," but it may possibly have once been "barbarian heads," implying a foreign origin. (I find no evidence for a folk explanation given to me: that they were named because of a macabre resemblance to barbarians' severed heads!)

There are millions of breads in this world, and to describe them all would be out of my reach. Suffice it to recount the travels of one form.

One of the most amazing stories in the history of bread is the saga of the traditional Easter loaf. This bread is made from the classic fertility symbols: wheat, eggs, butter, and milk. Sometimes spice seeds are added. Today, sugar is used, but in the old days it would have been sweetened (if at all) with honey or fruit syrup: more fertility symbols. The bread is kneaded three times, and rises three times. Before the last rise, it is split into three, rolled out, and braided, so the final loaf is like a triple-plait hair braid. Today these symbolize the Holy Trinity, but the bread long predates Christianity, and the number 3 was of great ritual and symbolic importance long before the trinitarian dogma was imagined. In pre-Christian East Europe, and locally until living memory, a girl braided her hair in three braids, which were cut off as a sacrifice when she married.

With the rise of Christianity, this bread became an Easter food. I suspect it had already been the bread of spring festivals for thousands of years. It is now found throughout the Christian world. In Scandinavia, Easter bread is eaten all year long, as an accompaniment to coffee.

The recipe started in the east Mediterranean: in Greece, or perhaps in Mesopotamia, where simple, early forms are still found. It seems to have spread through Syria and the Greek Near East very early. Its spread north and west is probably well within historic times but is hardly documented. Today, it is the Easter bread throughout Europe and the Christian Near East (in traditional areas).[3]

In some areas it has changed its meaning. Most notably, it was adopted by the Jews very early and became *challah,* used for Sabbath. For this, the dairy products had to drop out, so that the bread could be eaten with main meals that might involve meat.

In Sweden and Finland, it is a year-round specialty. The Finns, who call it *pulla,* make a veritable cult of it. A wife used to be judged by the quality of her *pulla.* In Mexico, where the ancient Aztecs and their kin celebrated the return of dead souls in the middle of fall, the bread has become the Bread of the Dead, and eaten on All Souls' Day, November 1. (Hallowe'en is part of this day—in old times, church days started at sunset, as they still do in Jewish reckoning.) The pre-Christian European feast of the dead was taken over by the Christians, giving us our holiday. It fused perfectly with the pre-Christian Mexican feast of the dead. But the Mexican feast is a joyous occasion, a time to remember loved ones and celebrate their lives, their rebirth in heaven, and their continuing "life" in their children and grandchildren. They are believed to visit their homes and enjoy—spiritually, not physically, of course—the foods put out for them. The old were remembered, with love and reverence, by the new, and children were brought to the family altar to meet the ancestors and to show that the torch was passed. Easter bread naturally migrated to this wonderful and life-affirming holiday.

So the bread of resurrection, rebirth, and new life became the bread of that day.

12 FOODS AND BORDERS
Ethnicities, Cuisines, and Boundary Crossings

Defining Foodways

Foodways are created by dynamic processes. We usually think of them as "ethnic," but ethnicity is not a God-given trait. It is politically defined. It changes constantly with shifting patterns of politics, conquest, and trade.

We speak of "French food," "Italian food," and "American food," but such labels are notoriously ambiguous. Does French food include Provençal? If not, where does French stop and Provençal start? Does Italian food include the Swiss-style food of the historically German-speaking valleys of the Alto Adige? American food is sometimes taken to mean all the food of the United States and Canada; sometimes to mean the Anglo-American tradition (without, for instance, Cajun or French-Canadian food); and sometimes to mean the vernacular and fast-food cooking of the United States, limited to such fare as hamburgers and hot dogs.

Cuisines confined to island nations may be more or less tightly bounded; one thinks of Japanese food, and to a less precise extent of

British food. (Is Scottish food separate?) Countries that border each other by land, and trade constantly, have a more difficult time keeping their cuisines separate. Cultural differences and ethnic rivalries sharpen boundaries. The United States and Mexico have not fused their cuisines, nor have France and Germany. Yet even in these cases, there is constant influence and borrowing—perhaps especially in areas that have changed hands, such as the U.S.-Mexico borderland (Velez-Ibañez 1996) or Alsace. A region that does not have its own nation-state, like Cataluña or Provence, or like the Levant under the Ottomans, has a more difficult time. Regions with fluid boundaries, frequent conquests, and constant trade, such as the Arab world, are particularly hard to bound.

Italian food is perhaps the most confusing term of them all, and so provides a good place to start. First, we have a historical question. "Ancient Roman food" changed to "Italian food" at some point. When? Roman food, as we know from Apicius's cookbook (Apicius 1958 [ca. sixth–seventh centuries]) and other sources (Dalby 1997, 2003), was characterized by use of lovage, rue, and other herbs absent from later Italian cooking. It also used a great deal of fermented fish sauce called *garum.* This paste was ancestral to Italian anchovy paste. However, it was, from the descriptions, rather more like the modern Southeast Asian fish sauces such as *nuoc mam.* And the early Romans had no pasta. At some point, these and other tastes were transformed. We do not know even approximately when lovage and rue gave way to rosemary and oregano (the former not used in Roman times for food, the latter rather rare; Dalby 2003) or when garum evolved into modern anchovy preparations.

We do know that the fall of the Roman empire and the subsequent conquest of southern Italy by the Arabs brought about profound changes. The Arabs introduced countless new foods, including rice, sugar, oranges, and the *sharbats* that later evolved into ice cream. They may have introduced or reintroduced durum wheat, the superhard variety of emmer used for pasta in recent centuries. Galen describes durum unmistakably (Galen 2000, 2003; Dalby 2003) and separates it from ordinary emmer, which was then and is now a regular Italian crop. (It, too, is used for pasta, but more rarely than durum.) Perhaps Galen may have known durum only from his homeland in Asia Minor, rather than from Italy—though, at least in later times, it has been much more an Italian crop than an Asian one. Certainly we have no subsequent unequivocal records of durum from Italy until the early Middle Ages. Durum was used to make bulghur and frikeh (dried sprouted kernels) in the Levant (Elias and Manthey 2005). Durum pasta was in Sicily by the eleventh or twelfth century (Wright 2000). Ancestral macaroni (not then a tubular pasta) was recorded. Lasagna derived from an earlier fried flat cake known to the Greeks as *laganon* (Wright 2000); it came to be boiled instead of fried, and then served with cheese and white sauce (the tomatoes, of course, were unknown before 1692). Pasta evolved from Greek ancestors, especially a pasta-like item called *itria,* at some point in late classical times (see Dalby 2003; Rodinson et al. 2001; Serventy and Sabban 2002).

The Arabs introduced new spicing patterns but learned also from Roman spicing (on Near Eastern food traditions, see Rodinson et al. 2001; Zubaida and Tapper 1994). Pepper, cumin, saffron, and other spices popular with the Romans joined cinnamon, cloves, cardamom, and other newly available oriental flavors.

Sicily remains something of a museum of medieval Arab cooking (LoMonte 1990; Simeti 1989; Wright 1999). Mainland Italy lost most of the Arab dishes during the Renaissance. The history has been tracked elsewhere (Sabban and Serventi 1997, 1998; Serventi and Sabban 2002 [2000]) and need not concern us here. What does matter to us is the extremely late origin of the cuisine that most foreigners call to mind when they hear the words "Italian food." On the one hand, the undergirding of bread, olives, and wine is ancient. On the other hand, however, New World crops have revolutionized Italy in very recent years. To the non-Italian world, Italian food is almost synonymous with tomato sauces, but the tomato became popular in the late eighteenth century and truly prevalent only in the nineteenth (see esp. Serventi and Sabban 2002 [2000] for the history). The first tomato-sauce recipe surviving from Italy is one from 1692, which significantly calls the sauce "Spanish" (Long 2000). It is, in fact, simply a Mexican salsa recipe—so it appears that Mexico's indigenous people inspired modern Italian cuisine, via Spanish intermediaries.

Turkey did not adopt the tomato until the late nineteenth century (Faroqhi 2000:269). Other New World crops were similarly late.

Through most of Italian history, polenta (Latin *pulmentum*) was a mush of wheat or other Mediterranean natives; its identification with American-style cornmeal mush is very recent. Green and red peppers, potatoes, and other New World crops became popular at about the same time as the tomato. Hard though it is to imagine such an Italian-named commodity as the zucchini as a recent introduction, it is so; it derives its name from the older, and native, *zucca,* a large melon used now for cheap candied fruit cubes. Chocolate spread somewhat earlier—it was common in the seventeenth century (Coe and Coe 1996)—but it is hardly a marker of Italian food.

Spatial borders are as confusing as temporal ones. One can even ask whether there *is* such a thing as "Italian food." The modern American stereotype is derived from the foods spread by the South Italian—especially Neapolitan—diaspora of the late nineteenth and early twentieth centuries (Diner 2002). From Naples and its hinterland came such characteristic items as pizza, unknown till recently in most of Italy. North Italian food is so different that it hardly seems part of the same world. It tends to use animal fats instead of olive oil. Until recently, it lacked pizza and was less wedded to the tomato and green pepper; Neapolitan influence in recent years has changed this (Serventi and Sabban 2002 [2000]), partly via demands by American tourists who expect "Italian food" and mean the Neapolitan-derived delicacies they are familiar with. The north still uses far more rice and maize. Cheeses, pastas, sausages, and sauces are different. Only a general commitment to pasta, bread, herbs, wine, and hard grating cheese unites the realms.

One might even consider separating Sicily as a realm unique unto itself, given its strong Arab flavors and almost wholly distinctive dishes. Moreover, different parts of Sicily—a small island, but centered by wild barren mountains and thus divided into coastal regions—have different cuisines. Sicily is to food what the Upper Amazon is to biology: a region of high diversity and high endemism. And then there is Sardinia. Waverly Root indulged in a bit of romantic exaggeration when he described Sardinian cuisine as "Stone Age" (Root 1971:655), but certainly Sardinian food is not much like downtown Rome's. Quite apart from alleged Neolithic survivals, we have more historically demonstrable survivals from days of Catalan rule, French influence, and Arab trade.

We thus have many Italian cuisines, from Arab Sicily to the Germans in the Alto Adige. Piedmontese cuisine verges on French; Genoese is close to the food of Provence; and so it goes.

Conversely, Italian-type food does not stop at current national borders. The traditional food of Nice is Italian-influenced Provençal, not French in any very meaningful way. Dalmatia and Albania show the effects of centuries of influence or outright rule by Italian states. To my taste, Dalmatian food is more like central Italian food than Sicilian is.

Can one define a cuisine?

Yes, as long as one does not strive for exactness. If one defines a style tightly, the next creative chef to come along will surely take the definition as a challenge, just as artists and musicians do when someone defines a style in the arts. Nothing stimulates artistic originality more than a chance to destroy an academic straitjacket.

This being said, there are two possibilities for providing some definition. First, one could give an extensive definition, listing all the dishes or types of dishes in a cuisine. Second, one could give a simple rule of thumb that would predict most cases and bring some clarity without necessarily being perfect.

I prefer the second approach, since the first seems a Sisyphean task. Two particularly interesting, simple ways to define cuisines have come to my attention. First is Waverly Root's subdivision of French food according to cooking fat. He defined three regions of France, characterized by predominance of butter, of animal fat (lard or poultry), and of olive oil (Root 1958). This seems a useful way to subdivide France, and Italy as well (cf. Root 1971), but is not much use in countries, like China or the United States, that use many types of oil interchangeably. I find Root's scheme locally useful and always thought provoking, but little help with the general case.

Far more satisfying is the "flavor principle" developed by Elisabeth and Paul Rozin (Rozin 1983). Paul Rozin is the world's expert on the psychology of reactions to smell; Elisabeth is a talented cook (as I am fortunate to know from some experience). Her insight was that cuisines, like some chefs, are best defined by signature spices. The great cuisines of the world are characterized by quite characteristic and distinctive assemblages of flavorings—herbs, spices, fermented preparations, and condiments in general. Chinese cuisine, for instance, is notoriously diverse. Staples, cooking oils, meats, and dish types vary wildly from place to place, even in the same general region. Yet we all sense a certain unity to "Chinese food." The Rozins point out that this unity comes from the specific mix of soy sauce and other soy ferments, fresh ginger, garlic, rice wine, and chile with which the Chinese flavor most complex dishes. They also note regional variants (Rozin 1983:3–4; see also Anderson 1988). Other regions have their signatures, duly described in Elisabeth's book.

More generally, Western cooks tend to serve at the same meal foods with the same basic flavor chemicals; east Asian—more specifically Korean—chefs prefer contrasts and will serve sweet dishes with bitter ones or dishes with radically different spicing at the same service (Ahn et al. 2011).

Yet such signature flavorings can change quickly and dramatically. Nowhere is this more clearly shown than in the spectacular fall of spices and rise of herbs in French cooking in the seventeenth and eighteenth centuries (Sabban and Serventi 1998; this was only part of a full, complex history; see, e.g., Wheaton 1983). France's medieval cuisine, like that of the rest of western Europe, was based on lavish use of pepper, ginger, cinnamon, cloves, and saffron, with rather less nutmeg, mace, anise seed, cumin, and others. Tastes changed rather suddenly. There were various reasons for this: changing trade routes, local nationalism, and so on. Above all, however, people simply changed their tastes. The old dishes seemed terribly overdone. Significantly, Baroque ornamentation gave way to neoclassical at about the same time. Changes in all aspects of the cuisine took place, from use of fats to the etiquette of dining arrangements. By the eighteenth century, cooking was based more on bringing out the taste of the basic ingredients; vegetables were commoner, but pepper was the only spice widely used. Brillat-Savarin's classic *Physiology of Taste* (1925 [1825]), for instance, says little about spices—especially by comparison with a cookbook of the fifteenth or sixteenth centuries! Other regions were still plainer. Travel accounts, and the major histories (Flandrin and Montanari 1996:esp. 491–506; Sabban and Serventi 1998; Wheaton 1983), suggest that travelers found little that was unfamiliar, and little that tasted different, on their "grand tours" or more ordinary voyages. Roast meats of many species, accompanied by simple vegetables and sweets, were the universal rule.

Food and borders, China. New World foods have reached a Sani minority village in a remote part of southwest China; the chiles and beans drying against the adobe wall reminded my Mexican field companions of home. Photo by E. N. Anderson, 1990.

By the nineteenth century, the rise of *fines herbes* was under way in France. In the twentieth, the dominance of herbs was complete. The *fines herbes* mix of French haute cuisine became, classically, parsley, chervil, tarragon, and thyme, with sweet marjoram a common fifth. Provençal cooking—itself rather variable by subregion—has quite a different set: basically parsley, laurel (bay leaf), and fennel, with tarragon, basil, thyme, and other herbs occasionally used (Chanot-Bullier 1983).

The same happened in Italy, but there the herbs were rosemary, oregano, flat-leaved parsley, and basil. Change in Italy propagated from northwest to southeast, a fact obviously related to proximity to France. Sicily remains to this day a holdout of medieval spicing.

England lost the elaborate spicing (except for pepper and mustard) but, notoriously, never replaced it with anything. A very few herbs were and are used, as in the folk song "Scarborough Fair": "parsley [or "savory"], sage, rosemary, and thyme." (Presumably those were for sale at the fair. Fairs were a major channel by which scarce flavorings reached the folk.) The core medieval mix of cinnamon, ginger, nutmeg, and cloves continued in specialized uses, notably pie. They were also the spices of mulled ale. An English drinking song claims,

> Cinnamon and ginger, nutmeg and cloves,
> That's what gave me my jolly red nose.

Clearly, the spices were absorbed in alcoholic solution.

The parts of Spain that were near to France also abandoned most condiments, retaining, above all, garlic. Interestingly, the Arabic and medieval cooking of Spain was heavily herb oriented, using considerable amounts of parsley and cilantro (Benavides-Barajas 1996; Bolens 1990; Eléxpuru 1994); this has, on the whole, continued, though apparently with reduced intensity. As in Italy, remote areas held out. Andalucía and neighboring provinces retain Arab spicing—though only in certain dishes, many of them rare and obscure (see Casas [1996] for many of them). Andalucía is the only part of Spain in which the wandering visitor is apt to encounter full medieval spicing, and then often only in "historic revival" cooking that is delightful but not necessarily excessively authentic.

Thus, the signature spicing of a whole region changed dramatically. In the sixteenth century, the elaborate spice mix was quite uniform across nations. By the twentieth, the elaborate mix was gone and had been replaced by a wild variety of local traditions.

In this case, it really seems fair to speak of a basically united European cooking in the Renaissance, followed by a breakup into national and regional cuisines (see Sabban and Serventi 1997, 1998). These latter did not become really distinct until after the eighteenth century, often not until late in the nineteenth—especially in the cases of cuisines now defined partly by New World foods, such as Italian, Provençal, and paprika-loving Hungarian. We think of them as "traditional" today and sometimes have the vague impression that they have "always" been essentially as they are now. Such is not the case.

Using flavor principles as our main guide, supplemented by attention to cooking oils and major distinctive ingredients, we can define hierarchies of world culinary regions. Such definition must always be rough and imprecise, for reasons stated. But the awareness that, say, Chinese cuisine is not easily separable from Korean does not mean that there is no such thing as Chinese cuisine or that we cannot separate Korean from it.

It seems possible to define, rather tentatively, seven great culinary macroregions, each including many national and regional cuisines: North Europe (including Anglophone North America), Mediterranean Europe, Latin America (excluding Mexico and Brazil), the Near East (stretching from Morocco to Afghanistan), South Asia, Southeast Asia, and China. Brazil, Mexico, Ethiopia, Japan, and arguably a few other countries have sharply distinct cuisines that do not fall within any of the "greats." Small traditions, from Native American to Polynesian to Australian Aboriginal, provide a vast number of shifting, usually poorly described traditions, outside the great regions.

We would expect some traditions to be intermediate—boundary cases—and we are not disappointed. Balkan cuisines provide a perfect series of intermediates between North Europe, Mediterranean Europe, and the Near East, and it would be ridiculous to try to classify them as one or another. Vietnam has borrowed heavily from China, especially in the north, and become as much Chinese as Southeast Asian. Guatemala and El Salvador have a unique, distinctive, isolated little cuisine, derived in great part from pre-Columbian Maya cooking. It is not quite different enough from Mexico and Latin America to be a fully independent species, but it is certainly not classifiable under either of those majors.

The winds and currents of history are reflected in all these. Just as Europe's cuisines have radically shifted, so have those of the Near East. Cookbooks reveal that cooking meat with fruit (usually dried fruit) was universal and very popular in the Middle Ages (Arberry 1939; Benavides-Barajas 1996; Bolens 1990). It survives today largely in Morocco, reflecting its enormous popularity in Arab Andalucía. Some few dishes, in fact, survive in Andalucía itself (see, e.g., several in Morales Rodríguez and Martínez García 1999). Iran, the Caucasus, and Afghanistan still use some fruit in cooking. This style has become rare in Turkey, Arabia, and the Levant, where Old World sweet fruits have been replaced by New World "vegetable" ones: tomatoes, squash, and green peppers. The same thing happened with the Moorish dishes in Mexico, and there may be some mutual influence on the east Mediterranean. Raisins get into stuffed grape leaves, but that is a far cry from the elaborate fruit-meat dishes of medieval times. Conversely, pasta has entered the Near Eastern realm since the early Middle Ages; it has become popular in quite different forms. Cuscus now defines the Maghrib (northwest Africa), while noodles are especially popular in Iran.

Foods identified with the Ottoman empire and the Greek traders that originally were part of it, such as baklava, cut across macroregional boundaries but reflect rather faithfully the old Ottoman borders. Baklava—originally a Turkish food (Buell et al. 2010), however much claimed by everyone else in the east Mediterranean—is popular in the old core areas of Ottoman wealth and power, rarer but well known in Ottoman marchlands (border regions), and a new, exotic introduction to the rest of the world.

Similarly, an Arab dish, still bearing the Arab name *boronía,* is universal in the Near East and around Andalucía, and thence even to Mexico (see Arberry 1939; Benavides-Barajas 1996; Bolens 1990; Rodinson et al. 2001; Thibaut-Comelade 1995; Wright 1999). Its name derives from Buran, the wife of the Abbasid Caliph al-Ma'mun in the ninth century (Nasrallah 2003 [1999]:30), who loved it. Originally a dish of eggplant cooked in savory fashion, sometimes with fruit, it now includes some or all of the New World favorites: green beans, tomato, squash, and green pepper.[1] It has evolved rather like the ratatouille of Provence, which probably shares a common ancestry in Arab vegetable cookery.

Thus, one can now break up the Near East into several large subregions, the results of recent history: the Maghrib; Egypt; Arabia; the Levant and Mesopotamia; Turkey; Iran and its areas of influence (the Caucasus and west Afghanistan). Similar games can be played with the other divisions of the earth (for China, see Anderson 1988). Each of these can be further subdivided. Within the Maghrib, Tunisia, Algeria, and Morocco all differ. Within Morocco, each major city and its associated hinterland has its own variants of the basic cuscus, tajin, shorba, and other recipes (see Hanger [2000] for a useful introduction and Wright [1999] for more detail).

Food and the World-System

Foods, more than anything else, reveal the workings of world-systems. The concept of world-systems was developed especially by Immanuel

Wallerstein in the 1970s (see Wallerstein 1976). A world-system is, basically, a collection of polities that trade and interact enough to form a single network. There is a core—the rich cluster of polities that dominate trade—and a periphery, consisting of the various areas that are economically deprived or marginalized; often they are dependent or politically weak. The classic case is the "modern world-system," dominated by western Europe and, since the late nineteenth century, by the United States as well. These constitute the core; the rest of the world is peripheral, though Japan (and to some extent Korea and Taiwan) have come close to core status.

World-systems existed from very early times. The world's first civilizations, Egypt and Mesopotamia, constituted little world-systems; the Nile valley was Egypt's core, while its periphery was the desert region. Mesopotamia's core was the city-states of what is now central and southern Iraq. Its periphery was the mountain and desert region surrounding that (cf. Chase-Dunn and Anderson 2005; Chase-Dunn and Mann 1998).

One must avoid thinking pejoratively of the "periphery" or thinking of the core as somehow special. For one thing, core and periphery regularly change places. Italy was core in Roman empire days, periphery by 800, core again in the Renaissance, periphery by 1800, and part of the core again by 2000. France and Frankish lands were a remote periphery in the Dark Ages, receiving foods and Christian foodways from the south; puritanism and wonder working flourished as local religions declined (Effros 2002). A holy man could drink poisoned wine with impunity, or cook food in a wooden vessel on an open flame without fear of burning the vessel (Effros 2002:21–23). A few centuries later, the same areas were setting the world's food tastes and secular intellectual agendas. Other Mediterranean lands, such as Turkey, Spain, and the Levant, sometimes dominated during Italy's "down" cycles. During the Dark Ages the core of the Western world-system was in far Baghdad, while in the capitalist era it moved to Amsterdam, London, or Paris.

Moreover, as the great African social scientist Ibn Khaldun pointed out in the fourteenth century (Ibn Khaldun 1958), the periphery is the land that guards the age-old virtues of courage, loyalty, equality, and fairness. The core is, all too often, the land of corruption, hypocrisy, and degeneration. As cores mature, the wealth of the rich becomes more important than the lives of the poor. Justice becomes a commodity, bought and sold along with the goods extorted or looted from hapless peripheries.

The very culinary sophistication of the core was, to Ibn Khaldun and many since, a mark of trouble. Caring so much about food may replace caring about people.

Even very simple stateless societies can be involved in world-systems; the Wintu and their neighbors in northern California were a very small one (Chase-Dunn and Mann 1998), and so were the Channel Chumash and neighboring Tongva (Gabrielino) in southern California. These societies all had extensive trade; the Chumash at least had whole communities supported by trading, and their trade routes went over land and water for hundreds of miles.

Much of history can be understood more easily with this concept in mind. The Mongol empire rose from a peripheral location between two world-systems, the Near East and China. It captured both, often using the newest military arts of one to attack the other. The Mongol khans then lived on an uneasy balance, trying to rule two realms from a desolate spot in between. The empire almost immediately fell apart. The most powerful grandsons of Genghis Khan succeeded—respectively—to the Near East, Central Asia, and China. Both the success and the breakup of the Mongol world were due to their strong awareness of world-systems: of the trade routes, of the dominance of rich metropolitan areas, of the core-periphery relationships thus created.

Mongol food, in 1200, was milk, fermented milk, wild plants, and, very rarely, some meat. Mongol food, by 1300, was sophisticated and elaborate. The *Yinshan Zhengyao,* the court nutrition and cooking manual published in Beijing in 1330, contains recipes from Mesopotamia, Iran, Central Asia, and Kashmir, as well as China, Mongolia, and perhaps other areas (Buell et al. 2010). Clearly, the Mongols wanted and needed to show their rulership of the world by serving dishes from all core regions.

Wallerstein's classic example was the de-development of East Europe—in particular, the fall of the Polish-Lithuanian empire. Between 1500 and 1850, Poland fell from vast wealth and power to political nonexistence. This was caused by the rise of Germany and Russia as centers; they reduced Poland (caught in between) to a mere supplier of bulk raw

Maya food, Mexico. My neighbor in Chunhuhub, Doña Elsi Rodriguez, cooking. Photo by E. N. Anderson, 1996.

Further cooking by Doña Elsi, Chunhuhub, Mexico. Photo by E. N. Anderson, 1996.

materials. More generally, Poland lost its centrality in the world-system, while shifting lines of trade and commerce made its enemies central (Wallerstein 1976). The effect on Poland's cuisine was not dissimilar to the effect on its political life (Dembínska 1999). As in Dark Age Gaul, a periphery slowly entered the mainstream, foodways and all, but then was re-peripheralized, losing much of its high court tradition of feasting (Wallerstein 1976).

Food, naturally, tracks world-systems very well indeed. Chinese food has been powerfully influential on its peripheries, classically including Korea, Vietnam, and (at least sometimes) Tibet. Southeast Asia is a culinary realm though it has never been a political unity; close trade relationships, and frequent battles, have spread ingredients and recipes. Moreover, Southeast Asia was peripheral to India in the Middle Ages, and this has left countless traces on foodways. Geography is not a sufficient explanation for the Southeast Asian food realm; ecology and geography would not predict that Bali's foodways would be far closer to distant India's than to those of New Guinea, relatively close and ecologically similar. Southeast Asia, incidentally, is a multicored world-system, or perhaps a group of small, closely related world-systems; central Burma, central Thailand, and Java were all historic cores. We can see here some additional complexity: such world-systems are themselves involved in bigger ones, and a local core may seem "semiperipheral" to someone from a more populous and influential core area like India or China.

Typically, the core has the most elaborate foodways; sophistication and elaboration diminish as one moves toward the periphery. China's most elaborate food is found in its long-established trading and administrative capitals; its next most elaborate is found in their immediate hinterlands; and the least elaborate Chinese-style food is seen in the remote mountains of Manchuria, Tibet, and Burma. Indian food is most elaborate in the old capitals, least so in the mountains of Assam and Nepal. Europe's most elaborate food is found in its old core lands, France and Italy, and within them sophistication is maximized in the old centers of wealth: Paris, Florence, Venice, Rome, and so on. Normally, the cores not only have the most elaborate food but also the most prestigious. Even peripheries have their centers and their even-more-peripheral peripheries; Balkan cooking is more sophisticated in Croatia than in Macedonia.

However, this generalization does not always hold. England is the most spectacular exception; for reasons still not fully explained, it remained, culinarily, a remote periphery of France, even when it rose to world rule at France's expense. Less dramatic, but still thought provoking, is the failure of many Latin American countries to develop cuisines matching their world importance. Currently, elaborate and subtle cuisines exist in Mexico and Peru, reflecting (at great remove) the glories of Aztec and Inca courts and also the fact that they were the centers of Spanish power in Central America and South America, respectively. Brazil has a different pattern: an elaborate cuisine is in the old center, Rio, and another center of elaboration and sophistication is the African-influenced state of Bahia. This reflects the slave trade and sugar economy of colonial times and the cross-fertilization of Portuguese, African, and Native American cuisines. Once again, a vanished world-system geography is preserved in a modern culinary one.

The United States slowly developed a distinctive, sophisticated, complex culinary landscape after it became a world-system power, but this complexity remains almost entirely confined to the great trading centers: New York, Seattle, San Francisco and the Bay Area (home of "California cuisine"), New Orleans, and so on. "American food" of world-system notoriety is the worst and least sophisticated of American cuisine. Much of this is because most of the vast central and southern reaches of the United States long remained peripheral in culinary matters, partaking hardly at all of American centrality. Like classic Third World countries, they supply raw materials to other lands—including Japan and Europe.

Thus, food follows world-systems but may preserve a vanished world order. Some of the imperial cuisine of the Aztecs lives on in Mexican villages. The glory of the vanished empires of Srivijaya and Mataram lives on in small Javanese cities that have long lost leadership to the upstart Dutch capital of Jakarta. Jakarta's food is elaborate, but it has not eclipsed the sophistication of Jogjakarta.

Survivals of old ways can turn up in remote places. The Toba Batak of interior Sumatera still make yogurt, reflecting the dominance of India in the early medieval period. India's dairy-food culture spread throughout southeast Asia, surviving now only in such remote, isolated places.

Conversely, the cuisine of the periphery migrates to the center. Los Angeles has been called "the capital of the Third World" and Miami

Roast guinea pigs, Cuzco market, Peru. A marker of local Andean cultures. Photo by E. N. Anderson.

"the capital of Latin America," in part because of the variety of restaurants to be found. Los Angeles has no cuisine of its own and depends on its incredible variety of imported talent. It is no less varied for that. A person on lunch break at Los Angeles City College, strolling to neighboring cafés, can choose between almost twenty different ethnic styles.

Amsterdam's restaurant scene, with its countless Indonesian and Surinamian eateries, recalls Dutch empire lost. London, similarly, is well supplied with restaurants featuring foods from India, Pakistan, Hong Kong, and other places that gave rise to the saying that "the sun never sets on the British empire." The sun set on the empire long ago, but for the food it is still high noon.

In both periphery and center, culinary ways mix, and the specific mix reflects world-system history. Surinam, since we speak of it, has a cuisine blended from Dutch, Javanese, Chinese, and Indian roots, with bits of African and Native American influence; this reflects the mix of laborers assembled there in Dutch imperial times. South Africa's cuisine is similarly blended from African, British, Dutch, Malay, and Indian roots. New Orleans's distinctive cuisine has Native American, Spanish, French, and Anglo-American ancestry, reflecting successive rulers; above all, it is heavily African, reflecting the origins of the main labor force. Another wonderful mix, the Nonya cooking of Malaysia and Singapore, derives from long-continued interchanges between China, Malaya, and Indonesia. It has recently received a good deal of scholarly attention as a sort of model fusion cuisine, especially from Sidney Cheung and Tan Chee-Beng (Cheung and Tan 2007; Tan 2011).

Particular foodstuffs have affected history. The classic studies of this are Salaman's work on the potato (Salaman 1985) and Sidney Mintz's on sugar (Mintz 1985, 2010). Even the lowly peanut has attracted an excellent history, which, among other things, stresses the crucial importance of African Americans in popularizing and spreading it (Smith 2002). Mintz traced the bitter saga of sugar, associated everywhere with slavery or indentured labor, with rural poverty, with expanding colonialism, and with viciously exploitative production and trading practices in general—all for a food that does little beyond cause cavities and make diabetes more common. The actual dynamics of ruler and ruled, exploiter and exploited, trader and supplier are commemorated here (Mintz 1996, 2010; Watson and Caldwell 2005).

Manipulating Ethnicity at the Table

Status and ethnicity are combined; to mark its rise in the political system, a group revalorizes its cuisine. As in the African-American case, groups that feel discriminated against may self-consciously develop their local cooking into an ethnic cuisine. This has happened in the last few decades to Provençal and Catalan cuisine. Catalan cooking has an ancient and distinctive tradition—it was the high-status, sophisticated cooking of the early Renaissance (Scully 1995; Thibaut-Comelade 1995), but Provençal cuisine seems not to have existed as a distinct entity until the nineteenth century. Early accounts suggest that the people of Provence were reduced by poverty to a diet of little more than bread, olive oil, and local fish or cheese (see, e.g., Le Roy Ladurie 1971) until trade, commerce, and New World food crops combined to bring prosperity and agricultural productivity to the region. Today, by contrast, it is not only diverse and wonderful, but it has also spawned local subvariants; each city-and-hinterland has its variants of the common dishes (Chanot-Boullier 1983; Médecin 1972). It has become prestigious worldwide, while Catalan cooking is almost unknown outside Cataluña.

We are particularly aware of food as identity when we think of ethnic groups. It is a truism that ethnic groups are characterized by, and often defined by, their foodways. Food-conscious groups such as the Italians and Chinese are particularly notable in this regard. Moreover, many countries, notably Italy (Root 1971) and India (Achaya 1994), but also China (Anderson 1988) and indeed all sizable nations, have a kaleidoscopic range of local cuisines. There are sub-varieties, sub-sub-varieties, and sub-sub-sub-varieties of the major traditions. Often a locale will be popular far beyond its own hinterland for a particular ingredient or dish.

In contrast, some groups have attracted almost equal fame for the sheer dullness of their cooking. The British are the famous case in the West. This dullness is, of course, much exaggerated in the stereotype. Shaanxi Province has the same reputation in China; based on wheat, lamb, pork, and Chinese cabbages, Shaanxi food is simple, plain, filling, and not strongly flavored. Chinese from other provinces find it lacking in flavor and variety.

Ethnic slurs are often based on foods. In the bad old days when ethnic insults were politically correct, Germans were "krauts," French were "frogs," and so on. An Irish Catholic friend of mine complained that she was called a "mackerel smacker" in her childhood in Boston. (Catholics had to eat fish on Friday, and mackerel was cheap enough for the supposedly indigent Irish.) The Chinese in the early medieval period were no different; northwesterners laughed at the frog eaters on the coast, who in turn ridiculed the northwesterners for eating yogurt and mutton (Anderson 1988).

The longest-lasting slur is the tall tale spun by Ammianus Marcellinus, in the fourth century CE: The Huns "have no need of fire nor of savory food, but eat the roots of wild plants and the half-raw flesh of any animal whatever, which they put between their thighs and the backs of their horses, and thus warm it a little" (Ammianus Marcellinus 1939:382–383; see also Laszlovszky 1998). This venerable bit of nonsense not only continued to be taught but was even transferred from the Huns to the Mongols and even appears in Jack Weatherford (2004)'s otherwise excellent book *Genghis Khan and the Making of the Modern World*. It was surely a lie from the beginning and is certainly not true of the Mongols, who boiled their meat to save its vital essence. Even less choosy nomads would have had the sense not to slaughter animals on the trail, mess their horses and clothing up with blood, and eat dirty meat when they needed to be fit for war.

Going beyond the stereotypes, we find some amazing manipulations of ethnicity. The folklorist Robert Georges, who is Greek American, once wrote—but, alas, never published—a paper called "You Eat What Others Think You Are" (1981). Here he noted that people who could cook Greek food very well, but were not of Greek ancestry, deprived him of their cooking because he was assumed to be too harsh a judge—much to his sorrow. His elderly relatives "back East" in older immigrant neighborhoods always cooked a set Greek festival menu when he visited them. It was always the same menu. It was nothing like ordinary food in Greece, but it had become the sacred tradition.

I have seen similar phenomena in many areas. In Hong Kong, many of my friends belonged to an ethnic group, the Teochiu, which is very different in language and foodways from the Cantonese who make up most of Hong Kong's population. My Teochiu friends would cook Cantonese food most of the time. They always ate Cantonese food when they were with Cantonese. But, for special occasions, especially family celebrations, they always went to Teochiu restaurants. In such contexts, like Robert Georges's family, they ate a more or less set menu of traditional festal dishes. Thus Teochiu identity was affirmed. For most of them, this was the only important way it was *ever* affirmed. Born and raised in Hong Kong, they spoke Cantonese, but they were still "Teochiu"—if only at festal dinners.

In Hong Kong, where the Cantonese are the majority, other Chinese ethnic groups like the Hakka also eat their own cuisines when holding their own ethnic festivals or dinners, to reassert identity. But they eat Cantonese food when with Cantonese, to affirm solidarity and avoid being labeled. They eat a mix at home, often eating Cantonese everyday foods and their own special festive foods. Recently southeast Asian food, reinterpreted by Chinese cooks, has become popular in Hong Kong (Tan 2011).

Sausages and dried meat in Hong Kong. Photo by Zelda Liang.

United States residents in East Asia often acted similarly, eating Asian food most of the time but putting on a "proper" Thanksgiving or Christmas feast for their American and Asian friends. Often, they would go to great lengths to get "traditional" Thanksgiving foods that they did not bother to eat at home.

Not all ethnic food is cooked by people of the ethnicity in question. A huge percentage of restaurant cooking in southern California is done by Mexicans, often illegal immigrants. At one time, many of these came from Zacatecas (a state with a high level of both education and cooking). These cooks produce much of the superb French and Italian food of Los Angeles's snob restaurants. They also produce Asian, Arab, Greek, and any other food one might want. One of the most difficult of Chinese cooking arts is making hand-swung noodles; Chinese chefs take years to learn it. The only expert I have seen doing it in California was a Mexican—working in a Chinese Korean restaurant!

Food and Migration

When migrants come to a new land, they gradually change their foodways. Eventually, they usually come to eat like the majority in the new home. America, being proverbially "a nation of immigrants," is a museum of changing ethnic cuisines (Gabaccia 1998; Klindienst 2007). Even little Jamaica is an amazing melting pot of African, Native American, and European traditions—and has become the subject of the one of the best and most thorough books on a single nation's food, B. W. Higman's *Jamaican Food* (2008).

Some groups are more resistant to change than others. Chinese and Mexicans in California are particularly tenacious of their foodways. There are good reasons. First, their cuisines are popular with almost everyone, so there is no real incentive to change. Second, their communities are constantly renewed by immigration. Third, they maintain large and dynamic ethnic enclaves. At the opposite extreme are East Europeans. They came to California in fair numbers, but immigration virtually stopped with the Depression. They did not often start restaurants, and their cuisines were not popular with Anglo-Americans. They also dispersed rapidly into the California "white" world.

I have done research on Chinese (Anderson and Wang 1987) and Finnish foodways in California. The difference in restaurant activity is striking. Chinese restaurants are everywhere in California, and many of them serve food about as good as one can find in Hong Kong or Taiwan today. They are well patronized by all ethnic communities.

By contrast, I have only once encountered a Finnish restaurant in Los Angeles. The owners (a middle-aged couple, excellent cooks) could not resist the Finnish tradition of hospitality; they refused to take money for the food, if they knew the people they were serving! Of course, the restaurant lasted only until they ran out of capital. I have heard similar reports from elsewhere in Finnish America. There have been no Finnish restaurants in California for a long time. There are, of course, more Chinese than Finns in the state, but the difference is not great enough to explain the restaurant findings. Finns were important in the settlement of the north coast, in particular, and large Finnish enclaves used to exist from the Bay Area to Oregon. California also has rather sizable numbers of Poles, Czechs, and Hungarians. There are a very few restaurants catering to them, but not as many as one would expect from the numbers of immigrants. The same cultural rule kept Malay/Bumiputera restaurants rare when I was in Malaysia. Hospitality led to bankruptcy in too many occasions.

Chinese immigrants in California acculturate to Anglo-American foodways in a fairly set fashion (Anderson and Wang 1987). First, they adopt American sweets and snack foods. Then they pick up American drinks, if they had not already done so in their homelands. Colas, milk, and "designer water" slowly replace tea and soybean drinks. Then breakfast Americanizes; cereal and toast replace congee and dumplings. Then lunch gives way. Dinner takes much longer to change. Finally, feast foods associated with the major Chinese holidays are the last to go. Other immigrant studies have found the same pattern. It seems to be almost universal.

We found that many Chinese drove up to 200 miles a weekend just to shop for food and eat out in Chinatown. So do many other Asians. Artesia, an enclave of immigrants from India, attracts Asian Indians from all over southern California. I remember when Artesia was a Portuguese enclave that attracted Portuguese from the same wide-flung region. The Portuguese (here and throughout California) merged fairly quickly into the general Anglo population, leaving Artesia to the latest immigrant community.

Such ethnic replacements are very common. The Indians, however, are probably going to stay because they merge less rapidly and because immigration is continuing.

In this modern world, "global village" that it is (Wilk 2006), Chinese food is everywhere (Foundation of Chinese Dietary Culture 1998; Wu and Cheung 2002; Wu and Tan 2001)—just as McDonald's is invading China (Watson 1997). The general cultural trend, worldwide, is for American culture to blanket everything. Thus, it is particularly interesting to the anthropologist to observe cases in which other cultural traditions "swim upstream": not just holding their own against the American deluge, they actually penetrate the American cultural fortress and propagate there. Italian, Chinese, Mexican, and Thai foods have been the most successful. Ethnic food has never respected ethnic boundaries. In fact, it is their crossing boundaries that makes them "ethnic" foods—as opposed to just "local" foods. Groups learn, imitate, and borrow all

Beans at the market, Otavalo, Ecuador. The Quechua, the largest Native American group today, provide most of the food for the town. Photo by E. N. Anderson, 1997.

the time. With the coming of "the global village" in the late twentieth century, ethnic food has exploded from its origin points.

Such spread never occurs without changes. The Chinese and Mongols in the 1300s changed the spicing of Near Eastern foods, adding soy sauce, large East Asian cardamoms, and other new flavors (Buell et al. 2010). Chinese food in turn changed in the United States. By the 1960s, when new streams of immigrants came from eastern Asia, American Chinese food was a distinct category of its own, complete with purely Californian inventions such as fortune cookies. The new immigrants, introducing genuine Cantonese, Shanghainese, or Sichuanese food, created a whole new culinary universe—distinct not only in taste qualities but also in the architecture, ambience, and location of the restaurants.

Pizza is probably the most dramatically changed ethnic food.[2] In its native area—Naples and environs—it was simply a flat bread baked with a topping of tomato, garlic, cheese, and perhaps an anchovy and some oregano. The word is almost certainly cognate with *pita,* meaning "flat bread" in Arabic and "small pie" in Greek. Pizza is only one of a class of Mediterranean flat breads with toppings baked on. It is comparable, for example, to Middle Eastern *lahmajun* (which just means "bread and meat" in Arabic)—which has had its own, earlier radiation into Turkey, Armenia, and farther afield.

In the United States, pizza took on a strange life of its own. Various thicknesses and forms of crust developed. For lack of true Italian ovens, pizza was baked in baking dishes in some areas. Toppings were improvised and grew more and more innovative. The standard came to include green peppers, onions, and olives as well as traditional tomato and cheese. Oregano, the basic flavoring of the early pizzas, shrank progressively in importance. Anchovies followed it into near oblivion. Meanwhile, a vast array of new pizzas arose, topped with hamburger, sausages, arugula, smoked salmon, feta cheese, or anything else imaginable. Dessert pizzas, topped with dessert cream and fruit, became briefly popular. Perhaps the strangest, to the food historian, is the "Hawaiian pizza," topped with ham and pineapple—a combination identified with pseudo-Hawaiian restaurants whose chefs were American Chinese. Neither ham nor pineapple is a native Hawaiian food. In fact, the combination owes more to midwestern America and, ultimately, to the British custom of serving ham with fruit preparations. Thus does the whole world-system inhere in one dish.

Such exchanges eventually undermine the correlation of ethnicity and foodways. In the Middle East, foodways extend broadly across ethnic lines. Central Asian food is rather uniform, in spite of some significant differences, whether one is eating among Tadzhiks, Uzbeks, or Turkmens. Where Turkey, Iran, and Iraq come together, Kurds, Armenians, Arabs, Turks, and Persians trade bullets but share foodways. There are distinctions made, but they as often distinguish cities and valleys as ethnic groups per se. Or, to put it another way, the citizens of one town may constitute a slightly distinct ethnic group of their own; Mosul in Iraq, for instance, is its own little world in more ways than one, and Mosul identity and foodways cut across religious and linguistic lines. The same can be said, with some reservations, about Istanbul and even about some particular quarters of Istanbul. The old markets and the old port have distinctive dishes and food traditions of their own.

Groups may vie to disown a foodway. Los Angeles Chinese tend to claim that fortune cookies and certain other "un-Chinese" dishes were invented in San Francisco, while San Franciscan Chinese claim they were invented in Los Angeles.

The popularity of American fast food in the contemporary world owes much to a desire to be seen as identifying with the rich, powerful, hard-driving, successful Americans (see, e.g., Watson 1997). Indeed, many people believe that by eating American style (and by dressing American style, and listening to American pop music) they can actually acquire those qualities and become rich. I often heard this article of faith in eastern Asia (see, again, Watson 1997). Some of them get to America and discover to their horror that the foodways of their emulation are the mark of the poorest and least successful of Americans—a class of people whose existence they had not imagined.

Ethnic survival of foodways is not simply a matter of ethnic conservatism or tenacity. It is influenced by ongoing interaction with the host societies. One can see this by comparing food with other arts of life. In music, for instance, the pattern has been very different. The Latin touch wins there, too, but native Andean, Celtic, and even aboriginal Australian musical traditions have proved more successful than Chinese in surviving robustly outside the homeland. This is largely because they are more appealing to the wider world. Irish food never attracted many; Irish music has millions of fans. Chinese food seems to become instantly popular with almost everyone in the world, but Chinese music tends to be neglected, not only by other ethnic groups but even by younger Chinese in the overseas communities.

In all, food and foodways have been internationalizing for centuries and have been defined on a world scale; foodways are to a great extent the products of global trade and global empire. Too much of the scholarly, and pseudoscholarly, literature of the last couple of decades seems premised on the assumption that "globalization" is a new thing. No scholar of foodways thinks so.

> If you don't like the news, go out and make your own.
> —*Graffito on a Berkeley newsstand (observed by the author in the 1960s)*

13 FEEDING THE WORLD

World Food Problems

All this understanding of foodways would be unworthy of attention if it did not help us with the world food problem.

At present, for the first time in the history of the world, there is food enough for all (Smil 2000). Yet over a billion people are undernourished. Hundreds of millions of people go to bed hungry most nights of their lives. Starvation is still one of the commonest causes of death.

Ironically, an almost equal number is overnourished, suffering from obesity. The world food problem, today, is not one of absolute lack but of absurdly wrong distribution. The Green Revolution—the introduction of new crop varieties, pesticides, and fertilizers in the 1960s and after—had many problems, but it did increase the food supply (see, e.g., Evans 1998). India, which probably has more hungry people than any other country, also has a large surplus of grain, which often threatens to rot unused for lack of storage and distribution facilities (Stone 2002). Technology has entered the twenty-first century, but social justice has gone back to the eleventh. Consider the enormous variations in food availability between, say, the United States and Haiti—or even between Silicon Valley and an isolated Indian reservation in America.

The problem of world food supply has been well discussed by a number of authors. Notable among recent authors are Lester Brown (1995, 1996), Vaclav Smil (2000), and L. T. Evans (1998; and the International Food Policy Research Institute [2002] provides a wide-ranging set of views; see also Patel 2007). All three men have written excellent books, filled with technical detail. They agree, broadly, on their data. They disagree on their prognoses: Brown is generally the pessimist, Evans the optimist, Smil the balanced, rational soul in between.

Most agree that social justice is the real problem (Brown 1996; Sen 1992). This includes the politics of science: what gets studied, what gets developed. Too often, agricultural research money goes to luxury crops for the rich rather than to staples of the poor. Raising cattle in rich-nation feedlots receives more attention than raising cattle for survival in the Sahel (cf. National Research Council 1996). A major collection of papers, *Cultivating Food Justice* (Alkon and Agyeman 2011) has recently appeared and considers the social questions, from poverty and poor access to the advantages of local markets. This book has informed the present chapter.

The sheer pressure of population is, of course, not something to ignore. Most authors seem to agree that the world can feed at least 30 billion people—perhaps twice that if people were willing to go back to the pre-industrial regimen of extremely penurious lives and constant threats of famine. However, feeding 30 billion would require essentially perfect government. No mistakes, miscalculations, wars, corruption, or other ordinary sins of nations could be tolerated. Moreover, current suicidal policies toward the environment would have to stop. All this being unlikely, it is correspondingly unlikely that the human population will rise above 10 billion or so. This figure will be reached by about 2050, at which time either voluntary restraint or Malthusian catastrophe will level the population off.

At present, falling birth rates and the spread of family planning make most experts cautiously hopeful that voluntary action will set the limit. However, explosive population growth in Latin America and parts of Africa remains disquieting, and the opposition to serious family planning by the Catholic Church and many Islamic regimes is even more so.

In particular, some crowded countries still have a high birth rate. Almost all countries have brought birth rates down in recent decades, but countries such as Egypt, Pakistan, and Nigeria still have high rates of increase and are already desperately stressed by shortages of water, fertile land, and other key inputs necessary for agriculture and food processing.

Technology is doing quite well in solving world food problems, and even the much-maligned global marketplace is at least doing what it is supposed to do—motivating production and getting the food around. The problem is lack of political will to help the hungry and to limit population growth.

Famine

In former centuries, famine was a much more constant threat than it is now (see Murton 2000). China had a famine, somewhere, almost every year in recorded history (Mallory 1926). The Aztecs were also bedeviled by frequent and horrible famines (Duran 1994 [sixteenth century]). Abnormal weather of any kind could produce famines anywhere. A great volcanic explosion in what is now Indonesia in the early nineteenth century produced "years without a summer" in Europe and America; the volcanic dust drifted north, and there was so much in the air that the sun was blocked. Europe starved. Many Germans blamed the Jews for somehow darkening the sun. Anti-Semitism, all too common even before, began a steady rise that led eventually—after many other episodes—to Hitler (Post 1976).

Perhaps the most famous famine in history was the potato famine in Europe in 1846–1848 (Salaman 1985; Woodham-Smith 1962). We in the English-speaking world speak of this as the "Irish" potato famine, but it affected far more people in Germany, Poland, Russia, and neighboring areas. The immediate cause was potato blight, *Phytophthora infestans* (usually described as a fungus, but actually an oomycete in the brown algae group—closer to kelp than to fungi—and thus dependent on wet soil). The genus *Phytophthora* is one of humanity's worst enemies, ranking with malaria and tuberculosis as a killer—but its murders are indirect. *Phytophthora infestans* slays not only potatoes but also many other crops. Avocados and related trees are killed by a closely related species, *P. cinnamomea,* and still other species kill still other crops and trees.

In 1846 and 1847, cold and wet summers allowed *P. infestans* to proliferate. By this time, much of Europe had become dependent on potatoes, especially the "lumper" variety. Evolving as organisms do, *P. infestans* naturally became more and more successful at parasitizing lumper potatoes. The wet weather brought things to a head, and the potato crop was virtually wiped out from Ireland to Russia. Ironically, Ireland continued to export thousands of tons of food to England—but the food was wheat and other elite products, too expensive for the Irish poor. Social problems exacerbated (if they did not actually create) the situation; the role of landlords and other elites is still debated (Lang 2001). The money earned by exporting crops bought some food from outside, but much of that was maize, which the Irish poor could not use; they lacked the know-how, the technology, and the fuel to prepare it. The Irish still blame the English for causing or exacerbating the famine by cold-blooded indifference, while the English still blame the Irish for laziness and ingratitude.

Millions of people died; millions more emigrated, primarily to the United States, whose culture was changed profoundly. The desperate poverty of the "hungry forties" was already severe, leading to rebellions and disorders; the famine brought outright revolution, from Germany to Hungary. New and uncompromising ideologies, from Marxian communism to extreme nationalism, flourished.

Even in olden times, famine was often due to deliberate political machinations, but it was often due to sheer magnitude of disaster and inability of even a caring government to bring in enough food fast enough (Li 2007; Mallory 1926). Frankly, famine and starvation are now strictly political matters, and they have been since World War II (Sen 1992). They are essentially confined to war zones like Afghanistan or to nations in which a cruel government is starving its opposition to death, as the Sudanese government did in its ultimately unsuccessful civil war with its southern peoples. The mass famines of China in 1959–1961(Dikötter 2010) and Ethiopia in the 1970s were due to extremist left-wing policies. Comparable right-wing extremism led to widespread hunger and starvation in Guatemala and South Africa in the 1980s. (On these and related matters, see Rummel 1998.)

In most of these cases, and in countless others, the world community did little. The South African government was subjected to extreme and eventually successful pressure, but otherwise there was little action. Ethiopia attracted relief attention, but even after the repressive regime fell, Ethiopia's problems have continued, without much international attention. Sudan, China, and Guatemala operated with relative impunity, even from mild criticism. Sudan and China had seats on the Human Rights Committee of the United Nations until 2002; deliberately starving millions of one's people to death is not a human rights issue to the grave diplomats of the twenty-first century. But it is a form of "structural violence," related to genocide (Anderson and Anderson 2012).

Serious famine is a straightforward political problem. It will be easily solved when political leaders decide that human life has value. It will continue to fester until then.

Food security for the future is not assured. Brown and Smil note that there is very little food stored in the system. Relatively few countries are net exporters of food on a large scale. The problem of chronic local undernutrition is more serious and less simple. It is something of a "hidden" problem.

One is left unsatisfied by the works of Brown, Smil, and the others. They talk of technical solutions: more fertilizer, less overfishing, more efficient use of water, less urban sprawl on farmland. Other writers, more political in background, talk of "socialism," which has been tried dozens of times and has not helped greatly, or of "free trade," which means little in an inevitably regulated world (see below). Anthropologists with a lifetime of field experience, such as Johan Pottier in his book *Anthropology of Food* (1999), are left saying, Yes, but everyone has known this for decades; what is *really* wrong here?

According to policy expert Ismail Serageldin, "10% of the world's population subsists on less than 0.5% of the world's income" (Serageldin 2002:54). Even the more fortunate 90% include many sufferers from poverty. Meanwhile, the rich get richer; Bill Gates's income is more than a million times that of the average American worker, and it's more than the combined total gross national product of several of the poorest countries.

Only political will can bring about more reasonable distribution of food, fertilizer, agricultural research, and new food sources in a world economy that increasingly concentrates wealth in the hands of the urban, educated sector of humanity and increasingly sucks wealth from farming and other food-producing sectors. Moreover, long experience teaches that simply handing out resources is fatal. It out-competes local farming, thus putting local farmers out of business; this solves no problems. Everyone quotes the proverb, "If I give a man a fish, I feed him for a day; if I teach him to fish, I feed him for a lifetime." This works only if he can buy fishhooks or nets and if someone makes sure that the fish aren't wiped out by pollution or uncontrolled open-access fishing. Unfortunately, almost all the world's fisheries are now thus compromised (see Brown [1995, 1996], and sources therein). We have to give people the chance to produce more, but in a context of conservation. That means more efficiency is necessary. We have to do more with less. That will take careful planning.

Few First World persons appreciate just how bad life is for most of the human race. It is not enough to visit Third World countries; one has to live with the poor for months or years. The chronic hunger, disease, violence, and insecurity that are their daily lot have to be experienced to be understood.

The self-serving myth that they "do not care" or "are used to it" is, of course, incorrect. Hunger, cold, disease, and murderous brutality are hardly things that one can "get used to" or endure without pain and suffering. The death of one's child hurts as much when one is poor as when one is rich. Indeed, since the poor often depend on their families for all the security and love they have, it may hurt more.

We have no way of knowing how many people starve to death per year, especially since most are diagnosed as dying of something else. Some minor disease comes in and finishes off a weakened body that, if well fed, could easily have withstood the germs. Estimates of malnutrition deaths run as high as 500,000 people per year (almost one per minute). Hunger in the United States was virtually eliminated by the late 1970s, but government policies in the 1980s and since have led to massive wealth transfers from poor to rich and massive cutbacks in food-aid programs, leading to rapid decrease in food adequacy for the poor. Real hunger is again with us.

There are other problems. The First World has cleaned up traditional pollutants, such as animal dung and raw sewage, and has set controls on new pollutants such as toxic chemicals. In most of the Third World, the traditional pollutants are still there, worse than ever because of population growth and uncontrolled urbanization. Added to them are the modern pollutants: toxic wastes, nuclear dumps, pesticide overuse, dangerous drugs, lawless industry, and the like.

Governments very often use the full panoply of modern weapons (save only nuclear arms) against their own people to eliminate minorities and enforce corrupt rule (Anderson and Anderson 2012; Rummel 1998). It is no surprise that they often do not care about famine or even use it as a calculated part of genocide.

Technical Non-Fixes

The failures of international development have been chronicled elsewhere (Anderson 2010b; Collier 2010; Dichter 2003; Ellerman 2005; Stiglitz 2003) and need not long concern us here. But to give one example, huge dams, now over 40,000 worldwide (Scudder 2005; on China, see Anderson 2012), are beloved of development agencies. They have been a disaster. I am not aware of a single case in which a big dam was a net benefit to food supply. They flood good farmland, displace farmers, create parasite- and disease-breeding grounds, and destroy fisheries. They are often installed more for power generation than for food production. Food supplies suffer. Even when they increase irrigation and control flooding, they usually destroy more farming capability than they create. They often enrich local landlords who grow non-food crops, rather than helping the poor by increasing food production. By contrast, small and numerous dams, combined with careful river management and protection, can provide irrigation, flood control, fish, water, plant foods, and other benefits without massively disrupting whole regions.

The Green Revolution has clearly saved the world from mass famine. The production gains in the last 40 years have been due in large part to it. Without it, hundreds of millions of people would have starved. Yet it has increased the use of pesticides and other dangerous chemicals. In many countries these have been overused to the point of becoming major dangers to human life. It also led to a focus on staple grains at the expense of more nutritious foods.

The Green Revolution has often been blamed for increasing the gap between rich and poor. This may be unfair, though the jury is still out. True, Green Revolution seeds and chemicals must be bought and are fairly expensive, but any government can make rural credit cheaply available, and the large payoffs easily make the small investments worthwhile—if agricultural practices are adequate. Another unfair charge is that the Green Revolution was about cash crops rather than subsistence. In fact, the Green Revolution was targeted toward food crops, beginning with the world's major ones: wheat, rice, maize, and potatoes, in that order. It went on to include manioc and millets; research is ongoing. The boom in cash crops that came at the same time was an independent phenomenon (though it benefited from the availability of farmland released from food production by the higher yields achieved through the Green Revolution). The Green Revolution did, however, lead to farmers switching to grain (now so productive) from nutritionally better and more critically needed crops like legumes and vegetables. This led, in turn, to unbalanced diets in India and elsewhere.

The gap between rich and poor expanded where governments failed to make credit available—or, in some cases, where governments quite cynically used the opportunity provided by the Green Revolution as a way to favor their rich friends and hurt the poor and weak. Even in these cases, the poor often got better off—just not as much better off as the rich did. This latter outcome is far from ideal, but at least it helps the poor. (All these matters remain controversial. I am speaking from my own experience, which involves interviewing leading Green Revolution scientists such as John Niederhouser, as well as my wife's and my rather considerable work in Third World rural development. As usual, Smil [2000] provides the most balanced view, but he is rather too optimistic, in my experience. See also Evans [1998] for serious—and optimistic—detail on future green possibilities.)

Unfortunately, the benefits of the Green Revolution have now been eaten up (literally) by population growth, leaving the world in danger again. In his speech on receiving the Nobel Prize in 1970, Norman Borlaug said: "There can be no permanent progress in the battle against hunger until the agencies that fight for increased food production and those that fight for population control unite in a common effort" (quoted by Jeffrey Sachs [2009:36] in a valuable article; see also Borlaug 2007).

Rural Decline

There is, today, a chronic malaise in the rural areas of the world. The people who should be producing food are in deep trouble. Most of the world's "hidden" food problem is, ironically, in rural food-producing areas. The hungriest people are often those who feed the rest of us.

Many rural people do not have enough land. There is barely enough farmland in the world to feed everyone, and that farmland is concentrated in relatively few hands. Giant American agribusiness firms own a very disproportionate share of it, not only in the United States but also in dozens of poor nations.

Local landlords own a great deal of the rest, especially in Latin America, and they tend to use it to produce cattle, cocaine, marijuana, palm oil, and other things that hurt more than they help. Cattle and palm oil are foods, but palm oil supplies only empty calories of saturated fat. Cattle are usually produced through the use of habitats that could produce a very great deal more of a very much more nutritious set of foodstuffs. In rich nations, cattle are fed grain that could be fed to humans. In both rich and poor nations, cattle are produced on land cleared of productive forests. Unlike some authors (e.g., Lappé and Collins 1971; Rifkin 1992), I have nothing against meat-eating or cattle. Grazing cattle on grassland seems a good use of an otherwise hard-to-use habitat, as long as it is not overgrazed. Cattle are often fed on things people can't eat, such as cornstalks; the problem is that many cattle are not raised that way.

At least cattle are a food. Much of the world's farmland has now been converted to biofuel production—basically, starving non-affluent children to feed the gas-guzzling SUV's of the rich. This has proved an unqualified disaster, not only forcing up food prices but also contributing at least as much to global warming as fossil fuels do—because the biofuels are produced by deforesting whole tracts of land and then producing crops with fossil-fuel-intensive agriculture! It often takes as much oil, in tractor fuels and machinery fuels, to produce biofuel as the resulting biofuel produces, so the net result is worse than the original disease (Biello 2011).

Concentration of land in the hands of a few is pernicious not just because it is unfair. On the one hand, the great landlords own far more land than they can properly oversee or care for. Inefficiency, waste, and low production are typical of huge estates. This is true even in the United States, where mechanized farming allows cultivation of vast uninhabited tracts. It is far more clear in Latin America. On the other hand, smallholders who are not only willing to work but actually desperate to work do not have enough land. Many of my friends in the Maya villages of Mexico do not have enough money for even a hectare of land, yet they have the energy, skill, and motivation to farm many hectares. Of all the truths found by anthropologists in studying food, the clearest and best documented is that small- to medium-scale free farmers are the most efficient producers. This was demonstrated in a classic worldwide survey by the late Robert Netting (1993). Absentee landlords are probably the least. As an English proverb says, "The best dung for the land is the tread of the master's foot."

Land reform has a history of delivering less than it promises (Tuma 1965), but has improved the situation in some areas, from Taiwan to Honduras and Mexico. Mexico's land reforms of the 1920s and 1930s have been eroded over time, but they still allow the nation to succeed far beyond most Third World countries. Some have too much land, many have too little, but the country produces most of its own food.

Unfortunately, shortage of acreage is only part of the story. More serious is the progressive degradation of the land itself.

Water is a problem that is exploding into crisis levels with unprecedented speed (Gleick 1998). Irrigation has gone about as far as it can go. Poor drainage, poor conservation, poor management, serious pollution, and the overdraft of irreplaceable groundwater resources have already led to abandonment of much irrigated land. Global warming is already exacerbating the situation in many areas, and history shows that worse is ahead (Battisti and Naylor 2009). There has been fear that wars will be fought over water, but a very thorough study by Wendy Barnaby (2009) shows that this is not the case. So far, at least, water struggles are peacefully resolved—partly because the downstream nations are usually in no position to fight. The upstream rivals could simply cut off their water and leave them, quite literally, to die in the dust. Current cases in point are Mexico versus the United States, Iraq and Syria versus Turkey, and Egypt versus Sudan and Ethiopia; the northern end of Mexico and the entire nations of Syria, Iraq, and Egypt depend entirely on water coming from other countries.

Moreover, irrigated land is easy to urbanize and usually densely populated. From Sacramento and Fresno to Baghdad and Karachi, huge cities are rapidly expanding over the world's irrigated landscape. At current rates of urbanization, California and perhaps Mexico will have no irrigated or irrigable land in about 50 years. Iraq, Syria, Pakistan, Iran, and several other nations are in acute danger too. Even China, with its vast area of irrigation, is at major risk. I was disturbed, on my latest visit, to see how correct was Lester Brown's assessment in *Who Will Feed China*? (1995). China is copying California, building new cities, airports, freeways, factories, and parking lots indiscriminately on the best farmland. Unlike California, China had a 3,000-year tradition of avoiding such building up of farmland, when possible. But the Communists changed all. Food production is suffering accordingly. The situation continues to worsen, with few signs of relief (Abe and Nickum 2009; Tilt 2009).

Soil erosion remains another major issue worldwide (Banwart 2011). The United States has largely controlled its erosion problem, thanks to incredible efforts by the Soil Conservation Service—now the Natural Resources Conservation Service—over the last 70 years. Smil (2000), in a long and very able discussion, points out that worldwide estimates of soil erosion differ considerably because the data simply aren't there. Yet, anyone who has visited—or even flown over—densely populated parts of the world knows that erosion is often catastrophic. Simply from my own experience, I can testify that the Middle East and North Africa suffer greatly from overgrazing and consequent erosion. The Mixteca Alta of Mexico has been a horrific moonscape for years, perhaps for centuries. Much of China has gone from dense, lush, primary forest to moonscape in the last couple of generations (here and in what follows on China, I have collected my observations and many statistics from standard sources in an overview paper [Anderson 2012]). India is in deep trouble, and much of Africa is facing explosive increase in erosion (I have seen it especially in Ethiopia).

Deforestation is a related problem. Deforested slopes erode easily. Deforestation reduces rainfall, at least locally. Deforestation deprives rural residents of firewood, wild fruit, medicinal herbs, and other necessary resources. Even hedgerows and unused roadsides used to provide wild greens, small game like rabbits, and a few fruits. Now, land shortages force cultivation of every inch of land. Even the edible weeds that used to grow among the crops are gone, killed by herbicides. Again, my wife's and my experience in a large number of rural areas around the world is more than sobering. In many cases where we have been on the ground, especially China, we are aware that the situation is far worse than that described in national statistics. (Abe and Nickum [2009] include some essays showing how dishonest these statistics are for China. Nor is China unique.)

A related problem is loss of biodiversity, which is costing not only countless valuable wild species but also literally hundreds of thousands of crop varieties with unique and valuable properties—especially resistance to diseases, but also taste, medical qualities, drought resistance, and other things we need more and more seriously. We need to revalue variation and stop overvaluing goods and monocrops (Bayon and Jenkins 2010—see their horrific photo of soybeans replacing forests in Brazil).

Much of the problem here is cultural: Europeans settled the globe, and now Europeans and North Americans control world trade and the giant multinational corporations and agencies. Since the dawn of agriculture, Europe had a relatively limited crop roster. Today, wheat, maize, rice, sugar, and a few other crops dominate the world; development efforts go to them; the thousands of other important food species are disappearing. This is an increasingly dangerous and unsupportable situation. A trio of recent articles by leading authorities in *Nature* provide a superb summary of this situation and why it is so dangerous (Barnosky et al. 2012; Cardinale et al. 2012; Ehrlich et al. 2012). The crisis is less obvious than the loss of soil and water, but it is correspondingly dangerous, since it is so often overlooked.

Such damage can be reversed. In addition to the United States, my personal observation reveals that Tunisia and Turkey have made great strides in restoring their lands, through grazing control and massive reforestation. Korea has done well, and even China has many very successful examples (again, from my personal knowledge—ignoring those statistics). Such efforts, if carried out worldwide, would greatly reduce the danger of famine.

Pollution, deforestation, and other environmental problems cause similar losses. Chesapeake Bay once could produce enough fish and shellfish to give every American a decent level of animal protein. It now produces a tiny fraction of what it used to. At present rates of ruin, it will be producing nothing edible within a very few years. Similar damage threatens New Jersey's waters (McCay 1998), San Francisco Bay, most of Mexico's inshore waters, and so on around the world. We have ruined as much bay and river habitat as would provide more than enough protein for everyone on earth.

Traditional varieties disappear, losing more and more genetic diversity. Sometimes taste preserves them or even brings about a revival, as with flavorful apple varieties in the United States (Green 2002), where thousands of varieties have dropped out of use but where many are being developed or preserved. "Slow food" movements and local loyalties preserve foods in Europe (Holley 2002). But these are situations of affluence. The vast, little-seen problem is in the poor areas of the world, where modern high-yield varieties displace hundreds of thousands of little-known, little-studied, often valuable local races of crop plants and animals.

People who could formerly support themselves by farm work are now finding that overpopulation, mechanization, loss of wild plant and animal resources, water shortage, and the spread of export-oriented and monocrop agriculture are conspiring to produce a general decline in rural areas around the world. There are no more weeds or waste grains for gleaners. The mixed farming systems that used to produce small surpluses of foods are replaced by endless rows of cotton, oil palm, rubber, or other inedibles. There is no firewood to cook what food can be found. Worst of all, as noted above, there is little work—in spite of the desperate need for human labor in erosion control, reforestation, water management, and countless other areas of enterprise. The problem lies with unenlightened governments (i.e., most governments); only a few, such as Tunisia's in the late twentieth century (but not today), realize that a small investment in paying people to reforest will be repaid many times over in erosion control and water retention.

Water becomes more and more scarce and polluted day by day. Two million people—almost all of them children—die each year from waterborne or foodborne diarrhea (World Health Organization 2002).

So the best and brightest move to the cities, depriving the rural areas of leadership. In the Mediterranean and in Mexico, I have encountered countless farming communities from which the best and brightest had fled. As rural Americans sometimes said in my childhood, "Around here, anyone with any git-up-and-go has got up and gone." The lure of good wages in the "north," or the cities, or the factories is strong, and the incentives to stay down on the farm are few indeed. My father and uncles did exactly the same thing, so I can hardly be judgmental. And such migration reduces population pressure and opens the world to people of talent who might otherwise never reach their potential. But, at some point, we will have to stop the flow by allowing small farmers to profit from their work.

Adding to rural woes is massive pollution by pesticides and fossil fuels. Also, white flour, white sugar, and alcohol are replacing the lost wild greens, game animals, and dooryard garden crops of former diets. The same number of calories may be coming in, but vitamin and mineral levels have crashed.

The combination of poverty, loss of local leadership, and cheap alcohol is particularly deadly. Throughout the world—including much of the United States—regions that used to be populated by poor but stalwart, tough, and resilient farmers are now hotbeds of alcoholism. Consequences range from family violence to massive impoverishment. One can find such situations from California's Central Valley to India and Peru. I have studied the phenomenon in British Columbia and encountered it from Yucatan to Malaysia.

All this has been overlooked by many development scholars. Economists see incomes rising. They do not look at the loss of free goods such as firewood, wild herbs, water, and game. They do not look at the ultimate costs of "higher" incomes when much of the money goes to alcohol and drugs. Politicians, even the few politicians who care about the less affluent, do not see (or do not admit to seeing) the progressive anomie, substance abuse, social breakdown, and brain drain. If they do, they blame the people themselves or, perhaps, the global economy. They do not put the blame where it should be placed: on the specific patterns of resource misuse that have come to characterize modern rural life.

The combination of mechanization, fossil fuel dependence, heavy use of poisons, monocropping (often with inedible crops such as cotton or unhealthy ones like sugar), decline of rural resources, and spread of junk food is a specific syndrome, not some sort of vague or automatic "globalization." (See, e.g., Conkin 2008.) They are the result of specific development policies common to capitalist, communist, fascist, and other modern societies, not some sort of vague or automatic "capitalism" or "neoliberalism." (The latter, a vacuous term, is particularly pernicious—it sounds like a diagnosis but has been rendered meaningless through being used to cover all sorts of systems.) The same can be said for the loss of small farms and the takeover of land by giant feudal estates or agribusiness corporations, shown repeatedly to be devastating to small communities (e.g., Goldschmidt 1947; Young ca. 1900 [1792]). We are not talking about globalization in general here but about one very specific way of bringing globalization to the countryside. It is deployed by the World Bank, the International Monetary Fund, and many governments of all stripes, but not by all; again, the few that resist are sometimes capitalist, sometimes communist, sometimes neither. Focusing on vague labels instead of specific problems is a mistake.

Globalization of this sort leads to fly-by-night agricultural and fisheries developments that leave the local landscape devastated and to perverse trade that creates or caters too much to perverse wants and creates "perverse subsidies." (See Myers 1998; case studies in point include Baer 1998, Eichenwald 2000, Mintz 1985, Roseberry 1996, Sheridan 1995, and Stonich 1993.)

The United States can serve as a case study because it is well studied and statistics are available. The average American farm gets more than $36,000 in subsidies (Simon 2002). The farm bill of 2008 provided over $89 billion in direct subsidies—payouts—as well as over $40 billion in crop insurance and a few billion in other direct funds (Imhoff 2012:26). Little of that goes to the small-farm majority; most of it goes to the giant agribusiness corporations. Only the bulk commodities are subsidized by direct payments of various kinds, with 41% going to maize, 26% to cotton, and the rest to wheat, soybeans, sugar, and a few others; fruits, vegetables, nuts, and other crops are not subsidized directly. Subsidies to the major grains and soybeans are indirect subsidies to meat production, since, for example, well over 90% of American maize was fed to animals until biofuel started to absorb over a third of it, and the soybeans go almost entirely to animals (Imhoff 2012). "The richest 10% of farm subsidy recipients take in almost three-quarters of payments." (Imhoff 2012:79).

Indirect subsidies benefit small farmers more. Research, education, rural roads, rural electrification, weather bulletins and drought monitoring, and dozens of other programs help rural residents. Yet research is disproportionately concentrated on the major commodities and on chemical-intensive large-scale agriculture. The giant agribusiness and chemical firms carry out much of their own research but also lobby the government to target its taxpayer-supported research toward big-farm questions. Even roads can be unfairly managed. I have seen more than one well-built county or state road leading to *one* ranch.

There are 2.2 million farms in the United States, but most are hobby or retirement farms that make very little; the 84% of American farms that earn under $100,000 per year *lose* money on farming; those families are actually making their money in other ways and running the farm for the lifestyle. Only 2% of farms make over $1,000,000 a year (Imhoff 2012:80). It is these farms that get the subsidies. In 2009, 305 farmers got over $200,000 each. "In 2010, 1% of farming entities received over 20% of all direct payments" (Imhoff 2012:887). Basically, the whole American farming system has been captured by the giant agribusiness and food-processing firms and the oil and chemical companies that sell them inputs. (Oil and gas are also heavily subsidized.) The result is a system stacked not only against small farmers but against the environment and the consumers. It is also a system that uses large amounts of fossil fuel to produce too much animal feed, cotton, sugar, and meat, and far too little of anything else. It also fights change; free enterprise puts a premium on innovation, but subsidies go to established (often dinosauric) firms, paying them *not* to innovate. It also motivates waste: some 40% of American food is wasted (Hsu 2012), mostly in storage and markets, but also a good deal in restaurants that give huge portions and homes that buy more than they eat.

The system is uneconomical; it is structured by subsidies to the rich, not by the market or any other normal planning mechanism. In the farm bill debates of 2012, an amendment to spare $4.5 billion in cuts to food stamps was defeated; at the same time, also defeated was an amendment to cut $3.5 billion in subsidies to the tiny handful of huge farm firms that produce sugar in the United States (Jilani 2012). Sugar production is uneconomic in the United States, surviving purely on subsidies.

This raises another problem with subsidies: they can support downright undesirable enterprises and thus give them disproportionate political power and funds. The extreme case was the tobacco industry, heavily subsidized until the 1990s. Fattened by huge slices of taxpayers' money, the tobacco companies not only got enough power to fight regulation for decades but also acquired many food companies, putting much of America's food supply under the control of people dedicated to propagating a less than healthy product.

This subsidizes a form of agriculture often accused of being wasteful and of being indifferent or hostile to conserving either the environment or genetic diversity; hence Myers's term "perverse subsidies." The U.S. government has earmarked large sums for conservation—up to a third as much as for the subsidy payouts—but in fact the funding for conservation is always cut very substantially by Congress, while the actual direct and indirect subsidies are not (Imhoff 2012). Nor is this system unique to the United States. Almost all countries do similar things. New Zealand is an exception, having gotten rid of subsidies in 1984—after which medium-scale, productive agriculture boomed (Imhoff 2012), set free from the oppressive weight of uneconomic, wasteful production.

Landlords, later joined by agribusiness firms (the new feudal lords of the world), have been able to capture the subsidies and supports in many countries—notably including the United States (see *The Farm Fiasco* by James Bovard, 1991; Myers 1998; Pottier 1999). Virtually every study ever done finds this to be a mistake. A favorite of such producers is cotton—valuable enough in its own right, perhaps, but a huge competitor with food crops for prime land and resources and a huge polluter of the environment; a quarter to a third of all pesticides used in the world are used on cotton. Conversely, vegetables and nutritious fruits require skilled labor, and thus tend to be small-farm crops.

The result in the United States and elsewhere is an agricultural system that, among other things, makes junk food artificially very cheap. Heavy subsidization of sugar (including maize, the source of high-fructose corn syrup) and of animal and dairy production, and lack of any subsidies for fruits and vegetables, has the obvious effect on American diets. Since America exports 60% of the maize and 40% of the soybeans in world trade (Imhoff 2012:17) and other producers also subsidize such commodities, the problem has gone worldwide. It is one factor in the explosive increase in obesity and diabetes worldwide.

A major structural problem with heavy subsidies is that they lock in the currently "successful" strategy and make creative change almost impossible. Every new farming method has to go up against the political and economic power of the entrenched interests who have succeeded not because of superior farming ability but because of superior subsidy-harvesting ability. As their methods get less and less sustainable, they remain in power by winning more and more supports. The "creative destruction" of the free market and the value of expert opinion and authority are both shoved aside.

The problem is not "free markets" or other bugaboos of the Left, nor is it "communism" and other bugaboos of the Right. China has even more serious problems than the United States, and they are due to exactly the same thing: heavy government investment in fossil fuels, pesticides, and big infrastructure, with little adequate cost-benefit accounting (Anderson 2012). The system has gone worldwide. (Some have even said it has the worst of socialism and the worst of capitalism.) It is a very specific program, based on enormous subsidies to giant primary-production firms, primarily oil, coal, chemical, and agribusiness firms and the financial firms that back them (see Anderson 2010b; Shiva 1997). It is characterized, in agriculture, by a powerful commitment to turning world agriculture over to these firms and undercutting the small farmers who are actually far more economical and productive—as demonstrated by countless studies (Anderson 2010b; Imhoff 2012; Netting 1993), including the World Bank's own. It creates a good deal of immediate agricultural growth (and other economic growth), but at such enormous cost to society and the environment that any actual cost-benefit analysis is devastating to it. Such cost-benefit accounting would have to take into account pollution, displacement of populations by big dams and big agricultural projects, social anomie and substance abuse caused by rural decline, loss of nature's services, including formerly free goods such as herbal medicines and wild foods, loss of topsoil, loss of fossil groundwater, and corruption of political systems by corporate bribery.

The world has not yet run short of most resources, but it has reached a point where hard choices must be faced. Biofuels versus food is the clearest case. By the early 2000s, observers were predicting a world in which rich people's SUV's would compete with poor people's children. That world has arrived. Food prices soar and maize availability drops because maize is diverted to fuel production (Imhoff 2012:130–138). After devastating Mexican maize farming by dumping cheap maize on the Mexican market, the United States made maize expensive again with its biofuel policies—leaving Mexico's consumer economy devastated, too (Imhoff 2012, but here my own and my students' research supplements him). The drought of 2012 reduced the American corn crop by about 50%, sending prices to high levels and reducing the world's food stocks, but much of the corn still went into the vehicles of the well-to-do (White 2012).

There are many other conflicts. Pesticides (especially neonicotinoids) and disease are wiping out bees necessary to production of many crops (ranging from almonds to alfalfa). Urban sprawl is consuming the world's best farmland.; 1.6 million acres *per year* acre lost to farming in the United States through urbanization (Imhoff 2012). The situation is much worse in other countries, notably China. Recreation and lawns vie for water with irrigation. Oil production trumps all else, wiping out fish in the Gulf of Mexico, forests and lakes in Alberta, and rainforest in Ecuador, as well as farm and grazing acreage in the United States. This raises issues of social justice (Anderson 2010b), irresponsibility, and even structural violence.

Urban regions of the world are not without comparable problems. The vast slums of the rapidly growing cities of the Third World need no comment. Mexico City and Tijuana are bad; Lima and Addis Ababa are worse. In the United States, hunger in inner cities is common, especially among the very young and the very old. Only western Europe has largely eliminated genuine want, but even there one sees many a pinched face and thin frame, especially among migrant workers.

Poverty and want are not equally shared within households. In most areas, women and children suffer disproportionately; the man of the house gets the best—he is supposedly the "breadwinner." There are ways around this. (Messer [1997] gives a comprehensive review of problems and solutions.) The future—the child-bearing potential of women and even the children already born—is sacrificed to supposed needs of the present.

Science and education lag far behind need. As always, the poor nations suffer the worst. Higher education is now usual in Europe, North America, and East Asia but as rare as ever in the poor countries (Serageldin 2002). The scientific-research establishment in the needy parts of the world is not only minute, it is shrinking fast because of brain drain, local wars, corruption, and the rest of the catalogue of problems. Moreover, science everywhere devotes little energy to the world food problem. The Egyptian scientist Ismail Serageldin challenges "scientists to work for the benefit of the entire human family. . . . So let us start. If not us, who? If not now, when?" (Serageldin 2002:58).

Fixing It?

The technical questions of providing more food are very well covered by Smil, Evans, and others.[1] Briefly, further crop breeding, genetic modification, and use of minor and neglected crops, coupled with conservation and sustainable use of fish and wild resources, will be necessary. The resistance to genetic modification seems due mostly to the intransigence of companies—especially Monsanto—in regard to testing and regulating the products. Surely this will be resolved; we will need genetically modified crops in the future.

Questions of cultural change—preferences, education, urban foodways, lifestyles—have also been widely and wisely addressed, notably by Michael Pollan (e.g., Pollan 2005), Gary Nabhan (2004, 2008a, 2008b), and a host of popular writers. The great restauranteur Alice Waters has been active in trying to get food into grade school gardens (Waters 2008). These writers are largely speaking to a relatively affluent, educated, urban readership and have been criticized (perhaps unfairly) for not offering much to the world poor. (Thorough consideration of this and related issues are found in Alkon and Agyeman [2011].) Being more involved in the "global south," I will deal here largely with issues of world agriculture.

Worldwide demand structures are part of the story. On the whole, the world market demands far too much palm oil, meat and fish, alcohol and other drugs, and wood. There is, to balance this, far too little interest in vegetables, fruits, herbs, spices—high-quality food in general. Labor-intensive, skill-intensive mixed farming used to be the rule almost everywhere. Now it is almost extinct in most of the world.

The cold-blooded strategy of saving the best for the rich, and letting the rest die, is ruled out by common morality. There is, also, the necessary strategic (and ethical) linking of human-rights concerns and environmental concerns. We cannot afford "social Darwinism" (which—incidentally—has nothing to do with Darwin), national triage, and the like. Not only is it immoral, we rely too much on each other in this modern world as well. Globalization enforces responsibility. Neglect of the Third World comes back to haunt the affluent, as diseases, terrorism, drugs, and corruption spread across national borders (Kearney 1996).

Certain environmentalist attacks on "consumption," "greed," "development," and the like must be seen in this light. We can cut luxury consumption by the fortunate 10%, but that would not buy us much. For one thing, their luxury consumption is, increasingly, of services and electronic information, not of material goods. More important, though, is that so much of the ecological damage in the world is caused by production of staple goods for ordinary people. More rice is grown than truffles. We do produce too much meat, worldwide, but by shifting to open range and using feedstocks inedible to humans, we would slightly increase the cost of meat but not necessarily decrease the supply. More important is the fact that the problem is not how much is produced but how it is produced and distributed.

There are still economic development experts—not agricultural experts—who say that we "must" extend modern industrial agriculture to Africa and other tropical regions because it is the system that "works." In fact, it is uneconomic and wasteful, and "works" only because unprotesting taxpayers keep pouring trillions of dollars of subsidies into it. It has enough trouble even in the world-class soils of the U.S. corn belt and the European plains; applied to Africa's uncompromising soils and climate, it would not be economic. Common in Africa and Brazil is a kind of soil mining: modern agriculture is introduced, does well as long as natural fertility and local biodiversity flourishes, and then declines in productivity as fertility declines while pests, salts in the soil, and climate problems build up. Adding more and more fertilizer is not a hope for the long term; nitrogen is expensive, while phosphorus and potassium are getting frighteningly close to limits as the easily exploited stocks are reaching peak production (Grantham 2012). Such agriculture would also displace the local people, who would leave successful farming careers to find unemployment in the slums.

We need small farms for reviving rural communities. However we cannot go back to the good old days of the preindustrial family farm, the traditional community, and the romantically idealized self-sufficient lifestyle. Those times may or may not have been good, but they most certainly were less than perfect. Quite apart from the appalling toll of disease, people suffered great pollution for small benefits. Horse manure was not obviously better than car exhaust is today, and oats for horse feed took up much farmland (about 17% a century ago; Imhoff 2012) that can now be used for human food. Children starved because the horses took the crops. Yet horses did not provide any of the speed and convenience of modern transportation methods. Pollution of water by untreated sewage was not obviously preferable to modern chemical pollution. Deforestation, animal extinctions, and general waste of the land were already serious in the Roman empire and catastrophic in the "good old days" of the nineteenth century.

The real trouble, though, is that old-time farming was even more inefficient than the modern kind. Unproductive agriculture meant that vast areas of land were needed to achieve the same total production that we now get on tiny plots. Wheat grown with the best modern technology yields more than twenty times as much per acre as it did in ordinary fields in the nineteenth century—and does *not* need much pesticide or chemical fertilizer to do it. (Pesticides are used far beyond any real need in most of the world. In Mexico, farmers regularly use ten times the recommended amounts, which are already set very high.) Similarly, fuel use was incredibly wasteful. Most of the world depended on firewood till recently. Far too much of it still does. Elsewhere, inefficiently burned coal created more fly ash and sulfurous gases than heat.

Modern technology has its problems—lots of them—but, at its best, it allows us to use land, fuel, and other resources efficiently. Automobiles are an improvement on horses, and modern automobiles require far less energy than they did in the gas-guzzling 1950s. Computers use little in the way of raw materials and can save vast amounts by allowing more efficient, precise use of other resources. Modern hi-tech processes use fuel so much more efficiently that the Los Angeles Basin today, with over 10 million people, produces much less smog than Los Angeles did 50 years ago.

Fortunately, the values of small-scale mixed farming are not tied to the horse, low-yield crop varieties, or the dismal isolation of old-time farms. Modern small mixed farms can take full advantage of a large range of organic and less-than-totally-organic options to produce food as intensively as large farms, without the waste, pollution, social pathology, and loss of diversity (social as well as biological). Farmers and philosophers, sometimes united in the same individual, have shown the way, and we need to follow it (T. Berry 1988, 1999; W. Berry 1982, 1996; Reed 2010).

But "organic" farming has its own problems. Average organic yields are still lower than conventional yields, though this can be largely fixed by very careful farming (Seufert et al. 2012). Oilseeds, fruits, and vegetables are especially close to equality in this regard. Low costs of oil, and thus of oil fuels and oil-based pesticides, have contributed to conventional farming being cheaper than organic, but this is changing as oil prices rise. There has also been failure to guarantee that "organic" farming really is organic, and there have been problems getting cheap organic food to ordinary people (Guthman 2001, 2004, 2011).

Another option is eating locally. The "locavore" movement has advocated eating foods from one's own immediate area. This reduces transportation costs and helps local farmers. However, it is feasible only if one lives in an area of extensive and diversified agriculture. It is hardly practical for most of the world. Coffee addicts like me, for instance, cannot live as locavores, unless we move to tropical mountains. As usual, a highly polarized debate has arisen, with the food industry lashing back to deify industrial agriculture and demonize locavores (e.g. Desrochers and Shimizu 2012). A middle position is the sensible one.

Thus, with apologies to my radical and back-to-the-land friends, we simply cannot solve the problems by going back to old-style farming and old-style local eating. The world is too heavily populated and too interlinked. The lavish resources of land, forest, water, and natural pest controls that supported the old system are gone. Large-scale industrial agriculture is a dead end, but romantic retreat is no solution.

Effort must still be focused on increasing food supply. World population continues to grow, and world crop land is shrinking. More productivity per acre must be the goal. The staple grains are already about as productive as they can get. Efforts must focus on minor crops that could extend cultivation or intensify it in areas less than optimal for staple grains. Tree crops (Smith 1950), legumes, and dry-land crops are particularly in need of research and development.

We could make a much larger difference much faster by focusing on an area almost always neglected: waste of food (Smil 2000). Much of the food in the United States is thrown away; estimates run anywhere from 20% on up. We lose as much again during transportation and storage.

Storage losses in the Third World are far more serious. Inadequate storage facilities are the rule in India, Africa, and much of Latin America. Perhaps as much as a quarter of all the grain in the Third World goes to rats, insects, and rot. Estimates in some countries run as high as 50%. Smil provides an excellent discussion of the whole matter but gives very conservative estimates for worldwide waste. In my experience, storage losses, fish thrown away by fishermen, crop losses to pests, and so on, are much higher than Smil's figures. In the Malaysian fishery I studied, for instance, 90% of the catch was converted into fertilizer rather than being used directly for human food. Even by the most conservative estimates, we lose and waste enough food to give all the hungry people on earth a first-class living.

Most necessary of all for the future is comprehensive and worldwide environmental planning. First priority for feeding the world must go to stopping the enormous and explosively increasing problems of erosion, deforestation, pollution, urbanization of farmland, exhaustion of water and fossil fuel supplies, and loss of wild foods.

Much of the development of the last 50 years has been counterproductive from the point of view of food production. This is obviously true when development involves urban sprawl onto prime farmland—as it usually does. However, even development sold as agricultural improvement is often counterproductive (Ascher 1999).

Genetically engineered crops (or GMOs, genetically modified organisms) will be part of the solution, but the technology has yet to increase production massively. It is at its best in reducing chemical use; one can engineer insecticidal properties into the plants themselves, for example. This remains controversial (Antoniou et al. 2012; Stone 2002).

The foolish refusal of the corporations to allow objective tests of their products has left us ignorant of the real costs and benefits of genetically modified crops. Bullying by major firms, especially Monsanto, has led to repression of number of disturbing reports on the ecological and environmental dangers of these crops (Alkon and Agyeman 2011; Antoniou et al. 2012). The firms have also fought against any meaningful tests of the long-term safety of these foods for humans, though tens of millions of Americans are currently eating them in great quantities with identified ill effects. The major proven problems are killing of beneficial insects along with pests (probably an inevitable side effect of engineering pest control into plants) and escape of engineered genes into crops around the GMO fields.

Genetically engineered crops are one technological complex that has suffered from hyped controversy. The United States' biotechnology establishment sees these as pure good—a bonanza. The rest of the world sees them as a threat: "Frankenstein foods." Both positions are extreme (Stone 2002). Genetic engineering merely does quickly what natural or artificial selection does slowly: it changes gene systems in a particular direction. It is not a golden gift, nor is it a monstrous interference with nature. It is just a way of speeding up a natural process. But it is not without danger. It creates new organisms with unknown potential for risk. Their genes are already spreading into non-target species, with unknown effects (Ellstrand 2005). New products have to be tested, however safe they may appear.

The blanket acceptance of genetic engineering in the United States cannot last. Unleashing such things as the "terminator gene" (that would prevent plants from seeding themselves) is unthinkable; the dangers are appalling (fortunately the gene did not, in the end, get unleashed; see Stone 2002). But Europe's blanket rejection of genetically engineered foods is not defensible either. Ironically, there is a turnabout case in the continued rejection by the United States of irradiated foods, which have been accepted virtually everywhere else and proven safe by the daily experience of literally billions of people.

What has to be done is to subject genetically engineered foods to the same checks as any other new product. They should run the gamut of tests that we routinely give to any new food or plant product. The biological and biotechnological establishment has generally taken the side of unsupervised, untested introduction of new foods. What has happened in the United States is that the foods are not tested at all because of a legal loophole: they are traditional foods—however changed. So they are not tested.

The European Food Safety Authority has found no believable case against GMOs, dismissing recent claims of carcinogenesis in rats (Kupferschmidt 2012); this body is notably cautious, not taking on faith the many recent claims of health benefits from cranberries or chocolate, for instance. More testing is simply necessary.

Traditional development of minor and obscure crops, and of wild food sources that could be domesticated, will prove more and more valuable. These little-known crops and methods of traditional food production and consumption provide great hope.

The National Research Council has released several books on "lost crops," notably *Lost Crops of the Incas* (1989) and *Lost Crops of Africa* (1996). These are the tip of a very large iceberg. Every issue of the journal *Economic Botany* introduces us to crops that could be developed. Many of these grow in areas that now produce nothing edible or, worse, areas that produce staple foods unsustainably. Worked-out lands could be reclaimed by the planting of locally appropriate, usually traditional, crops or by the use of local animals.

Conversely, there is no hope for schemes to convert tropical forests and other valuable habitats into low-value monocrop agriculture such as cattle pastures, sugar plantations, or oil and rubber estates. We know that these are disasters from every point of view. They should be absolutely and permanently stopped. If valuable habitats must be sacrificed, they should be replaced only by intensive, high-yield, diversified farming!

One could wish for a worldwide tax system that would redirect some money from rich individuals and nations to poor ones. This is not going to happen in the foreseeable future. Worldwide opportunities for education would be more effective and are a more realistic hope. World poverty might also be alleviated by developing ways for the poor to live better without much more money. Development efforts will have to create economic opportunities. This means more than simple expansion of economic activity. Much recent economic growth has provided opportunities only for skilled workers in affluent parts of the world.

Opportunities for the poorest, in both rich and poor countries, are provided largely by local microenterprise and small-business development. The Grameen Bank and its imitators provide loans as small as one dollar to local grass-roots entrepreneurs. I have seen the success of the Grameen and other programs in Bangladesh; these are really impressive programs. They work. But they are not yet big enough to do everything, and they have not traveled well; attempts to replicate Bangladesh success in other countries have been sadly less than successful (Ellerman [2005], and personal communication). Thus we need other development also, and even the loathsome sweatshops of First World multinationals have a part to play—hopefully for a very short while.

One point usually missed by developers, in my experience, is the need to keep up "value-added bootstrapping." Whether one is talking of a project, an industry, or a nation, the goal should be to keep adding value to products and thus increase the profitability of an enterprise. Sweatshops should be replaced as soon as possible with more profitable enterprises. This requires training the workforce (including the managers!) in more and more skilled, specialized operations.

In food production, the goal should be to replace bulk commodities with specialized, high-profit ones. In the Yucatan Peninsula, the Mexican government introduced large-scale citrus culture but could think of nothing better to do with the fruit than to make concentrated orange juice—a bottom-end product and a drug on the market. The Maya quickly found that the profits were in selling high-quality fresh fruit in the cities, especially the new resorts such as Cancun. A single orange in Cancun brought as much as a crate of them sold to a juicer. Then the Maya learned that *fresh* juice sold on the street for many times the price that bulk juicing for concentrate would bring. Fresh orange juice, at a good, healthy price, is now a major income source in the Yucatan Peninsula. (Tragically, the problem of monoculture eventually surfaced: rapidly spreading disease. The citrus industry is rapidly disappearing now.) In other parts of Mexico, fresh fruit is exported to the United States, where it brings even more. Specialty fruit products could increase the profit margin even beyond that.

Something similar has happened with coffee. The government of Mexico, until recently, focused on bulk production of ordinary-quality coffee, thus trying to compete with Brazil, a hopeless task. Other

Central American countries have gone for quality rather than quantity and made a fortune doing it. Local Mexican planters—old Oaxaca families and new Maya Indian entrepreneurs in Chiapas—have bucked the trend, producing shade-grown and organic coffees of superior quality.

If the Mexican government would assist local entrepreneurs in developing such ideas, instead of focusing on bulk production of low-quality, non-competitive products, rural poverty could be eliminated in Mexico. It will not be easy. (As I write, falling coffee prices have played hob with Mexico's attempts to cure its coffee problems.) But it can happen. There is a serious need for the rich nations to support this by buying only shade-grown coffee, but, in a very unfortunate example, Starbuck's discontinued its Mexican shade-grown coffee line, apparently because of supply and quality problems. If there is one place where "virtuous eating" truly matters, it is in the coffee trade (see, e.g., Anderson 2003).

As agricultural economist Pedro Sanchez says: "Policies should shift from prioritizing food aid to providing poor farmers with access to training, markets and to farm inputs such as fertilizer and improved seed. In addition to being cheaper, such investments allow farmers to grow food to feed themselves, to sell the surplus and to diversify"; such aid raised maize yields in Malawi by almost 300% in 2 years (Sanchez 2009:148). Peter Rosset (2011) reports that speculators and biofuel production have run food prices and agricultural input prices up, causing general rural hardship; poor farmers have to buy food and inputs too.

Ecology constrains our choices. Tropical coasts will never have Greenland's seal-hunting opportunities. However, plant breeding and selective trade can do wonders. A culturally conservative group, far from home, can often manage to retain a staple food that is not ecologically optimal. With enough time and plant-breeding expertise, they can make it optimal far beyond its previous scope of habitats. Wheat was originally limited to Mediterranean-steppe hill country with warm, moist winters and rainless summers. It now grows from central Canada to southern Mexico and from north China to the Asian tropics. Adapting the wheat plant to the blizzard-swept high plains of North America was an almost impossible task, heroically carried out, yet that region is now the world's wheat basket. Even more difficult was the development of wheats adapted to Mexico's and China's dry summer-rain zones, yet these, too, are major sources today.

Several good ideas could add to revolutionizing small farming. Among these are a revival of hedgerows and windbreaks, largely abandoned now because of mechanical cultivation. They remain valuable. The wildlife benefits, protective functions, and diversity-maintaining values of hedges are so well known that it is really incredible that they continue to vanish. Multicropping and diversity-maintaining farming, composting, small-field systems, low-tillage agriculture, and soil erosion controls such as terracing are all necessary.

Integrated pest management is an approach that uses pesticides only as a last resort and relies preferentially on cropping methods and natural predators to control pests. This not only prevents pollution, it gives—in the long run—far better control than heavy pesticide use.

With techniques like these, we could grow a great deal more food much more cheaply—though at least initially it would require more labor and skill and thus require an appreciable initial cost.

All this can supplement the non-traditional concerns with more efficient machinery, more efficient and low-polluting fuel use, and other aspects of sustainable and efficiency-promoting development. This whole matter has been thoroughly covered in Daly and Cobb (1994) and other standard sources and need not be pursued.

A necessary part of this—as every field-worker in development knows but as almost no one else seems to know—is rural health care. We simply cannot feed the world, or maintain a rural workforce, if we leave rural areas to the ravages of ill health.

Part of this agenda goes beyond agriculture itself. Rural areas everywhere (except perhaps in northwest Europe) are underserved by social services. Education, in particular, is desperately needed in rural areas. This is as true in the United States as in the Third World countries I know. Americans are strikingly ignorant of where their food comes from, how it is produced, and what is in it. A number of initiatives to fix this are in play but are outside the scope of the present book (see my website, www.krazykioti.com, for details).

To be of any real value, the education must involve serious attention to food production and consumption and to the environment. This is as true in cities as in the country—perhaps even more true. Yet, education is all too often directed toward rote memorization of facts irrelevant to ordinary life.[2]

If we all want the same thing, we give enormous power to those who produce it. Inevitably, they translate this power into political advantage. This is bad even at best; it leads to market distortion through special favors and subsidies, including government-financed research. At worst (and the worst is typical), they use much of that power to divide their enemies by political and social hatreds (Anderson 2010b). They thus make themselves immune to political checks and balances. A side effect is that they increase the already troublesome focus on hatred and rivalry that characterizes political systems. When the environment crashes the hatred may break out, as impoverished and desperate people seek for scapegoats to blame and for weaker people to rip off.

By contrast, a varied and diverse ecological system, and a political system where everyone has some recourse against special interests, is protected against both economic ruin and political violence. Genuine democracies are singularly free of famines, wars, and governmental massacres (see, e.g., Rummel 1998; Sen 1992).

On the whole, this means moving toward free markets, but not toward the giant, highly subsidized corporate world miscalled "the free market" today. A totally free market cannot exist, at least not above the level of a tiny isolated village. The state—some sort of government—has to set laws and market rules, establish and protect currency, provide security, enforce contracts, provide courts for litigation in cases of uncertainty or fraud, and generally create the whole shell in which the market lives. States can and do influence "free" markets, making them produce small farms, giant agribusinesses, or reactionary landlords, as politics directs.

Markets are also distorted by people's tendencies to worry too much about losses relative to gains, to discount the future, to neglect statistics, and in general to bias their accounting. Markets remain the best hope for the future—centralized planning simply does not work. But we have to stack markets to prevent "runs" and irrational thinking as much as possible (Timmer 2012).

On the other side of the political divide, communist experiments in the twentieth century made it clear that massive communization and forced industrialization of agriculture were counterproductive (to use the mildest possible word). Many on the Left were dismissive of such problems as water supply, soil erosion, vegetation decline, and genetic erosion. Some writers seemed to think that all one had to do was end the global economy and destroy the multinational corporations.

In general, all solutions based heavily on political gimmicks fail to take into account the fact that politics is basically about relative power and status, which are inherently limited. Politics is normally a zero-sum (or negative-sum) game: if I win, you lose. Food production has to be positive-sum: we must play—ideally, by cooperating—to produce more. Trying to get politicians and would-be politicians to think this way is difficult, to put it mildly. Technicians, farmers, and ordinary citizens are better at it.

Fortunately, there are ways to cooperate and build. Writers such as Brown (1995, 1996) and Smil (2000) do say at least something about politics and institutions. More has been said by environmentalists such as David Roodman (1998) and Norman Myers (1998) and by food security experts like Johan Pottier (1999). Their frameworks allow us to use the undeniably good ideas of the above-cited schools.

All this gives very little comfort to political dogmatists, left or right. The solutions proven to work come from both left and right. Both left and right have also produced many solutions and ideas that clearly fail. One must keep an open mind and look at facts and results, not at rhetoric and political smear campaigns.

Final Word

Humans are surprising animals. When the leaders fail, ordinary people take over. As they have given us food and a safe environment in the past, so they may again. They need only the opportunity. An end to oppression and exploitation would unleash the forces that can save us all.

Food, in the last analysis, is inseparable from emotion and meaning. We cannot solve the world's food problems without taking that into account.

This is the time to remember the millions—billions—of unsung human beings who have created the foods we eat and the foodways we love. Few of them are named in history. The vast majority—the creators of bread, of lime-processed corn dough, of potatoes, of chicken soup, of noodles and dumplings and chapatis—are nameless. They have disappeared in the vast world. Nutritional anthropology's greatest value lies in its recalling to mind the accomplishments of these countless, unknown heroes and geniuses. We owe them our lives, and we do not even know their names.

> Let us now praise famous men. . . .
> There be of them, that have left a name behind them, that their praises might be reported.
> And some there be, which have no memorial; who are perished, as though they had never been; and are become as though they had never been born; and their children after them.
> But these were merciful men, whose righteousness hath not been for gotten. . . .
> Their seed shall remain for ever, and their glory shall not be blotted out.
> —Ecclus. 44:1, 8–13[3]

This page intentionally left blank

What could I tell you, my lady, of the secrets of Nature which I have discovered while cooking? . . . Lepezio Leonardo was right in saying that it is possible to philosophize and prepare dinner at the same time. And I could also add: if Aristotle had known how to cook he would have written even more than he did.

—Sor Juana Ines de la Cruz, eighteenth-century Mexico (de la Cruz 2005:274)

APPENDIX

EXPLAINING IT ALL
Nutritional Anthropology and Food Scholarship

Food Research

Research on food in culture was, until recently, a rare pastime. The only country where food was taken seriously was, of course, France. There, gourmetship and food scholarship had always flourished together. Starting in the 1920s, the Annales School of historians, a group associated with the journal *Annales: Economies, Sociétés, Civilisations,* devoted particular attention to food and its effect on history (see Forster and Ranum 1979). Classic research in the tradition includes Fernand Braudel's work on France and the Mediterranean (e.g., Braudel 1973 [1966]) and Emmanuel Le Roy Ladurie's writings on Provence (notably Le Roy Ladurie 1971). In general, the Annales historians stuck close to basics: ecology, economy, trade. These they considered to be the major determinants of foodways over the long term, a time frame that Braudel made famous as the *longue durée.* They were, however, acutely aware of the role of culture and style; how could French eaters be otherwise?

Thanks to them, and to historians more concerned with shifting styles, food history became more and more respectable, even outside of the French cultural sphere. The United States was the last to follow; food studies were still dismissed as frivolous until the 1980s. Studies of food consumption, in particular, were relegated to the academic Siberia of a "women's field." (By contrast, food production—agricultural science—was a "men's field," in fact, one of the last bastions of almost-all-male academic departments. Thus it got many times the funding of food-consumption studies.) Women's liberation probably had more effect than Annales School influence on the rise of food research.

In the 1990s and since, an explosion of superb scholarship on food has occurred, spearheaded as usual by historians (see below) but also by cookbook writers, sociologists, psychologists, and anthropologists.

Nutritional anthropology is thus, by definition, biocultural and biosocial. It cannot separate biology and genetics from cultural and social studies. In any study of actual foodways, these approaches must be combined.

Anthropologists studied food from the beginning of the discipline. Lewis Henry Morgan (widely called the "father of anthropology" in the United States) built his theories of culture on "modes of livelihood"—subsistence technologies, such as fishing, hunting, herding, and farming (Morgan 1877). Influenced by Morgan, Frank Cushing carried out the first extensive fieldwork in anthropology, inventing the methodology later known as "participant observation." Cushing lived with the Zuni of New Mexico for 4 years, learning, among other things, everything about their foodways. His still unexcelled account of Zuni foods was published in 1920, but the research was done in the 1870s. The great anthropologist Franz Boas assembled and published George Hunt's 300-page collection of "Kwakiutl" (Kwakwaka'wakw) recipes from British Columbia (Boas 1921). Such epochal studies were often dismissed at the time as mere trivia; today we recognize them as invaluable sources of information. Both Cushing and Boas recognized that foods could not be seen in isolation. They supplied information on the social context of production and consumption, the relevant religious beliefs, the myths, the etiquette of feasting—everything one would need to understand food production and consumption in those societies.

Following them, Bronislaw Malinowski in the first half of the twentieth century stressed the importance of biological needs (at a time when most anthropologists were concentrating on society and religion). His own studies of food were impressive enough but were largely embedded in longer ethnographic works (Malinowski 1922, 1935). His students, however, concentrated more specifically on food. Raymond and Rosemary Firth produced exemplary ethnographies (Raymond Firth 1936, 1959, 1962; Rosemary Firth 1966), but the true leader in the field was Audrey Richards.

A British lady in the grand tradition, Richards went to one of the most remote, harsh, and food-stressed parts of Africa. Here she studied villages in drought areas and in areas affected by copper mines that drew off adult males and left the farming to women and children. Her studies make harrowing reading, especially when one realizes that conditions in "Rhodesia"—now Zambia—have not greatly changed since she wrote (as my wife and I were recently able to observe). She describes children starving, women desperately seeking scattered seeds, men lying near-motionless for months on end because they did not have enough food to get up and move around. She dedicated her life to bringing economic and agricultural progress to Africa and was able to accomplish a great deal. Perhaps fortunately, she did not live to see that progress reversed by AIDS and governments. In the process, she launched nutritional anthropology and defined a focus on how social, economic, and cultural conditions affect the food situation. Her major works (Richards 1939, 1948 [1932]) remain foundational in the field.

On the American side of the Atlantic, a similar role was played by John Bennett. Bennett remains one of the least appreciated historic fathers of anthropology. During World War II, he worked with Margaret Mead and others to see how anthropology could contribute to the war effort (Committee on Food Habits 1943; it did not help appreciation of Bennett's work that it often came out under such anonymous headings as this; see Bennett 1946, 1969). He found a niche in the question of nutrition on the home front. One of the startling findings of World War I was that many, if not most, draftees were so poorly nourished that they were unfit for service. This was more true in England than in the United States, but it was bad enough everywhere (Drummond and Wilbraham 1958). It led to crash programs in nutrition and, ultimately, to studies by Bennett and others of the cultural matrix that allowed a rich country to malnourish its children (Bennett 1946). Bennett went on to develop a career of comprehensive studies of agriculture and food use.

Peace brought hopeful efforts to rebuild war-torn areas and, by extension, to develop areas that had always been poor. This brought Richards back to Africa; it also brought to Latin America such workers as Nevin and Mary Scrimshaw and their daughter Susan (who has lived an entire lifetime in nutritional and public health). The Scrimshaws introduced nutritional supplements in Guatemala (Scrimshaw 1995).

From the above researches came the concept of the food system (Goody 1982).

The "world food problem" was extremely serious during the 1950s and 1960s; more and more attention was devoted to it by governments and individuals. Anthropological studies grew apace. By the 1960s, "nutritional anthropology" was a buzzword. The Council on Nutritional Anthropology began life in 1975. I was there, a green kid, in awe of the Scrimshaws and other leaders in the field who organized the society. By 1977, a book, *Nutrition and Anthropology in Action*, edited by Thomas Fitzgerald and with preface by Audrey Richards, set the seal on the field; it was real and was oriented not only toward understanding foodways but also toward coping with malnutrition worldwide.

By 1984, Ellen Messer's comprehensive review could turn up 340 titles in a selective review of the field (Messer 1984; cf. Messer 1997). Subsequent work extends the universe of nutritional anthropology to archeology (Bray 2003; Dietler and Hayden 2001; Gosden and Hather 1999), gender issues and their relation to power and community (Counihan 1999, 2000), and many other realms (see e.g. such collections as Bringéus 2001; Dietler and Hayden 2001; Sharman 1991). Above all, anthropologists have examined the social order. Classic works in this area include Jack Goody's *Cooking, Cuisine, and Class* (1982) and Sidney Mintz's *Sweetness and Power* (1985).

Updated reviews of the field include the excellent textbook by Bryant et al. (2003) and collections of readings by Counihan and van Esterik (2007) and by Goodman et al. (2000). Among a number of huge reference books and encyclopedias, the *Encyclopedia of Food and Culture* edited by Solomon Katz (2003) and the *Routledge International Handbook of Food Studies* edited by Ken Albala (2012) are outstanding.

Nutritional anthropology is founded on the premise—going back to Cushing and Boas—that one cannot understand foodways, and thus cannot really succeed in feeding the hungry, unless one understands the full range of meanings that become attached to food in traditional and modern cultures.

Even though such matters are cultural, they have biological roots that cannot be ignored. Human food sharing, for instance, has its primate analogues (see, e.g., de Waal 1996; Strier 1999) and its own evolutionary history (Barkow et al. 1992; Cronk 1999; Etkin 2009; Ridley 1996).

Nutritional anthropology fuses at its margins with other areas of food research, including sociology of food (Mennell et al. 1992; Murcott 1984), history of food (Albala 2002; Braudel 1973 [1966]; Flandrin and Montanari 1999; Redon et al. 1991; Toussaint-Samat 1992 [1987]), agricultural and plant science studies (Salaman 1985), food science (McGee 1984, 2004), and much else. There is a large and active field of food psychology (Capaldi 1996; Conner and Armitage 2002; Logue 1986; Lyman 1989), which has found, for instance, that most or all mammals avoid food that has made them vomit, even if only once. Humans display this trait. (I still cannot even bear the sight of a certain type of hard candy. My parents bought, and hid a whole pound of it, just before my fifth Christmas. You can guess the rest. . . .) Mammals even avoid foods first tried at a time when they were nauseated for other reasons. Even historians of science (Laudan 1998) and philosophers (Curtin and Heldke 1992) have deigned to sully their usually pure hands with such lowly, earthy matters.

Many books now monograph national cuisines; the most comprehensive to date is Higman's *Jamaican Food* (2008).

Even cookbook writing lies close to food anthropology. The better ethnic cookbooks are true ethnographies, describing the social and historical causes of foodways as well as giving recipes. An early exemplar of this breed was George Lang's (1971) *Cuisine of Hungary*; the tradition continues with works like Scharfenberg's (1989) *Cuisines of Germany.* Sometimes, as in the cases of Clifford Wright's (1999) *A Mediterranean Feast* or Diana Kennedy's books on Mexican food (e.g., Kennedy 1998), we have a serious historical work that has some recipes in it, rather than a "cookbook." Sometimes one is clearly dealing with the latter case. Medievalists in particular have been busy in recent years taking cookbooks and food writing very seriously, indeed, as a major source of insight into medieval society. For instance, Dembínska's (1999) *Food and Drink in Medieval Poland* is a formal piece of historical research that includes carefully reconstructed recipes. Appropriately, it was published by a scholarly press rather than by a cookbook publisher. Mary Ella Milham's recent translation of Platina's classic Italian Renaissance cookbook *De Honeste Voluptate* (Milham 1998) is also solidly in the "scholarly" camp. So is Paul Buell, E. N. Anderson, and Charles Perry's (2010) edition of the medieval Mongol/Chinese cookbook *Yinshan Zhengyao* and Maxime Rodinson, A. J. Arberry, and Charles Perry's (2001) collection of medieval Arabic foodlore. The Society for Creative Anachronism, not usually noted for its ivory-tower bookishness, has been a leader in developing serious scholarship on medieval foodways. Food is no longer a trivial matter.

What sets nutritional anthropology off from these disciplines is, above all, our focus on explaining foodways in terms of root causes—especially the biocultural matrix. For a historian of Spanish food, it may be enough to show that potatoes entered Spain from Peru and Chile and spread slowly as they became locally adapted and accepted. For anthropologists (and "virtual" anthropologists like Salaman [1985]), it is necessary to explain why potatoes spread at all: why they are nutritionally and agriculturally advantageous. Only this can explain their unique level of acceptance in Spain, where they have been far more successful than any other New World crop.

Anthropologists are, however, not always unique in this. Where we are really unique is in our focus on cross-cultural comparison. Rare is the food historian who is an expert on two non-neighboring societies, but anthropologists are expected to be experts on the whole world.

Obviously, this means that anthropologists often have less knowledge of most (or all!) of the societies they talk about than historians do. Similarly, we usually know less about the biological side of eating than do the professional nutritionists. But since our task is general explanation rather than specific detail, we are usually content to make the trade-off. Different goals lead to different strategies.

Anthropologists often specialize in the study of small, isolated, highly traditional societies—Australian aborigines, Bangladeshi villagers, Maya farmers, Chinese fisherfolk. This is an area of research that has been left to us. It is *not* true that anthropologists study primarily such groups; the majority of anthropological research is done in modern industrial societies. What is true is that few people other than anthropologists acknowledge the existence and importance of the small, tradition-oriented groups that still survive in this contemporary world.

It is often difficult to figure out the home discipline of a writer of articles for, say, the food journal *Petits Propos Culinaires.* Anthropologists, historians of science or of culture, sociologists, cookbook writers, medical nutritionists, agriculturalists, and ordinary food lovers cheerfully share their knowledge, and one usually has to look at the author's work address if one cares to know what is the author's home discipline. Typical edited volumes today have titles such as *Food: Multidisciplinary Perspectives* (Harriss-White and Hoffenberg 1994) and *Food and the Status Quest: An Interdisciplinary Perspective* (Wiessner and Schiefenhövel 1996). In these books, anthropologists, sociologists, historians, biologists, and others all find a place.

Methodology

The reader will perhaps find it interesting to see how anthropologists do research on these matters.

Assessing the nutritional status of a community is a specialized and rather difficult art (see Dufour and Teufel 1995; Jelliffe 1966; Jerome et al. 1980; Shils et al. 1999). Food composition can be roughly estimated from food composition tables (e.g., Pennington and Spurgen 2009), but chemical analysis is needed for serious research.

The main method used in anthropological research is *participant observation.* (On methods, Christine Wilson's works are still standard; see Wilson [1974, 1976]. On anthropological methods in general, the bible is H. Russell Bernard's [2006] *Research Methods in Anthropology*, which is a must-have for all anthropologists and ethnographers.) This involves living with people and doing, more or less, what they do. We are lucky, studying food; in most cases, we can cook and eat with our informants. True participant observation is normally impossible in studies of sexual behavior and by definition is impossible in studies of people's inner spiritual lives. But it is the way to find out about food. Without living for months in Chinese households, cooking as they did, I would not have understood Chinese fuel economy, water economy, or patterns of moving around—things that Chinese homemakers cannot easily talk about because so much of the behavior is "overlearned" to the point of being done quite unconsciously or preattentively. There is no substitute for participant observation, and it must be done for a long time.

With it go several standard techniques. The *24-hour recall* is perhaps the most widely used. This involves simply asking people what they have eaten in the last 24 hours. After they tell all they can remember, one may prompt a bit. One-week or 2-week recalls may be used for finding out about shopping, bulk purchases, and the like. Recalls are less than ideal. First, people forget minor snacks and drinks. An extreme case is Anne Fleuret's finding in Tanzania (Fleuret, personal communication ca. 1978) that—judging from their 24-hour recalls—her informants had all starved to death years ago. Since they were alive and talking to her, she naturally doubted their 24-hour recalls. Following them around, she found they were continually nibbling on leaves and berries as they worked and walked to and from fields. They got critical calories and *most* of their vitamins this way. When they went to the city, they naturally failed to eat all these trivial little things and consequently were in extreme danger of death from malnutrition.

Second, people are not always fully honest. Alcohol sales figures in the United States are several times as high as the alcohol consumption reported by people answering questionnaires. One study found that their interview data agreed with local stores' sales figures for meat, milk, vegetables, and so on, but when it came to alcohol the sales were five times the reported consumption! I suspect that this was not just lying. Ninety percent of the alcohol drunk in the United States is drunk by 10% of the drinkers, and I fear that these were in no shape to fill out a questionnaire or answer an interview!

Some of my students, working with a religious sect that has very strict food laws, happened to notice that the food cabinets of their informants were stocked with many cans and boxes (some open and obviously recently used) that contained forbidden items—items that the informants did not mention in their recalls and interviews!

In this modern world of dieting, people can be unrealistic about their calorie consumption. This is more true of women than men (Poehlman and Horton 1999:100).

Following people around is standard. Christine Wilson resorted to "child following" in Malaysia (Wilson 1974) because children could not recall all the snacks they had at various houses they visited during the day. The best people to do "child following" are, of course, children.

Grown-up following is also useful, but behavior of the research subjects is bound to be affected. I have talked to fledgling anthropologists who were amazed at the care and health consciousness of American shoppers they studied. I asked, "Don't you think it might have made a difference in their behavior that they were being watched and taped by a couple of university experts?"

Interviews in anthropology may be structured—written out in detail beforehand—or open-ended and unstructured. The interviewer must know what she wants to find out and ask it in the most culturally appropriate way.

In calculating nutrition, one can weigh the food people eat and then look up in a table how much food value it has. A pound of potatoes has so many calories, so much vitamin C, and so forth. This method is broadly adequate, but in many situations it has problems. The people may be growing a special variety that is quite different from the samples used in preparing the tables. Guatemalan peasants, for example, who appeared to be getting far too little lysine, were actually growing a local high-lysine corn variety. Instead of needing better lysine nutrition themselves, they improved lysine nutrition worldwide, for the gene was bred into other maize varieties. Local varieties of greens and berries often run higher in vitamins than commercial varieties. Salmon at the rivermouth are much fatter than salmon at the headwaters; they use all their stored fat to swim up the stream. Therefore, the specialist will always collect extensive samples, freeze them immediately, and rush them to a lab for analysis. (Vitamin C and other nutrients disappear quickly, hence the care.) The ordinary anthropologist will find this difficult to arrange and impractical and will fall back on the food tables most of the time. But beware: when studying salmon fishermen way upstream, allow for that fat loss. And find a lab for local vegetables.

Specimens of unknown foodstuffs must be collected and identified (ideally, by local biologists at local universities). Photograph, tape, and videotape documentation of foods, food preparation, and eating transactions is highly desirable and frequently necessary. Building up a file of photos, for identification and teaching, should be done early.

This page intentionally left blank

NOTES

Notes to the Introduction

1. The original of this is a line by the early-nineteenth-century chef Louis Ude: "It is very remarkable, that in France, where there is but one religion, the sauces are infinitely varied, whilst in England, where the different sects are innumerable, there is, we may say, but one single sauce. Melted butter . . ." (quoted in Clifton and Spencer 1993:88).
2. The full verse is, "Ye are the salt of the earth: but if the salt have lost his savour, wherewith shall it be salted? It is thenceforth good for nothing, but to be cast out, and to be trodden under foot of men." The reference is to impure salt gathered from the ground, as opposed to sea salt. Sea salt is all soluble; "salt of the earth" includes a substantial amount of carbonates and other less soluble material. If it is stored carelessly, dew or other moisture will leach the salt out of it, leaving only the worthless residue behind. So we have a beautiful and effective metaphor, one well understood by Jesus' hearers. I wonder what biblical literalists make of this verse?
3. Thus I can spare myself from heavy-duty coverage of areas I do not know well and that are covered very well in existing textbooks (see Beardsworth and Keil 1997; Bryant et al. 2003).

Notes to Chapter 1

1. This is especially true in species like ours. We are too large to be easy prey for most predators. Moreover, we are pair-bonded and relatively egalitarian (Boehm 1999). Species like deer and elephant seals, in which the strongest or toughest male has a whole harem of females, can afford to lose many males in battles over harems. However, even among these species, the weaker males prefer to stay alive and hang around the fringes of the harem in case some female strays—as they often do. Among humans, peaceable groups can outbreed warlike ones.

   Social behavior evolves, and some closely related species differ radically in their degree of sociability. Coyotes are loners or paired and forage on small, widely distributed bits of food, while African hunting dogs are social and go for large animals. Scrub jays live in pairs and forage for widely distributed resources while the closely related pinyon jays seek out fruiting pinyon-pine groves (Marzluff and Balda 1992).
2. This is not disproved by the tendency of some humans to step out on occasion. So do other pair-bonded animals. Claims in the literature that "most" human societies are "polygamous" are irrelevant; almost always, it is only the rich that can afford more than one mate. There are a few societies where genuine polygamy is common and a few in China and Venezuela in which a given individual has many lovers rather than one mate. These are specialized, rare cases. The vast majority of humans exist in a state of monogamy—sloppy monogamy, sometimes, but monogamy. Even "swingers" and other sexually promiscuous individuals frequently marry and stay married, often in explicitly "open marriages" that are quite stable, proving that something is going on that is deeper and more complex than mere sex.

   Within a given society, men show a range of behaviors that show individual rationality recapitulating evolutionary ecology: middle-class men who need to invest a lot in their children form stable marriages, while males in disturbed or underclass situations often form transient pair-bonds and often do not care for their children. On pair-bonding issues, see the excellent, thoughtful review by David Geary (2000).

   The question is important for nutritional studies because food is normally prepared and eaten in the family group—though in New Guinea and some other areas there are societies in which men live in men's houses and women prepare food collectively. Since the overwhelming majority of human families involve a couple and their children, often with a few other kinfolk around, the context of cooking is set accordingly. The relatively few polygamous houses adjust, based on how complex they are. Single-parent households are actually much more frequent; contrary to many foolish claims in the media, they are not a new development because short life spans in earlier centuries led to depressingly large numbers of widows and widowers. Then and now, they have trouble providing and preparing food on an adequate level. My grandmother was widowed when she had six young children to feed from a small, struggling farm; she was tough enough to manage, but I cannot imagine how she did it.

3. At least not in any very meaningful sense. The final, tiny detail that "makes it language" by some highly arbitrary definition may have been added recently. The only communicative skill that all humans share, and that no other animal has been shown to share, is the ability to formulate long, complex, hierarchically nested grammatical strings of symbols, that is, the sort of thing we now call "sentences." (Many languages have structures quite unlike English sentences but are similarly complex.) Other animals—even complex communicators like mockingbirds, bowerbirds, dolphins, and chimpanzees—do not get above the level of the simple phrase. They can be far more impressive phrase makers than we usually think. They can handle complex symbols and relations thereof, as well as integration of gesture and vocal sign, and many other complexities. But they cannot nest these in more and more complex hierarchic structures that are then systematically varied, as wholes, to make "questions" or "passive constructions," or the like. See Noam Chomsky's classic work *Syntactic Structures* (1957; see also Pinker 1997), as well as Barkow et al. (1992). This appears to be part of a wider ability to nest plans (we have tactics, strategies, objectives, goals, missions, etc.); this is sometimes known as "recursion." Recursion of more than two levels is rare or absent in non-humans, but recursion five layers deep is common in humans. See, for example, David Kronenfeld (1979) and Lewis Petrinovitch (1995). The ability to create elaborately structured sentences may indeed be late, but it would have followed a long, slow evolution of more and more complex communication (Pinker 1997), both gestural and vocal.

   A related question is that of how music evolved, since many scientists still think, as did Gianbattista Vico 250 years ago (Vico 1948 [1744]; see also Mithen 2005; Wallin et al. 2000), that people sang before they talked, or at least that music and speech differentiated from a common source. From something like chanting, language differentiated to deal with more cognitive issues; music differentiated to communicate broad emotional states and moods. Music remains close to language in many key features (cf. Dissanayake 2000).

4. One of the mistakes made by Dawkins (e.g., 1976) and his ilk is assuming that natural selection has fine-tuned us for a very specific lifestyle and that everything we do is optimal from the genes' point of view. However, recall that what matters (to the gene) is being able to leave more descendants than one's competition. This means that some very poor solutions are acceptable, as long as the other solutions around are even worse. Humans have to put up with a lower back only partially re-engineered for upright stance, an appendix good only for hosting appendicitis, a lot of useless body hair, and many

other disproofs of the "argument by design." Genes not only fail to specify everything; they specify a lot of less-than-optimal end results. Mutation, recombination, and other genetic changes guarantee that this situation will never quite be resolved. Perfection does not belong to this world.

On these matters, see *The Adapted Mind* (Barkow et al. 1992). The various authors of this book point out that natural selection works on particular abilities, not on the brain as a whole. The brain as a whole did enlarge and increase its ability in all sectors. It had to; you can't run a mainframe computer off a flashlight battery and a worn-out extension cord. However, what mattered were the particular abilities that allowed us to win: route finding, talking, sharing, recognizing, calculating where the best feeding chances were, and the like. Above all, it is obvious from the work of A. Damasio and H. Damasio (see Damasio 1994) that our greatest and most important ability is integrating emotion and cognition. This permits complex social life; it is *the* social faculty.

The most recent controversy along these lines is between Eliot Sober and David Sloan Wilson on the one hand (Sober and Wilson 1999) and several critics on the other (Buss and Duntley 1999; Nunney 1998; the controversy is still ongoing at this writing, but nothing much new has been said since those sources). Sober and Wilson maintain that people are so social that they must have been selected for it by massive selection for social groups and against unsocial ones. The members of the groups have to be related for this to work (otherwise, no Darwinian selection), but most members of a typical foraging band are indeed more or less related. Buss, Nunney, and many other critics argue that individual selection is quite adequate to explain what we see. What we see is, after all, not self-sacrificing worker bees but people calculating very sharply and closely how much they are getting out of a social exchange. (Did Joe give me a present last year? How big was it? Do I have to reciprocate?) People cheerfully sacrifice their lives for others—even for strangers, and even for strangers' pets—so we are not the calculating cynics that Buss, at his worst, makes us out to be; however, kin selection within an already-social group can explain self-sacrifice. So Buss and Nunney have the best of it, so far. But the issue is far from settled. However, it has been fairly well resolved in recent works explaining how kin selection could evolve into group selection by bootstrapping; see the main text.

5. An interesting case in point: identical twins are routinely assumed to be literally "identical," and there are some stories—highly specious! (Marks 2002)—of identical twins reared apart who still have remarkable (indeed, preposterous) similarities. Yet my twin nieces differ notably. One of them got shortchanged in the womb; she was in a cramped position and got starved for nutrients. She was born small and feeble. In such situations, the human body is programmed by an impeccable genetic mechanism to play catch-up and play it fast. The small twin thus grew fast and furiously, and through

childhood she was taller, stronger, heavier, and more rapidly maturing than her sister. This fed into behavior; neither of them is a shrinking violet—they are of the healthy, soccer-playing subspecies of American girl—but the once-starved twin is definitely the assertive, athletic one of the pair, while her sister is more "traditionally feminine." They are still very, very similar, but far from identical, in spite of identical genomes. Thus do genes usually code for *development,* not traits.

6. One odd corner of human tool use concerns toothpicks. People were using them 2 million years ago (Holden 2000), and chimpanzees not only use them but give each other dental care (McGrew 2000).
7. For instance, for the Diegueno and Cahuilla, groups I know reasonably well, Kelly estimates 40% land-animal meat, 50% plant food, 10% fishing, 40% meat, and 60% plant foods, respectively (Kelly 1995). Recent research makes it clear that the ratio was more like 10% meat to 70% vegetables and 10%–20% fish for the Diegueno, 10% meat and 90% vegetable foods for the Cahuilla. These groups live largely in the desert, where game is almost non-existent. What they did get came largely from hunting in the mountains. I do not mean to blame Kelly, an excellent authority; he did the best he could with poor sources. The Cahuilla and Diegueno (properly, Kumeyaay) were not really "hunter-gatherers," since they practiced agriculture. Their agriculture supplied only a fraction of their diet, however; most of their food came from gathering. Their game resources were so poor that if they had hunted intensively they would have exterminated the game in short order. This is not an unrealistic possibility; the interior Northwest Coast peoples apparently hunted deer and elk into rarity (cf. Krech 1999). The continued existence of deer and mountain sheep in Cahuilla-Kumeyaay country proves that hunting was very light. The Kumeyaay had access to the ocean but rarely stayed there long; hence the small amount of fish. Another source of a pro-meat bias in Kelly's data is that many societies were changed by contact with the modern world. The heavy dependence on meat in the Great Plains—Kelly (1995:67) lists 90% for some societies—is a post-contact phenomenon, created by access to horses and guns. Before these came, the Plains were lightly inhabited. The few residents seem to have eaten more plant foods than they did in later times—though meat was always a staple in that land of bison.

Notes to Chapter 2

1. A calorie is the amount of heat it takes to raise 1 kilogram of water 1 degree Celsius at average sea-level air pressure. Technically, this is a "large calorie," or "Calorie" with capital C; a small calorie is the amount of heat required to raise a gram of water 1 degree Celsius. Food is thus evaluated, here, in terms of its energy value. The body "burns" food very efficiently, if slowly.

2. Sugars are short-chain carbohydrates; starches are longer; celluloses, lignins, and so forth, are even longer. Very long-chain carbohydrates, including the celluloses, lignins, and so forth, can be broken down only by certain microorganisms. Humans actually have some in their lower gut and can get up to 10% of calories from the by-products of microorganismal digestion (Milton 2000a, 2000b, 2000c), but normally humans must eat sugars, starches, proteins, and fats. Cows and other herbivores have ways of getting more from the microorganisms; the various extra "stomachs" of a cow are really microorganism farms, in which the tenants busily ferment celluloses and such into materials the cow can use. Hence cows can thrive not only on grass and hay but even on wood, while mere humans cannot even handle the grass. The flip side is that digesting cellulose—even with microorganismal help—is so demanding that it limits the cow's brain power. Humans live on a very easily digested, high-energy diet, which allows us to outperform a cow in that realm.
3. Long before Szent-György discovered vitamin C and its effects, a widely known American folk song about the horrors of Arkansas (sorry, Arkansas readers!) contained the significant lines:

    He fed me on corn dodgers, as hard as any rock;
    My teeth began to loosen and my knees began to knock.

   These are symptoms of scurvy. Within my memory, American children suffered "green apple fever" in spring—after a winter of dry foods, they were desperate for fresh ones, and would make themselves sick eating green apples and the like. Greens eaten "to clean the blood" were also popular; the symptoms of unclean blood were precisely the symptoms of scurvy. Little did my elders know that the problem was, not something in the blood, but rather something not in the blood.

Notes to Chapter 4

1. "Volatile oil" is used in two senses: to refer to specific compounds or (more typically) to refer to the complex mixes of compounds that constitute the actual distillate of the plant or other substance in question. Many volatile oils in this latter sense are mixes of two or three dozen chemicals, often similar to each other but sometimes including quite different types of molecules. There are several chemical classes of volatile oils. Volatile oils are very common in nature, but a given plant (or other substance) usually has very little volatile oil. Rarely do volatile oils constitute even 5% of leaf tissues.

   Some volatile oils with antiseptic properties include the aromatic oils of the following (Claus 1956; Tyler et al. 1981): anise, camphor, chile, cardamom, cinnamon, clove, cubeb, cumin, eucalyptus, garlic, juniper, lavender, lemon, onion, oregano, pepper, peppermint, pine, rosemary, saffron, sandalwood, thyme, and wintergreen. See the fuller discussion in Billing and Sherman's papers.

2. It was believed by many in previous eras that the *scent* of the volatile oils in question had directly therapeutic properties (Corbin 1986). These scents were used in medieval Europe to counter the effluvia that were formerly thought to cause plague (see, e.g., Nohl 1961:62–66). In later centuries, an entire science of countering stenches by beneficial scents evolved (Corbin 1986). It almost disappeared in the decades following the discoveries of Pasteur and Koch (Corbin 1986), but it did not quite die out.

   Aromatherapy, a medical tradition developed by Edward Bach, still uses scents—almost all of them spicy, herbal, and floral volatiles—to cure diseases (Tisserand 1977, 1988). Aromatherapy is generally dismissed as quackery, but this may be premature. Scents such as lavender and eucalyptus have pronounced effects on human electroencephalogram (EEG) wave patterns (Lorig and Schwartz 1988). Many people feel cheered and relaxed by experiencing many of the odors in question, especially herbal ones; thus aromatherapy for moods may turn out to have some scientific value (Ehrlichman and Bastone 1992). Lawless (1991) has provided some evaluation, noting, for example, that lavender scent has been reported to be relaxing by some researchers (Torii et al. 1988), but not by others. One study showed some contradiction between self-report and EEG action in individuals' responses to lavender (Lorig and Schwartz 1988). Recent work tends to confirm lavender's real and positive effects.

3. Humans use fragrances in communication, but only insofar as culture has "constructed" such uses. There is no close relationship or resemblance between spicy and floral smells and the chemicals that serve as pheromones in non-human primates. Evidence on human pheromones is equivocal, and research is needed (Engen 1981:139–144; Serby and Chobor 1992, esp. the article by Ehrlichman and Bastone 1992). Humans recognize individual smells, as when infants recognize their mother's body scent (Schmidt and Beauchamp 1992). See, for example, the attempt by Wright (1994) to find reliable accounts of human pheromone activity; none was forthcoming. The famous scent of truffles is a mimic of boar sexual pheromones (Maugh 1982) because truffles are distributed by pigs. The pig is attracted by the scent, and, finding no other pig, it eats the truffle (presumably to console itself). Humans have a similar-scented sex pheromone, and this very possibly explains the human fondness for truffles (Ackerman 1990; Maugh 1982). If so, pheromones do influence food tastes, in at least one (rather trivial) case.

   However, when humans wish to announce their sexual interest and/or availability, or when they simply wish to smell good, they seem to use perfumes and the like—typically floral and spice smells. This appears to be true in every culture for which such matters are documented, though research is needed.

The use of these botanicals in skin and hair care has clearly led to their being "natural symbols" (*sensu* Douglas 1970) for health, physical fitness, and/or sensuality.

4. However, some studies show that young children like the smells of feces and spices about equally well (Kneip and Young 1931), but these studies are rather inconclusive, since young children are apt to be unclear and inconsistent in responses, and the experiments are not always easy to do or interpret (see discussion in Engen 1981:esp. 130–137). It has been pointed out (Schmidt and Beauchamp 1992:387) that animals such as the skunk, and many plants as well, produce many scents specifically to repel enemies, and these smells must be widely perceived as unpleasant if they are to be effective. If Engen were correct that skunk smell is not naturally disliked (Engen 1991:44), skunks would not use it so successfully in defense against people and other potential predators.
5. This chapter began life as a paper by Silver Damsen (a graduate student) and myself. Otherwise uncredited observations above come largely from my fieldwork, including observations in many cultures around the world. I am deeply grateful for advice, assistance, and suggestions of Mary Baker, Peter Brabant, Nina Etkin, Alan Fix, Alexandra Maryanski, Daniel Moerman, Paul Rozin, and especially Paul Sherman. Remaining errors are strictly mine.

Notes to Chapter 5

1. New mothers are particularly vulnerable to certain deficiencies, as we have seen, and traditional cultures have thus found many ways to feed them. The Chinese, for instance, devote many resources to pregnant and nursing women. Women who otherwise must live on little more than rice are given chicken, pig's liver (rich in iron and B vitamins), ginger, rice wine, sesame oil, and other high-nutrient, high-protein, high-calorie foods to keep them in health and able to nurse (see Anderson 1988).
2. One reader of this work has complained about the lack of agrobiology. An adequate treatment of this subject would take a book much larger than the present one—which is about food, not crop growth. Moreover, there is a plethora of books on agrobiology and on agriculture and its invention; see the sources cited above.

Note to Chapter 6

1. The term "junk food" (now translated into various languages, e.g., *comida chatarra* in Spanish) is both vague and pejorative, though it has a certain use. Everyone seems to agree on a core of cheap candy, salty snacks, and mass-produced cheap sweets of all kinds. Most would add soft drinks. Some use the term to include reasonably nutritious items like hamburgers and pizza, largely because these are cheap and easily available in "fast food"

restaurants. I prefer to enclose the terms "junk food" and "fast food" in scare quotes. Among other things, "fast food" (cf. Schlosser 2001) seems truly wrong as a label for what it usually covers. The street stalls of Singapore and Mexico, the pizzerias and "bars" of Italy, the old-time *daipaidongs* of Hong Kong, and countless other venues around the world provide superb, nutritious, excellently cooked food that is actually "faster" than that found in certain well-known chain restaurants. In Italy in 2002 I found that restaurants sometimes advertise "slow food"—in English as well as Italian!—to lure the modern (post-Schlosserian?) tourist.

Note to Chapter 7

1. There are more than five senses. Temperature awareness, for instance, is a separate sense on its own, and the alternation of hot and cold dishes in certain cuisines caters to it. Pain is really a separate sense from touch and has its own slightly masochistic foodway in the adoration of stimulants like chile, black pepper, ginger, mustard, horseradish, and smartweed (*Polygonum* species, the Vietnamese *rau ram*). Otherwise bland Japanese food is spiked with ginger and *wasabi* (*Wasabia wasabi,* a horseradish) to give it a potent "mouthfeel."

Notes to Chapter 9

1. In this passage, the great Chinese social thinker Mengzi (Mencius, to the Western world) is in desperate straits but is turning down a compromised appointment. Bears' paws remain a Chinese delicacy—which is now a problem for endangered bear species. "Right" undertranslates *yi,* which, here, means acting with absolute honor and probity.
2. As a meat eater, I am frequently faced with the line, "If you saw animals being butchered, you would never eat meat again." In fact, thanks to my rural past in a simpler, more subsistence-oriented age, I have not only seen many animals butchered, I have butchered animals myself. Reminiscing about this to vegetarians does not always go over well.

Notes to Chapter 11

1. I know this largely from my own interviews of people from the relevant areas, but see also Hamad Ammar (1954).
2. This comes from my interviews in France; I, too, can taste the differences between French bread in 1974 (when I first visited France) and ordinary supermarket bread now; the Poilâne breads are indeed like the old-time small-bakery product. There are equivalent "artisanal" bakeries now in most affluent countries. The irony of the former peasant breads becoming expensive luxuries gets more pronounced by the year.

3. To be exact, the commonest and best recipe—I have recorded it among Finns, in Mexico, and elsewhere—is one cup of milk, three eggs, one stick of butter, six cups of flour (more or less), and aromatic seeds and/or citrus peel and dried fruit, as you choose. The Finns use cardamom, the Mexicans prefer anise; I mix both:

   Scald the milk, melting the butter in it. Cream three packets of dry yeast in that, when it cools to lukewarm. Then mix this and the eggs into the flour, adding more flour if the dough is too wet to work. Knead 25 minutes. Let rise 11/2 hours. Knock down, knead quickly, let rise half-hour or so. Knock down, knead briefly, braid, let rise till doubled in bulk. Bake at 350 degrees for about 25 minutes, till the surface just begins to brown; watch out—it burns easily. You can glaze it with egg, or a sugar glaze, or anything else you want.

   In Oaxaca they make beautiful sculptures out of the dough—birds, animals, and so on—but these usually become unrecognizable when they rise or when they are baked. To keep them looking pretty, you have to use a much stiffer dough, which results in an almost inedibly solid bread. Beauty or taste— not both!

Notes to Chapter 12

1. Significantly, *boronía* still contains fruit in the most interesting version to cross my stove. This version, found in an obscure local cookbook from Cordoba (Spain), deserves wider circulation. Here is a translation, somewhat augmented, from Morales Rodríguez and Martínez García (1999:153–154; this cookbook provides several other recipes for the dish):

   1 lb. eggplants (young, tender ones)
   1 lb. summer squash (young, tender ones)
   6 tbsp. oil (originally olive oil, but any light oil will do)
   1 lb. green or red peppers
   2 lb. tomatoes
   1 tsp. vinegar
   2 quinces
   Salt to taste
   1 white onion

   Peel and core the quinces. Cut them up into medium-sized pieces, and boil in salted water. Peel the eggplant and squash it if you wish, cut it up, and add it to the water when the quinces soften. Boil briefly, till all are soft but not mushy. Note that the eggplants are *not* first salted and drained—their slight bitterness balances the sweetness of the quince.

   Heat the oil in a frying pan. When it is hot, throw in the onion, finely chopped, and the peppers, seeded and cut in thin strips. Scald the tomatoes, peel, remove the seeds, chop, add to frying pan. Cover and simmer.

When nearly done, add the cut-up vegetables. Add some salt and the vinegar. Cover and cook briefly.

It is also possible to omit the separate boiling. Start by frying the onion, then add the eggplant and quince, then the pepper, then the squash, then the water, then the tomato, then the vinegar—this is a lazy way to do it, but produces a tolerable result.

2. The following paragraphs are *not* intended to be full coverage of Italian food in America; I am dealing only with pizza. For the Italian story, see Diner (2002).

Notes to Chapter 13

1. The United States has dealt with its well-known decline in education levels by focusing more and more on such meaningless rote memorization and drifting farther and farther from any attention to useful skills, let alone matters of serious concern such as the environment. Meanwhile, funding cutbacks guarantee that schools continue to deteriorate physically. Many are literally falling down around the children. The children, being no fools, take very seriously the contrast between schools and shopping malls. They can see where American society's priorities are. No wonder American children don't want to study.
2. Historically, the settlers of the Midwest were as badly off as the moderns; they lived on pork, corn, game, and not much else. Similarly, my Texas family, in its farming days, grew cotton and lived on store-bought flour, cornmeal, and the like, though they did keep a couple of cows for milk and grow and preserve a few vegetables; they also foraged for wild foods. Widespread gardening of vegetables and fruits was commoner in the northeast and northwest and exploded in popularity in the early twentieth century, as modern nutritional knowledge added itself to marketing options and wonderful new offerings from the nurseries. Urbanization and agribusiness progressively eliminated most vegetable and fruit farms in the late twentieth century. Even backyard vegetable gardens, common in my youth, have become rare.
3. Ecclesiasticus provides the ideal conclusion to this chapter, but, reader, please recall that "men" meant "people"—both genders—in King James's day.

This page intentionally left blank

REFERENCES

Abe, Ken-Ichi, and James E. Nickum, eds. 2009. *Good Earths: Regional and Historical Insights into China's Environment.* Kyoto: Kyoto University Press; Melbourne: Trans Pacific Press.

Achaya, K. T. 1994. *Indian Food: A Historical Companion.* Delhi: Oxford University Press.

———. 2002. *A Historical Dictionary of Indian Food.* New Delhi: Oxford University Press.

Ackerman, Diane. 1990. *A Natural History of the Senses.* New York: Random House.

Adamson, Melitta Weiss. 2002. *Regional Cuisines of Medieval Europe: A Book of Essays.* London: Routledge.

Agamben, Giorgio. 1998. *Homo Sacer: Sovereign Power and Bare Life,* translated by Daniel Heller-Roazen. Stanford, CA: Stanford University Press.

Ahn, Yong-Yeol, Sebastian Ahnert, James Bagrow, and Albert-László Barabási. 2011. "Flavor Network and the Principles of Food Pairing." *Scientific Reports* 1, no. 196. doi:10.1038srep00196.

Albala, Kenneth. 2000. "Southern Europe." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1203–1210. Cambridge: Cambridge University Press.

———. 2002. *Eating Right in the Renaissance.* Berkeley: University of California Press.

———. 2009. “The First Scientific Defense of a Vegetarian Diet.” In *Proceedings of the Oxford Symposium on Food and Cookery, 2008,* edited by Susan R. Friedland, 29–35. Blackawton, Totnes, Devon: Prospect Books.

———, ed. 2012. *The Routledge International Handbook of Food Studies*. London: Routledge.

Al-Biruni [Abū Raihān Muhammad bin Ahmad Al-Bīrūnī]. 1971 [eleventh century]. *Al-Biruni's India,* translated by Edward C. Sachau. New York: Norton. (Text originally composed in Arabic.)

———. 1973. *Al-Bīrūnī's Book on Pharmacy and Materia Medica,* edited and translated by Hakim Mohammed Said. Karachi: Hamdard National Foundation.

Alkon, Alison Hope, and Julian Agyeman, eds. 2011. *Cultivating Food Justice: Race, Class and Sustainability*. Cambridge, MA: MIT Press.

Allen, Jane E. 2002. “Snack Makers Targeting Trans Fats.” *Los Angeles Times* (September 30): S1, S5.

Allport, Susan. 2006. *The Queen of Fats: Why Omega-3s Were Removed from the Western Diet and What We Can Do to Replace Them*. Berkeley: University of California Press.

Alston, Julian M., Jason M. Beddow, and Philip G. Pardey. 2009. “Agricultural Research, Productivity, and Food Prices in the Long Run.” *Science* 325:1209–1210.

American Psychologist. 2007. Special issue: “Eating Disorders.” 62, no. 3 (April): 158–246.

Ammar, Hamed. 1954. *Growing Up in an Egyptian Village.* London: Routledge & Kegan Paul.

Ammianus Marcellinus. 1939. *History,* translated by J. C. Rolfe. Loeb Classical Library. Cambridge, MA: Harvard University Press.

Anderson, E. N. 1987. “Why Is Humoral Medicine So Popular?” *Social Science and Medicine* 25:331–337.

———. 1988. *The Food of China.* New Haven, CT: Yale University Press.

———. 1990. “Up against Famine: The Chinese Diet in the Early Twentieth Century.” *Crossroads* 1:11–24.

———. 1996. *Ecologies of the Heart.* New York: Oxford University Press.

———. 2003. “Caffeine and Culture.” In *Drugs, Labor, and Colonial Expansion,* edited by William Jankowiak and Daniel Bradburd, 159–176. Tucson: University of Arizona Press.

———. 2005. *Political Ecology of a Yucatec Maya Community*. Tucson: University of Arizona Press.

———. 2010a. “Food and Feasting in the Zona Maya of Quintana Roo.” In *Pre-Columbian Foodways: Interdisciplinary Approaches to Food, Culture, and Markets in Ancient Mesoamerica,* edited by John Staller and Michael Carrasco, 441–465. New York: Springer.

———. 2010b. *The Pursuit of Ecotopia*. Santa Barbara, CA: Praeger.

———. 2012. “Environmental Ruin: A Drag on China's Future.” Paper presented at the Annual Conference of the California Sociological Association, Riverside.

Anderson, E. N., and Barbara A. Anderson. 2012. *Warning Signs of Genocide.* Lanham, MD: Lexington Books.

Anderson, E. N., M. L. Anderson, and John Ho. 1978. "Environmental Background of Young Chinese Nasopharyngeal Cancer Patients." In *Nasopharyngeal Carcinoma: Etiology and Control,* edited by G. Dethe and Y. Ho, 231–240. Geneva: World Health Organization.

Anderson, E. N., Eugene Hunn, Deborah Pearsall, and Nancy Turner, eds. 2011. *Ethnobiology*. New York: Wiley-Blackwell.

Anderson, E. N., and Chun-hua Wang. 1987. "Changing Foodways of Chinese Immigrants in Southern California." *Annals of the Chinese Historical Society of the Pacific Northwest,* 1985–1986, 63–69.

Angyal, A. 1941. "Disgust and Related Aversions." *Journal of Abnormal and Social Psychology* 36:393–412.

Anholt, Robert R. H. 1992. "Molecular Aspects of Olfaction." In *Science of Olfaction,* edited by Michael J. Serby and Karen L. Chodor, 51–79. New York: Springer-Verlag.

Anthony, David W. 2007. *The Horse, the Wheel and Language: How Bornze-Age Riders from the Eurasian Steppes Shaped the Modern World*. Princeton, NJ: Princeton University Press.

Antoniou, Michael, Claire Robinson, and John Fagan. 2012. "GMO Myths and Truths: An Evidence-Based Study of the Claims Made for the Safety and Efficacy of Genetically Modified Crops." ver. 1.3b, June. London: Earth Open Source. http://earthopensource.org/files/pdfs/GMO_Myths_and_Truths/GMO_Myths_and_Truths_1.3b.pdf.

Apicius. 1958 [ca. sixth–seventh centuries]. *The Roman Cookery Book,* translated and edited by Barbara Flower and Elisabeth Rosenbaum. London: Peter Nevill.

Arberry, A. J. 1939. "A Baghdad Cookery-Book." *Islamic Culture* 13:22–47, 189–214.

———. 1959. *The Romance of the Ruba'iyat.* London: George Allen & Unwin.

Arens, William. 1979. *The Man-Eating Myth.* New York: Oxford University Press.

Armelagos, George J. 2000. "Take Two Beers and Call Me in 1,600 Years." *Natural History* (May): 50–53.

———. 2010. "The Omnivore's Dilemma: The Evolution of the Brain and the Determinants of Food Choice." *Journal of Anthropological Research* 66:161–186.

Ascher, William. 1999. *Why Governments Waste Natural Resources.* Baltimore, MD: Johns Hopkins University Press.

Athenaeus. 1927–1941. *The Deipnosophists,* translated by Charles Burton Gulick. 7 vols. Loeb Classical Library. Cambridge, MA: Harvard University Press.

———. 2006–2011. *The Learned Banqueters,* translated by S. Douglas Olson. 7 vols. Loeb Classical Library. Cambridge, MA: Harvard University Press.

Atran, Scott. 1990. *Cognitive Foundations of Natural History* Cambridge: Cambridge University Press.

———. 2002. *In Gods We Trust.* New York: Oxford University Press.

Avieli, Nir. 2005. "Vietnamese New Year Rice Cakes: Iconic Festive Dishes and Contested National Identity." *Ethnology* 44:167–189.

———. 2012. *Rice Talks: Food and Community in a Vietnamese Town.* Bloomington: Indiana University Press.

Axel, Richard. 1995. "The Molecular Logic of Smell." *Scientific American* 273:154–159.

Azar, Beth. 2001. "Blueberries + Exercise = Healthy Minds?" *Monitor on Psychology* (December 2001): 26–28.

Baer, Roberta. 1998. *Cooking—and Coping—among the Cacti: Diet, Nutrition, and Available Income in Northwestern Mexico.* Amsterdam: Gordon & Breach.

Bailey, Robert C., Genevieve Head, Mark Jenike, Bruce Owen, Robert Rechtkman, and Elzbieta Zechenter. 1989. "Hunting and Gathering in Tropical Rain Forest: Is It Possible?" *American Anthropologist* 91:59–82.

Bakalar, Nicholas. 2012. "Partners in Flavour." *Nature* 486, no. 7403:S4–S5.

Baker, Mary. 1995. "Medicinal Plant Use by Capuchin Monkeys (*Cebus capucinus*)." *American Journal of Primatology* 38:263–270.

Bandura, Albert. 1982. "Self-Efficacy Mechanism in Human Agency." *American Psychologist* 37:122–147.

———. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice-Hall.

Banwart, Steve. 2011. "Save Our Soils." *Nature* 474:151–152.

Barker, Graeme. 2006. *The Agricultural Revolution in Prehistory.* Oxford: Oxford University Press.

Barkow, Jeffrey, Linda Cosmides, and John Tooby, eds. 1992. *The Adapted Mind.* New York: Oxford University Press.

Barnaby, Wendy. 2009. "Do Nations Go to War over Water?" *Nature* 458:282–283.

Barndt, Deborah. 2002. *Tangled Routes: Women, Work and Globalization on the Tomato Trail*. Lanham, MD: Rowman & Littlefield.

Barnosky, Anthony D., Elizabeth A. Hadly, Jordi Bascompte, Eric L. Berlow, James H. Brown, Mikael Fortelius, Wayne M. Getz, John Harte, Alan Hastings, Pablo A. Marquet, Neo D. Martinez, Arne Mooers, Peter Roopnarine, Geerat Vermeij, John W. Williams, Rosemary Gillespie, Justin Kitzes, Charles Marshall, Nicholas Matzke, David P. Mindell, Eloy Revilla, and Adam B. Smith. 2012. "Approaching a State Shift in Earth's Biosphere." *Nature* 486:52–58.

Baro, Mamadou, and Tara F. Deubel. 2006. "Persistent Hunger: Perspectives on Vulnerability, Famine, and Food Security in Sub-Saharan Africa." *Annual Review of Anthropology* 35:521–538.

Battisti, David S., and Rosamond L. Naylor. 2009. "Historical Warnings of Future Food Insecurity with Unprecedented Seasonal Heat." *Science* 323:240–244.

Baumeister, Roy. 2005. *The Cultural Animal: Human Nature, Meaning, and Social Life*. New York: Oxford University Press.

Bayon, Ricardo, and Michael Jenkins. 2010. "The Business of Biodiversity." *Nature* 466:184–185.

BBC News Online. 2007. "How Spicy Foods Can Kill Cancers." January 9.

———. 2012b. “Obesity ‘Bad for Brain’ by Hastening Cognitive Decline.” August 21.
Beardsworth, Alan, and Teresa Keil. 1997. *Sociology on the Menu: An Invitation to the Study of Food and Society.* London: Routledge.
Beatty, Perrin H., and Allen G. Good. 2011. “Future Prospects for Cereals That Fix Nitrogen.” *Science* 333:416–417.
Bell, David, and Gill Valentine, eds. 1997. *Consuming Geographies: We Are What We Eat.* London: Routledge.
Bell, Rudolph. 1985. *Holy Anorexia.* Chicago: University of Chicago Press.
Bellwood, Peter, and Colin Renfrew, eds. 2002. *Examining the Farming/Language Dispersal Hypothesis*. Cambridge: McDonald Institute Monographs.
Benavides-Barajas, L. 1996. *Al Andalus, La Cocina y su Historia: Reinos de Taifas, Norte de Africa, Judios, Mudéjares y Moriscos.* Motril, Spain: Dulcinea.
Benedek, Thomas G. 2000. “Food as Aphrodisiacs and Anaphrodisiacs?” In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1523–1534. Cambridge: Cambridge University Press.
Bennett, John. 1946. “An Interpretation of the Scope and Implications of Social Scientific Research in Human Subsistence.” *American Anthropologist* 48:553–573.
———. 1969. *Northern Plainsmen: Adaptive Strategy and Agrarian Life.* Chicago: Aldine.
Berlin, Brent. 1992. *Ethnobiological Nomenclature*. Princeton, NJ: Princeton University Press.
Berna, Francesco, Paul Goldberg, Liora Kolska Horwitz, James Brink, Sharon Holt, Marion Barnford, and Michael Chazan. 2012. “Microstratigraphic Evidence of in Situ Fire in the Acheulian Strata of Wonderwerk Cave, Northern Cape Province, South Africa.” *Proceedings of the National Academy of Sciences* (April 2). doi:10.1073/pnas.1117620109.
Bernard, H. Russell. 2006. *Research Methods in Anthropology.* Lanham, MD: AltaMira/Rowman & Littlefield.
Berry, Thomas. 1988. *The Dream of the Earth*. San Francisco: Sierra Club Books.
———. 1999. *The Great Work: Our Way into the Future*. New York: Bell Tower.
Berry, Wendell. 1982. *The Gift of Good Land: Further Essays Cultural and Agricultural*. New York: North Point Press.
———. 1996. *The Unsettling of America*. 3rd ed. San Francisco: Sierra Club Books.
Biello, David. 2011. “The False Promise of Biofuels.” *Scientific American* (August): 59–65.
Billing, Jennifer, and Paul Sherman. 1998. “Microbial Functions of Spices: Why Some Like It Hot.” *Quarterly Review of Biology* 73:3–49.
Blackburn, Susan Tucker, and Donna Lee Loper. 1992. *Maternal, Fetal, and Neonatal Physiology: A Clinical Perspective.* Philadelphia: Saunders.
Blumenschine, Robert J., and John A. Cavallo. 1992. “Scavenging and Human Evolution.” *Scientific American* (October 1992): 90–96.
Boas, Franz. 1888. *The Central Eskimo.* 6th Annual Report, 1884–1885. Washington, DC: Bureau of American Ethnology.

———. 1921. *Ethnology of the Kwakiutl.* 35th Annual Report, 1913–1914. Washington, DC: Bureau of American Ethnology.

Bocquet-Appel, Jean-Pierre, and Stephan Naji. 2006. "Testing the Hypothesis of a Worldwide Neolithic Demographic Transition: Corroboration from American Cemeteries." *Current Anthropology* 47:341–365.

Boehm, Christopher. 1999. *Hierarchy in the Forest: The Evolution of Egalitarian Behavior.* Cambridge, MA: Harvard University Press.

———. 2012. *Moral Origins: The Evolution of Virtue, Altruism, and Shame*. New York: Basic Books.

Bohannon, John. 2010. "A Taste for Controversy." *Science* 328:1471–1473.

Bolens, Lucie. 1990. *La cuisine andalouse, un art de vivre Xie–XIIIe Siècle.* Paris: Albin Michel.

Bolton, Ralph. 1979. "Guinea Pigs, Protein and Ritual." *Ethnology* 18:229–252.

Bordo, Susan. 1997. "Anorexia Nervosa: Psychopathology as the Crystallization of Culture." In *Food and Culture: A Reader,* edited by Carole Counihan and Penny Van Esterik, 226–250. New York: Routledge.

Borlaug, Norman. 2007. "Feeding a Hungry World." Editorial. *Science* 318:359.

Boserup, Ester. 1965. *The Conditions of Agricultural Growth.* Chicago: Aldine.

Bottéro, Jean. 1995. *Textes culinaires mésopotamiens.* New York: Eisenbrauns.

Bourdieu, Pierre. 1977. *Outline of a Theory of Practice.* Cambridge: Cambridge University Press.

———. 1990 [1980]. *The Logic of Practice,* translated by Richard Nice. Stanford, CA: Stanford University Press. (Originally published in French.)

Bourke, Andrew F. G. 2011. *Principles of Social Evolution.* Oxford: Oxford University Press.

Bovard, James. 1991. *The Farm Fiasco.* San Francisco: Institute for Policy Studies.

Bowles, Samuel. 2006. "Group Competition, Reproductive Leveling, and the Evolution of Human Altruism." *Science* 314:1569–1572.

Bowles, Samuel, and Herbert Gintis. 2011. *A Cooperative Species: Human Reciprocity and Its Evolution*. Princeton, NJ: Princeton University Press.

Boyd, Robert, and Sarah Mathew. 2007. "A Narrow Road to Cooperation." *Science* 316:1858–1859.

Boyd, Robert, and Peter Richerson. 2005. *The Origin and Evolution of Cultures.* New York: Oxford University Press.

Braudel, Fernand. 1973 [1966]. *The Mediterranean and the Mediterranean World in the Age of Philip II,* translated by Sian Reynolds. New York: Harper & Row. (Originally published in French.)

Braun, David R., John W. K. Harris, Naomi E. Levin, Jack T. McCoy, Andy I. R. Herries, Marion K. Bamford, Laura C. Bishop, Brian G. Richmond, and Mzalendo Kibunjia. 2010. "Early Hominin Diet Included Diverse Terrestrial and Aquatic Animals 1.95 Ma in East Turkana, Kenya." *Proceedings of the National Academy of Sciences* 107:10002–10007.

Bray, Tamara (ed.). 2003. *The Archaeology and Politics of Food and Feasting in Early States and Empires.* New York: Kluwer Academic/Plenum Publishers.

Brears, Peter. 2008. *Cooking and Dining in Medieval England*. Totnes, Devon: Prospect Books.

Brewis, Alexandra, Amber Wutich, Ashlan Falletta-Cowden, and Isa Rodriguez-Soto. 2011. "Body Norms and Fat Stigma in Global Perspective." *Current Anthropology* 52:269–276.

Brillat-Savarin, Jean Anthelme. 1925 [1825]. *The Physiology of Taste.* London: Peter Davies. (Originally published in French.)

Bringéus, Nils-Arvid. 2001. *Man, Food and Milieu: A Swedish Approach to Food Ethnography.* East Linton, Scotland: Tuckwell.

Bromage, Timothy, and Friedemann Schrenk, eds. 1999. *African Biogeography, Climate Change, and Human Evolution.* New York: Oxford University Press.

Brown, Cecil. 1984. *Language and Living Things*. New Brunswick, NJ: Rutgers University Press.

———. 1996. "A Widespread Marking Reversal in Languages of the Southeastern United States." *Anthropological Linguistics* 38:439–460.

Brown, Eryn. 2012. "All Red Meat Is Risky, a Study Finds." *Los Angeles Times* (March 13), AA1–AA2.

Brown, Lester. 1995. *Who Will Feed China? Wake-Up Call for a Small Planet.* Washington, DC: Norton/ Worldwatch Institute.

———. 1996. *Tough Choices: Facing the Challenge of Food Scarcity.* New York: Norton.

Brown, Paula, and Donald Tuzin. 1983. *The Ethnography of Cannibalism.* Special publication.Washington, DC: Society for Psychological Anthropology.

Brown, Peter, and Melvin Konner. 1998. "An Anthropological Perspective on Obesity." In *Understanding and Applying Medical Anthropology,* edited by Peter J. Brown, 401–413. Mountain View, CA: Mayfield.

Bruch, Hinde. 1978. *The Golden Cage: The Enigma of Anorexia Nervosa.* Cambridge, MA: Harvard University Press.

Bryant, Carol A., Kathleen M. DeWalt, Anita Courtney, and Jeffrey Schwartz; 2003. *The Cultural Feast: An Introduction to Food and Society.* 2nd ed. Belmont, CA: Thomson/Wadsworth.

Buell, Paul D., E. N. Anderson, and Charles Perry. 2010. *A Soup for the Qan.* 2nd ed. Leiden: Brill.

Burnett, D. Graham. 2007. *Trying Leviathan.* Princeton, NJ: Princeton University Press.

Burton, Robert. 1932 [1638]. *The Anatomy of Melancholy.* New York: Dutton.

Buss, David. 2003. *The Evolution of Desire*. New York: Basic Books.

Buss, David, and Joshua Duntley. 1999. "Individuals or Selfish Groups?" [Review of Sober and Wilson 1999.] *Contemporary Psychology* 44:327–329.

Cain, William S., J. Enrique Cometto-Muniz, and Rene A. de Wijk. 1992. "Techniques in the Quantitative Study of Human Olfaction." In *Science of Olfaction,* edited by Michael J. Serby and Karen L. Chobor, 279–308. New York: Springer-Verlag.

Campany, Robert Ford. 2002. *To Live as Long as Heaven and Earth: A Translation and Study of Ge Hong's Traditions of Divine Transcendents.* Berkeley: University of California Press.

Campbell, T. Colin, and Thomas Campbell II. 2005. *The China Study.* Dallas, TX: Benbella Books.

Cao Xueqin. 1973–1986 [eighteenth century]. *The Story of the Stone,* translated by David Hawkes and John Minford. London: Penguin. (Originally published in Chinese.)

Capaldi, Elizabeth, ed. 1996. *Why We Eat What We Eat: The Psychology of Eating.* Washington, DC: American Psychological Association.

Cardinale, Bradley J., J. Emmett Duff, Andrew Gonzalez, David U. Hooper, Charles Perrings, Patrick Venail, Anita Narwani, Georgina M. Mace, David Tilman, David A. Wardle, Ann P. Kinzig, Gretchen C. Daily, Michel Loreau, James B. Grace, Anne Larigauderie, Diane S. Srivastava, and Shahid Naeem. 2012. "Biodiversity Loss and Its Impact on Humanity." *Nature* 486:59–67.

Carmody, Rachel, Gil Weintraub, and Richard Wrangham. 2011. "Energetic Consequences of Thermal and Nonthermal Food Processing." *Proceedings of the National Academy of Sciences* (November 7). doi:10.1073 / pnas1111247108.

Carney, Judith. 2001. *Black Rice.* Cambridge, MA: Harvard University Press.

Carpenter, Siri. 2003. "Bitter News for Tender Tongues." *Science* 299:1306.

Casas, Penelope. 1996. *Delicioso! The Regional Cuisines of Spain.* New York: Knopf.

Caterina, Michael J. 2007. "Sticky Spices." *Nature* 445:491–492.

Caterina, M. J., A. Leffler, A. B. Malmberg, W. J. Martin, J. Trafton, K. R. Petersen-Zeitz, M. Koltzenburg, A. I. Basbaum, and D. Julius. 2000. "Impaired Nociception and Pain Sensation in Mice Lacking the Capsaicin Receptor." *Science* 288:306–313.

Catholic Encyclopedia. 1907–1912. "The Real Presence of Christ in the Eucharist." *Catholic Online,* http://www.catholic.org/encyclopedia/view.php?id=4398.

Certeau, Michel de. 1984. *The Practice of Everyday Life,* translated by Steven Rendell. Berkeley: University of California Press.

Chang Chung-ching. 1981 [second century CE]. *Shang Han Lun,* edited by Otsuka Keisetsu, translated by Hong-yen Hsu and William Peacher. Los Angeles: Oriental Healing Arts Press. (Originally published in Chinese.)

Chang, K. C., ed. 1977. *Food in Chinese Culture.* New Haven, CT: Yale University Press.

Chanot-Bullier, C. 1983. *Vieii receto de cousino prouvençalo/Vieilles recettes de cuisine provençale.* Marseille: Tacoussel.

Chapple, Christopher Key, ed. 1998. *Jainism and Ecology.* Cambridge, MA: Harvard University Press/ Center for the Study of World Religions.

Chase-Dunn, Christopher, and E. N. Anderson, eds. 2005. *The Historical Evolution of World-Systems.* New York: Palgrave MacMillan.

Chase-Dunn, Christopher, and Kelly Mann. 1998. *The Wintu and Their Neighbors: A Very Small World-System in Northern California.* Tucson: University of Arizona Press.

Chauncey, Katherine. 2009. *Metabolic Syndrome: A Skills Course.* 2nd ed. Falls Church, VA: Nutrition Dimension.

Check, Erika. 2006. "How Africa Learned to Love the Cow." *Nature* 444:994–996.

Cheng Wing-fun and Hervé Collet. 1998. *Dans la cuisine du poète taoïste.* Millemont, France: Moundarren.

Cheung, Sidney, and Tan Chee-Beng. 2007. *Food and Foodways in Asia: Resource, Tradition and Cooking*. London: Routledge.

Childe, V. Gordon. 1951. *Man Makes Himself.* New York: New American Library.

Chobor, Karen L. 1992. "A Neurolinguistic Perspective of the Study of Olfaction." In *Science of Olfaction,* edited by Michael J. Serby and Karen L. Chobor, 355–377. New York: Springer-Verlag.

Chomsky, Noam. 1957. *Syntactic Structures.* Hague: Mouton.

Chong, Key Ray. 1990. *Cannibalism in China.* Wakefield, NH: Longwood Academic.

Claus, Edward P. 1956. *Gathercole and Wirth's Pharmacognosy.* 3rd ed. Philadelphia: Lea & Febiger.

Clifton, Claire, and Colin Spencer. 1993. *The Faber Book of Food.* London: Faber & Faber.

Clutton-Brock, Juliet. 2012. *Animals as Domesticates: A World View through History.* East Lansing: Michigan State University Press.

Coates, Peter. 1998. *Nature: Western Attitudes since Ancient Times.* London: Polity Press.

Coe, Andrew. 2009. *Chop Suey: A Cultural History of Chinese Food in the United States.* New York: Oxford University Press.

Coe, Sophie. 1994. *America's First Cuisines.* Austin: University of Texas Press.

Coe, Sophie, and Michael Coe. 1996. T*he True History of Chocolate.* London: Thames & Hudson.

Cohen, Mark R., and George Armelagos. 1984. *Paleopathology and the Origins of Agriculture.* New York: Academic Press.

Collier, Paul. 2007. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done about It*. New York: Oxford University Press.

———. 2010. *The Plundered Planet: Why We Must—and How We Can—Manage Nature for Global Prosperity.* Oxford: Oxford University Press.

Coltrain, Joan Brenner, and Steven W. Leavitt. 2002. "Climate and Diet in Fremont Prehistory: Ecological Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin." *American Antiquity* 67:453–485.

Committee on Food Habits. 1943. *The Problem of Changing Food Habits.* Bulletin no. 109.Washington, DC: National Research Council.

Conis, Elena. 2003. "Chips for Some, Tofu for Others." *Los Angeles Times* (August 4), health section.

Conkin, Paul Keith. 2008. *A Revolution Down on the Farm: The Transformation of American Agriculture since 1929*. Lexington: University Press of Kentucky.

Conner, Mark, and Christopher J. Armitage. 2002. *The Social Psychology of Food.* Philadelphia: Open University Press.

Conner, Wm. E. 2001. "N-3 Fatty Acids from Fish and Fish Oil: Panacea or Nostrum?" *American Journal of Clinical Nutrition* 74:415–416.

Coon, Carleton. 1958. *Caravan.* Rev. ed. New York: Henry Holt.

Cooper, John. 1993. *Eat and Be Satisfied: A Social History of Jewish Food.* Northvale, NJ: Jason Aronson.

Corbin, Alain. 1986. *The Foul and the Fragrant.* Cambridge, MA: Harvard University Press.

Cordain, Loren, S. Boyd Eaton, Anthony Sebastian, Neil Mann, Staffan Lindeberg, Bruce A. Watkins, James H. O'Keefe, and Janette Brand-Miller. 2005. "Origins and Evolution of the Western Diet: Health Implications for the 21st Century." *American Journal of Clinical Nutrition* 81:341–354.

Cordain, Loren, Janette Brand Miller, S. Boyd Eaton, Neil Mann, Susanne H. A. Holt, and John D. Speth. 2000. "Plant-Animal Subsistence Ratios and Macronutrient Energy Estimations in Worldwide Hunter-Gatherer Diets." *American Journal of Clinical Nutrition* 71:682–692.

Counihan, Carole. 1999. *The Anthropology of Food and Body: Gender, Meaning, and Power.* New York: Routledge.

———. 2000. "The Social and Cultural Uses of Food." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1513–1522. Cambridge: Cambridge University Press.

———. 2004. *Around the Tuscan Table: Food, Family, and Gender in Twentieth Century Florence.* London: Routledge.

Counihan, Carole, and Penny van Esterik, eds. 2007. *Food and Culture: A Reader.* 2nd ed. London: Routledge.

Crane, Hillary K. 2004. "Gluten Intolerance and Intolerant Churches: Conflicts over Advising Catholics with Celiac Sprue." Paper presented at the Annual Meeting of the American Anthropological Association, Atlanta, GA.

Crawford, David. 2008. *Moroccan Households in the World Economy: Labor and Inequality in a Berber Village*. Baton Rouge: Louisiana State University Press.

Cromley, Janet. 2006. "You're Burning Calories *Right Now.*" *Los Angeles Times* (February 27): F1, F11.

Crone, Patricia. 1987. *Meccan Trade and the Rise of Islam.* Princeton, NJ: Princeton University Press.

Cronk, Lee. 1999. *That Complex Whole: The Evolution of Human Behavior.* Boulder, CO: Westview.

Cudel, Evelyn. 1994. "High Incidence of Diabetes in the O'odham: Community Approach in Prevention and Control for a Native American Tribe." PhD diss., Department of Anthropology, University of California, Riverside.

Cummings, M. 1981. "Can Some People Synthesize Ascorbic Acid?" *American Journal of Clinical Nutrition* 34:297–298.

Cunningham, A. S., Derrick B. Jelliffe, and E. F. P. Jelliffe. 1991. "Breast-Feeding and Health in the 1980s: A Global Epidemiologic Review." *Journal of Pediatrics* 118:659–666.

Curtin, Deane W., and Lisa M. Heldke, eds. 1992. *Cooking, Eating, Thinking: Transformative Philosophies of Food.* Bloomington: Indiana University Press.

Cushing, Frank. 1920. *Zuni Breadstuffs.* New York: Museum of the American Indian/Heye Foundation.

Dahlberg, Frances, ed. 1981. *Woman the Gatherer.* New Haven, CT: Yale University Press.

Dalby, Andrew. 1997. *Siren Feasts: A History of Food and Gastronomy in Greece.* London: Routledge.

———. 2000. *Dangerous Tastes.* Berkeley: University of California Press.

———. 2003. *Food in the Ancient World from A to Z.* London: Routledge.

Daly, Herman, and John Cobb. 1994. *For the Common Good.* 2nd ed. Boston: Beacon.

Daly, Martin, and Margo Wilson. 1999. *The Truth about Cinderella: A Darwinian View of Parental Love.* New Haven, CT: Yale University Press.

Damasio, Antonio. 1994. *Descartes' Error.* New York: Putnam.

Damerow, Peter. 1996. "Food Production and Social Status as Documented in Proto-Cuneiform Texts." In *Food and the Status Quest: An Interdisciplinary Perspective,* edited by Polly Wiessner and Wulf Schiefenhövel, 149–170. Oxford: Berghahn.

Damsen, Silver. 1993. "Human Odor Preferences and Aversions." *Ms.Magazine.*

Darby, William, Louis Grivetti, and Paul Ghalioungi. 1977. *Food: The Gift of Osiris.* New York: Academic Press.

Davey, Monica. 2010. "And Now, a State Microbe." *New York Times* (April 15). www.nytimes.com/2010/04/16/us/16microbe.html?_r=0.

Davidson, Alan. 2000. *The Oxford Companion to Food.* Oxford: Oxford University Press.

Dawkins, Richard. 1976. *The Selfish Gene.* Oxford: Oxford University Press.

De la Cruz, Sor Juana Ines. 2005. *Sor Juana Ines de la Cruz.* Translated by M. S. Peden and I. Stavans. New York: Paulist Press.

DeLauro, Rosa L. 2003. "Imported Drugs: FDA Suddenly Gets 'Concerned.'" *Los Angeles Times* (November 5): B15.

Dembínska, Maria. 1999. *Food and Drink in Medieval Poland: Rediscovering Cuisine of the Past,* translated by Magdalena Thomas, revised and adapted by William Woys Weaver. Philadelphia: University of Pennsylvania Press.

Denham, Tim, José Iriarte, and Luc Vrydaghs, eds. 2007. *Rethinking Agriculture: Archaeological and Ethnoarchaeological Perspectives.* Walnut Creek, CA: Left Coast Press.

Desrochers, Pierre, and Hiroko Shimizu. 2012. *The Locavore's Dilemma: In Praise of the 10,000-Mile Diet.* New York: Public Affairs.

Deutsch, R. 1977. *The New Nuts among the Berries.* Palo Alto, CA: Bull Publishing.
DeVore, Sally, and Thelma White. 1978. *The Appetites of Man: An Invitation to Better Nutrition from Nine Healthier Societies.* Garden City, NY: Doubleday.
De Waal, Franz. 1996. *Good Natured.* Cambridge, MA: Harvard University Press.
Diamond, Jared. 1997. *Why Is Sex Fun?* New York: HarperCollins.
———. 2005. *Collapse: How Societies Choose to Fail or Succeed.* New York: Viking,
Dichter, Thomas. 2003. *Despite Good Intentions: Why Development Assistance to the Third World Has Failed.* Amherst and Boston: University of Massachusetts Press.
Diener, Paul, and Eugene Robkin. 1978. "Ecology, Evolution, and the Search for Cultural Origins: The Question of Islamic Pig Prohibition." *Current Anthropology* 19, no. 3:493–540.
Dietler, Michael. 2006. "Alcohol: Anthropological/Archaeological Perspectives." *Annual Review of Anthropology* 35:229–249.
Dietler, Michael, and Brian Hayden, eds. 2001. *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics, and Power.* Washington, DC: Smithsonian Institution Press.
Dikötter, Frank. 2010. *Mao's Great Famine: The History of China's Most Devastating Catastrophe, 1958–1962.* New York: Walker & Co.
Dilthey, Wilhelm. 1985 [late nineteenth century]. *Introduction to the Human Sciences,* translated and edited by Rudolf Makkreel and Frithjof Rodi. Princeton, NJ: Princeton University Press. (Originally published in German.)
Diner, Hasia R. 2002. *Hungering for America: Italian, Irish and Jewish Food-ways in the Age of Immigration.* Cambridge, MA: Harvard University Press.
"Dinner in a Mound." 2001. *Science* 291:587.
Dissanayake, Ellen. 2000. "Antecedents of the Temporal Arts in Early Mother-Infant Interaction." In *The Origins of Music,* edited by Nils Wallin, Bjorn Merker, and Steven Brown, 389–410. Cambridge, MA: MIT Press.
Dobkin de Rios, Marlene, and Brian Hayden. 1985. "Odourous Differentiation and Variability in the Sexual Division of Labour among Hunters/Gatherers." *Journal of Human Evolution* 14:219–228.
Dolhinow, Phyllis. 1999. Review of "Demonic Males: Apes and the Origins of Human Violence" by Richard Wrangham and Dale Peterson. *American Anthropologist* 101:445–446.
Doniger, Wendy, and Brian Smith, eds. and trans. 1991. *The Laws of Manu,* with introduction by Wendy Doniger and Brian Smith. New York: Penguin.
Doty, Richard L. 1991. "Olfactory Function in Neonates." In *The Human Sense of Smell,* ed. D. G. Laing, R. L. Doty, and W. Breipohl, 155–165. New York: Springer-Verlag.
Douglas, Mary. 1966. *Purity and Danger.* New York: Praeger.
———. 1970. *Natural Symbols.* London: Barrie & Rockliff.
———. 1975. *Implicit Meanings.* London: Routledge & Kegan Paul.

Dove, Michael. 2011. *The Banana Tree at the Gate: A History of Marginal Peoples and Global Markets in Borneo.* New Haven, CT: Yale University Press.

Draper, H. H. 2000. "Human Nutritional Adaptation: Biological and Cultural Aspects." In *The Cambridge World History of Food,* ed. Kenneth Kiple and B. K. Ornelas, 1466–1476. Cambridge: Cambridge University Press.

Drexler, Madeline. 2003. "Some Cipro with That Burger?" *Los Angeles Times* (June 29): M2.

Drucker, Philip, and Robert Heizer. 1967. *To Make My Name Good.* Berkeley: University of California Press.

Drummond, John, and Anne Wilbraham. 1958. *The Englishman's Food.* Rev. ed. London: J. Cape.

Du Bois, Christine, Chee-Beng Tan, Sidney Mintz, eds. 2008. The World of Soy. Urbana and Chicago: University of Illinois Press.

Dufour, Darna L., and Nicolette I. Teufel. 1995. "Minimum Data Sets for the Description of Diet and Measurement of Food Intake and Nutritional Status." In *The Comparative Analysis of Human Societies: Toward Common Standards for Data Collection and Reporting,* ed. Emilio L. Moran, 97–128. Boulder, CO: Lynne Rienner.

Dunbar, Robin. 1993. "Coevolution of Neocortical Size, Group Size and Language in Humans." *Behavioral and Brain Sciences* 16:681–735.

———. 1996. *Grooming, Gossip, and the Evolution of Language.* Cambridge, MA: Harvard University Press.

Dunne, Julie, Richard P. Evershed, Mélanie Salque, Lucy Cramp, Silvia Bruni, Kathleen Ryan, Stefano Biagetti, and Savino di Lernia. 2012. "First Dairying in Green Saharan Africa in the Fifth Millennium BC." *Nature* 486:390–394.

Dupuis, E. Melanie. 2002. Nature's Perfect Food: How Milk Became America's Drink. New York: New York University Press.

Duran, Fray Diego. 1994 [sixteenth century]. *The History of the Indies of New Spain,* translated and edited by Doris Heyden. Norman: University of Oklahoma Press. (Originally published in Spanish.)

Durkheim, Emile. 1995 [1912]. *The Elementary Forms of the Religious Life,* translated by Karen E. Fields. New York: Simon & Schuster. (Originally published in French.)

Eaton, S. Boyd, Stanley B. Eaton III, and Loren Cordain. 2002. "Evolution, Diet, and Health." In *Human Diet: Its Origin and Evolution,* edited by Peter S. Ungar and Mark F. Telford, 7–18. Westport, CT: Bergin & Garvey.

Eberwine, Donna. 2002. "Globesity: The Crisis of Growing Proportions." *Perspectives in Health* 7, no. 3:6–11.

Effros, Bonnie. 2002. *Creating Community with Food and Drink in Merovingian Gaul.* New York: Palgrave Macmillan.

Ehrlich, Paul R., Peter M. Kareiva, and Gretchen C. Daily. 2012. "Securing Natural Capital and Expanding Equity to Rescale Civilization." *Nature* 486:68–73.

Ehrlichman, Howard, and Linda Bastone. 1992. "Olfaction and Emotion." In *Science of Olfaction,* edited by Michael J. Serby and Karen L. Chobor, 410–438. New York: Springer-Verlag.

Eichenwald, Kurt. 2000. *The Informant.* New York: Broadway Books.

Eléxpuru, Inés. 1994. *La cocina de al-Andalus.* Madrid: Alianza Editorial.

Elias, Elias M., and Frank A. Manthey. 2005. "End Products: Present and Future Uses." In *Durum Wheat Breeding: Current Approaches and Future Strategies*, edited by Conxita Royo, Miloudi M. Nachit, Natale Di Fonzo, Jose Luis Araus, Wolfgang H. Pfeiffer, and Gustavo A. Slafer, 1:63–85. Binghamton, NY: Food Products Press.

Elias, Norbert. 1978. *The Civilizing Process: The History of Manners*, translated by Edmund Jephcott. New York: Urizen Books.

Ellerman, David. 2005. *Helping People Help Themselves: From the World Bank to an Alternative Philosophy of Development Assistance*. Ann Arbor: University of Michigan Press.

Ellstrand, Norman. 2005. *Dangerous Liaisons? When Cultivated Plants Mate with Wild Relatives.* Baltimore, MD: Johns Hopkins University Press.

Engen, Trygg. 1981. *The Perception of Odors.* New York: Academic Press.

———. 1988. "The Acquisition of Odour Hedonics." In *Perfumery,* edited by Steve Van Toller and George H. Dodd, 79–90. New York: Chapman & Hall.

———. 1991. *Odor Sensation and Memory.* New York: Praeger.

Epicurus. 2011. "Selected Fragments by Epicurus." Translated by Peter Saint-Andre. www.monadnock.net/epicurus/fragments.html, accessed May 7, 2013.

Etkin, Nina, ed. 1986. *Plants in Indigenous Medicine and Diet: Biobehavioral Approaches.* Bedford Hills, NY: Redgrave.

———, ed. 1994. *Eating on the Wild Side.* Tucson: University of Arizona Press.

———. 2009. *Foods of Association*. Tucson: University of Arizona Press.

Evans, L. T. 1998. *Feeding the Ten Billion: Plants and Population Growth.* Cambridge: Cambridge University Press.

Evelyn, John. 2012 [1699]. *Acetaria, a Discourse of Sallets.* Lexington, KY: Filiquarian. (Typed from a 1937 edition by the Brooklyn Botanic Garden.)

Fabre-Vassas, Claudine. 1997 [1994]. *The Singular Beast,* translated by Carol Volk. New York: Columbia University Press. (Originally published in French as *La bete singuliere* by Gallimard.)

Fairbanks, Virgil F. 1999. "Iron in Medicine and Nutrition." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James Olson, Moshe Shike, and A. Catharine Ross, 193–221. Philadelphia: Lippincott Williams & Wilkins.

Faris, Stephan. 2012. "Eat Like an Italian." *Time*, February 20. Currents 1–4.

Farley, Maggie. 2002. "World Hunger on the Rise Again." *Los Angeles Times,* (October 16): A4.

Faroqhi, Suraiya. 2000. *Subjects of the Sultans: Culture and Everyday Life in the Ottoman Empire from the Middle Ages until the Beginning of the Twentieth Century.* London: I. B. Tauris.

Fausto, Carlos. 2007. "Feasting on People: Eating Animals and Humans in Amazonia." *Current Anthropology* 48:497–530.

Feely-Harnik, Gillian. 1994. *The Lord's Table: The Meaning of Food in Early Judaism and Christianity.* Washington, DC: Smithsonian Institution Press.

Feld, Steven, and Keith Basso. 1996. *Senses of Place.* Santa Fe, NM: School of American Research.

Fessler, Daniel M. T. 2002. "Reproductive Immunosuppression and Diet: An Evolutionary Perspective on Pregnancy Sickness and Meat Consumption." *Current Anthropology* 43:19–61.

Firth, Raymond. 1936. *We the Tikopia.* London: George Allen & Unwin.

———. 1959. *Social Change in Tikopia.* London: George Allen & Unwin.

———. 1962. *Economics of the New Zealand Maori.* London: George Allen & Unwin.

Firth, Rosemary. 1966. *Housekeeping among Malay Peasants.* London: Athlone Press.

Fischler, Claude. 1990. *L'homnivore.* Paris: Editions Odile Jacob.

Fish, Jennifer. 1993. *New England Missionaries in Early 19th Century Hawaii: A Study in Acculturation.* MA thesis, Department of History, University of California, Riverside.

Fitzgerald, Thomas K., ed. 1977. *Nutrition and Anthropology in Action.* Leiden: Van Gorcum.

Flandrin, Jean-Louis, and Massimo Montanari, directors. 1996. *Histoire de l'alimentation.* Paris: Fayard.

———, directors. 1999. *Food: A Culinary History,* edited by Albert Sonnenfeld, translated by Clarissa Botsford et al. New York: Columbia University Press. (Originally published in French as Flandrin and Montanari 1996.)

Foley, Jonathan A., et al. 2011. "Solutions for a Cultivated Planet." *Science* 478:337–342.

Forster, Robert, and Orest Ranum, eds. 1979. *Food and Drink in History: Selections from the* Annales: Economies, Sociétés, Civilisations. Baltimore, MD: Johns Hopkins University Press.

Foster, George. 1994. *Hippocrates' Latin American Legacy.* Amsterdam: Gordon & Breach.

Foucault, Michel. 1970. *The Order of Things.* New York: Random House.

Foundation of Chinese Dietary Culture. 1998. *Fifth Symposium on Chinese Dietary Culture.* Taipei, Taiwan: Foundation of Chinese Dietary Culture.

Fox, J. J. 1977. *Harvest of the Palm.* Cambridge, MA: Harvard University Press.

Fox, Vickers. 1997. *Spoiled.* New York: Basic Books.

Frake, Charles. 1980. "The Ethnographic Study of Cognitive Systems." In *Language and Cultural Description,* edited by Anwar S. Dil, 1–17. Stanford, CA: Stanford University Press.

Frankl, Viktor. 1959. *Man's Search for Meaning.* Boston: Beacon Press.

———. 1978. *The Unheard Cry for Meaning.* New York: Simon & Schuster.

Friedman, Howard S., and Leslie R. Martin. 2011. *The Longevity Project.* New York: Hudson Street Press/Penguin Group.

Friese, Kurt Michael, Kraig Kraft, and Gary Nabhan. 2011. *Chasing Chile: Hot Spots along the Pepper Trail.* White River Junction, VT: Chelsea Green.
Gabaccia, Donna R. 1998. *We Are What We Eat: Ethnic Foods and the Making of Americans.* Cambridge, MA: Harvard University Press.
Gade, Daniel W. 1976. "Horsemeat as Human Food in France." *Ecology of Food and Nutrition* 5:1–11.
Galen. 2000. *Galen on Food and Diet,* translated and edited by Mark Grant. London: Routledge.
———. 2003. *Galen on the Properties of Foodstuffs,* translated and edited by Owen Powell. Cambridge: Cambridge University Press.
Gardner, Martin. 1957. *Fads and Fallacies in the Name of Science.* New York: Dover.
Geary, David C. 2000. "Evolution and Proximate Expression of Human Paternal Investment." *Psychological Bulletin* 126:55–77.
Geertz, Clifford. 1963. *Agricultural Involution.* Berkeley: University of California Press.
Georgakas, Dan. 1980. *The Methuselah Factor.* New York: Simon & Schuster.
Georges, Robert. 1981. "You Eat What Others Think You Are." Paper presented at the Annual Meeting of the Southern California Academy of Sciences, Los Angeles.
Gerstein, Mark, and Deyou Zheng. 2006. "The Real Life of Pseudogenes." *Scientific American* (August): 49–55.
Gibbons, Ann. 2012. "An Evolutionary Theory of Dentistry." *Science* 336:973–975.
Gibbons, Boyd. 1986. "The Intimate Sense of Smell." *National Geographic* 170:514–525.
Gibbons, Euell. 1962. *Stalking the Wild Asparagus.* New York: David McKay.
Gilbert, Avery. 2008. *What the Nose Knows: The Science of Scent in Everyday Life*. New York: Crown.
Gill, Richardson. 2000. *The Great Maya Droughts.* Albuquerque: University of New Mexico Press.
Gintis, Herbert, Samuel Bowles, Robert Boyd, and Ernst Fehr, eds. 2005. *Moral Sentiments and Material Interests: The Foundations of Cooperation in Economic Life.* Cambridge, MA: MIT Press.
Glausiusz, Josie. 2008. "The Hidden Power of Scent." *Scientific American Mind* (August–September): 38–45.
Gleick, Peter. 1998. *The World's Water.* Washington, DC: Island Press.
Gluckman, Peter, and Mark Hanson. 2012. *Fat, Fate and Disease*. New York: Oxford University Press.
Goldschmidt, Walter. 1947. *As You Sow.* New York: Harcourt, Brace.
Gombrich, E. H. 1984. *The Sense of Order: A Study in the Psychology of Decorative Art.* Ithaca, NY: Cornell University Press.
Goodman, Alan H., Darna L. Dufour, and Gretel H. Pelto. 2000. *Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition.* Mountain View, CA: Mayfield.
Goodman, Alan, and Thomas Leatherman, eds. 1998. *Building a New Biocultural Synthesis.* Ann Arbor: University of Michigan Press.

Goody, Jack. 1982. *Cooking, Cuisine, and Class.* Cambridge: Cambridge University Press.

Gosden, Chris, and Jon Hather. 1999. *The Prehistory of Food: Appetites for Change.* Cambridge: Cambridge University Press.

Gould, Stephen Jay. 2002. *The Structure of Evolutionary Theory.* Cambridge, MA: Harvard University Press.

Grantham, Jeremy. 2012. "Be Persuasive. Be Brave. Be Arrested (If Necessary)." *Nature* 491:303.

Gray, Patience. 1997. *Honey from a Weed.* Devon: Prospect Books.

Green, Emily. 2002. "The Temptation Is Back." *Los Angeles Times* (October 23): F1, F4.

Greene, Lawrence. 1977. *Malnutrition, Behavior, and Social Organization.* New York: Academic Press.

———. 1980. *Social and Biological Predictors of Nutritional Status, Physical Growth, and Neural Development.* New York: Academic Press.

Gregoire, Jean-Pierre. 1998. "Major Units for the Transformation of Grain: The Grain-Grinding Households (e2-HAR.HAR) of Southern Mesopotamia at the End of the Third Millennium BCE." In *Prehistory of Agriculture: New Experimental and Ethnographic Approaches,* edited by Patricia Anderson, 223–237. Los Angeles: Institute of Archaeology, University of California, Los Angeles.

Grieve, M. 1931. *A Modern Herbal.* New York: Harcourt, Brace.

Grimes, David A. 1995. "Clinical Resarch in Ancient Babylon: Methodologic Insights from the Book of Daniel." *Obstetrics and Gynecology* 86:1031–1034.

Grove, A. T., and Oliver Rackham. 2001. *The Nature of Mediterranean Europe: An Ecological History.* New Haven, CT: Yale University Press.

Guerrero Guerrero, Raúl. 1987. *Toneucáyotl: El pan nuestro de cada día*. Mexico City: Instituto Nacional de Antropología e Historia (INAH).

Gundel, Karoly. 1964. *Hungarian Cookery Book.* Budapest: Athenaeum.

Gurven, Michael. 2006. "The Evolution of Contingent Cooperation." *Current Anthropology* 47:185–192.

Gurven, Michael, and Kim Hill. 2009. "Why Do Men Hunt? A Reevaluation of 'Man the Hunter' and the Sexual Division of Labor." *Current Anthropology* 50:51–74.

Guthman, Julie. 2001. *Organic Production in California: Ideal and Real.* California Institute for Rural Studies.

———. 2004. *Agrarian Dreams: The Paradox of Organic Farming in California.* Berkeley: University of California Press.

———. 2011. *Weighing In: Obesity, Food Justice, and the Limits of Capitalism.* Berkeley: University of California Press.

Haldorsen, Sylvi, Hasan Akan, Bahattin Çelik, and Manfred Heun. 2011. "The Climate of the Younger Dryas as a Boundary for Einkorn Domestication." *Vegetation History and Archaeobotany* 20:305–318.

Hall, Gwendolyn Midlo. 1992. *Africans in Colonial Louisiana: The Development of Afro-Creole Culture in the Eighteenth Century*. Baton Rouge: Louisiana State University Press.

Hanger, Catherine. 2000. *World Food: Morocco.* Hawthorn, Australia: Lonely Planet.

Hanks, William. 1990. *Referential Practice.* Chicago: University of Chicago Press.

Harington, John. 1966 [ca. 1600]. *The School of Salernum*. Salerno: Ente Provinciale per il Turismo.

Harlow, Mary, and Wendy Smith. 2001. "Between Fasting and Feasting: The Literary and Archaeobotanical Evidence for Monastic Diet in Late Antique Egypt." *Antiquity* 75:758–769.

Harner, Michael. 1977. "The Ecological Basis for Aztec Sacrifice." *American Ethnologist* 4:117–135.

Harris, Judith Rich. 1998. *The Nurture Assumption.* New York: Free Press.

Harris, Marvin. 1966. "The Cultural Ecology of India's Sacred Cattle." *Current Anthropology* 7:51–66.

———. 1974. *Cows, Pigs, Wars, and Witches: The Riddles of Culture.* New York: Random House.

———. 1985. *Good to Eat: Riddles of Food and Culture.* New York: Simon & Schuster.

———. 1987. *The Sacred Cow and the Abominable Pig: Riddles of Food and Culture.* New York: Simon & Schuster.

Harris, Marvin, and Eric B. Ross, eds. 1987. *Food and Evolution: Toward a Theory of Human Food Habits.* Philadelphia: Temple University Press.

Harriss-White, Barbara, and Sir Raymond Hoffenberg, eds. 1994. *Food: Multidisciplinary Perspectives.* Oxford: Blackwell.

Hartman, Louis F., and A. L. Oppenheim. 1950. *On Beer and Brewing Techniques in Ancient Mesopotamia.* Supplement to the *Journal of the American Oriental Society,* no. 10. Baltimore, MD: American Oriental Society.

Hattox, Ralph S. 1985. *Coffee and Coffeehouses: The Origins of a Social Beverage in the Medieval Near East.* Seattle: University of Washington Press.

Hawkes, Kristen. 1993. "Why Hunter-Gatherers Work: An Ancient Version of the Problem of Public Goods." *Current Anthropology* 34:341–363.

Hayami, Yujiro, and Vernon Ruttan. 1985. *Agricultural Development.* 2d ed. Baltimore, MD: Johns Hopkins University Press.

Headland, Thomas N., and Lawrence A. Reid. 1989. "Hunter-Gatherers and Their Neighbors from Prehistory to the Present." *Current Anthropology* 30:43–66.

Heiser, Charles. 1976. *The Sunflower.* Norman: University of Oklahoma Press.

Heldke, Lisa. 1988. "Recipes for Theory Making." *Hypatia* 3:15–29.

Henkin, Robert I. 1967. "Abnormalities of Taste and Olfaction in Various Disease States." In *The Chemical Senses and Nutrition,* edited by Morley Kare and Owen Maller, 95–114. Baltimore, MD: Johns Hopkins University Press.

Henry, Amanda G., Peter S. Ungar, Benjamin H. Passey, Matt Sponheimer, Lloyd Rossouw, Marion Bamford, Paul Sandberg, Darryl J. de Ruiter, and Lee Berger. 2012. "The Diet of *Australopithecus sediba*." *Nature* 487:90–93.

Herbert, Victor. 1999. "Folic Acid." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James A. Olson, Moshe Shike, and A. Catherine Ross, 443–446. Philadelphia: Lippincott Williams & Wilkins.

Herodotus. 1954 [fifth century BCE]. *The Histories,* translated by Audrey de Selincourt. Harmondsworth, Middlesex: Penguin. (Originally published in Greek.)

Hess, Karen. 1992. *The Carolina Rice Kitchen.* Columbia: University of South Carolina Press.

Higman, B. W. 2008. *Jamaican Food: History, Biology, Culture.* Kingston, Jamaica: University of the West Indies Press.

Hill, Kim, and Magdalena Hurtado. 2012. "Human Reproductive Assistance." *Nature* 483:160–161.

Hill, Kim, and Hillard Kaplan. 1993. "On Why Male Foragers Hunt and Share Food." With response by Kristin Hawkes. *Current Anthropology* 34:701–710.

Hinton, William. 1966. *Fanshen.* New York: Monthly Review Press.

Hippocrates [ascribed]. 1978. *Hippocratic Writings,* edited by G. E. R. Lloyd. London: Penguin.

Hoberg, Eric P., Nancy L. Alkire, Alan de Queiroz, and Arlene Jones. 2001. "Out of Africa: Origins of the *Taenia* Tapeworms in Humans." *Proceedings of the Royal Society of London* 268:781–787.

Holden, Constance. 2000. "Man, the Toothpick User." *Science* 288:607.

———. 2003. "Pudgy Pets." *Science* 301:1665.

Holley, David. 2002. "Europe's Food Regions Fight to Keep Their Good Names." *Los Angeles Times* (September 16): A1, A8.

Hopkins, Jerry. 1999. *Strange Foods.* Tokyo: Tuttle.

Horden, Peregrine, and Nicholas Purcell. 2000. *The Corrupting Sea: A Study of Mediterranean History.* Oxford: Blackwell.

Horovitz, Bruce. 2012. "Foodies Enjoy Different Tastes than the Rest of Us." *USA Today* (April 25).

Hovmøller, Mogens S., Stephanie Walter, and Annemarie Fejer Justesen. 2010. "Escalating Threat of Wheat Rusts." *Science* 329:369.

Howell, David G., and Jonathan P. Swinchatt. 2000. "A Discussion of Geology, Soils, Wines, and History of the Napa Valley Region." *California Geology* 53, no. 3:4–12.

Hsu, Tiffany. 2012. "Americans Toss Out as Much as 40% of Their Food, Study Says." *Los Angeles Times* (August 21). http://articles.latimes.com/2012/aug/21/business/la-fi-mo-food-waste-nrdc-20120821.

Huang, H. T. 2002. "Hypolactasia and the Chinese Diet." *Current Anthropology* 43:809–819.

Hughes, R. E. 2000. "Scurvy." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 988–1000. Cambridge: Cambridge University Press.

Hume, David. 1992. "Of the Immortality of the Soul." In *Writings on Religion,* edited by Antony Flew. Chicago: Open Court.

Hung Tzu-Ch'eng. 1959 [sixteenth century]. *A Chinese Garden of Serenity,* translated by Chao Tze-ch'ang. New York: Peter Pauper Press. (Originally published as *Cai Gen Tan,* Discussing vegetable roots.)

Hunn, Eugene. 1979. "The Abominations of Leviticus Revisited." In *Classifications in the Social Context,* edited by Roy Ellen and D. Pearson, 103–118. New York: Academic Press.

Imhoff, Daniel. 2012. *Food Fight: The Citizen's Guide to the Nexst Food and Farm Bill.* Healdsburg, CA: Watershed Media.

Ibn Khaldun. 1958. *The Muqaddimah,* translated by Franz Rosenthal. New York: Pantheon.

International Food Policy Research Institute. 2002. *Sustainable Food Security for All by 2020.* Washington, DC: International Food Policy Research Institute.

Isaac, Bryan. 2005. Aztec Cannibalism: Nahua vs. Spanish and Mestizo Accounts in the Valley of Mexico. *Ancient Mesoamerica* 16:1–10.

Isaac, Glynn. 1978. "The Food-Sharing Behavior of Protohuman Hominids." *Scientific American* 238, no. 4:90–108.

———. 1979. "Food Sharing and Human Evolution: Archaeological Evidence from the Plio-Pleistocene of East Africa." *Journal of Anthropological Research* 34:311–325.

Ishige, Naomichi. 2001. *The History and Culture of Japanese Food.* London: Kegan Paul.

Jacob, H. E. 1944. *Six Thousand Years of Bread.* New York: Doubleday, Doran.

Jägfors, Ulf. 2004. "The African Akonting and the Origin of the Banjo." *Old-Time Herald* (Winter 2003–2004): 26–33.

Jantzen, Daniel. 1998. "Gardenification of Wild Nature and the Human Footprint." *Science* 279:1312–1313.

Jelliffe, D. B. 1966. *The Assessment of the Nutritional Status of the Community.* Geneva: World Health Organization.

Jerome, Norge, Randy Kandel, and Gretel Pelto. 1980. *Nutritional Anthropology.* Pleasantville, NY: Redgrave.

Jiang, Peihua, Jesusa Josue, Xia Li, Dieter Glaser, Weihua Li, Joseph G. Brand, Robert Margolskee, Danielle Read, and Gary K. Beauchamp. 2012. "Major Taste Loss in Carnivorous Mammals." *Proceedings of the National Academy of Sciences* (March 12). doi:10.1073/pnas1118360109.

Jilani, Zaid. 2012. "The Hidden Costs of Corruption in the U.S. Senate: Cutting Food Stamps While Giving the Sugar Lobby Billions." *Republic Report* (June 24). www.republicreport.org/2012/the-human-cost-of-corruption-in-the-u-s-senate-cutting-food-stamps-while-giving-the-sugar-lobby-billions/.

Johns, Timothy. 1991. *With Bitter Herbs They Shall Eat It.* Tucson: University of Arizona Press.

Johnson, Samuel. 1963. *Johnson's Dictionary: A Modern Selection* edited by E. L. McAdam, Jr., and George Milne. New York: Pantheon.

Jones, Martin. 2007. *Feast: Why Humans Share Food.* New York: Oxford University Press.

Jones, Peter J. H., and Stanley Kubow. 1999. "Lipids, Sterols, and Their Metabolites." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James Olson, Moshe Shike, and A. Catharine Ross, 67–94. Philadelphia: Lippincott Williams & Wilkins.

Jourdain, Robert. 1997. *Music, the Brain, and Ecstasy.* New York: William Morrow.

Joyce, James. 1961. *Ulysses.* New York: Modern Library.

Joyes, Claire. 1989. *Monet's Table: The Cooking Journals of Claude Monet.* New York: Simon & Schuster.

Kallas, John. 2002. *The Wild Food Primer.* Portland, OR: Institute for Wild Food Education.

Kant, Immanuel. 1978 [1798]. *Anthropology from a Pragmatic Point of View,* translated by Victor Lyle Dowdell. Carbondale: Southern Illinois University Press. (Originally published in German.)

Kaplan, Stephen. 1992. "Environmental Preference in a Knowledge-Sharing, Knowledge-Using Organism." In *The Adapted Mind,* edited by Jerome H. Barkow, Leda Cosmides, and John Tooby, 588–598. New York: Oxford University Press.

Katan, M. B., and Nicole M. de Roos. 2003. "Toward Evidence-Based Health Claims for Foods." *Science* 299:206–207.

Katz, Solomon, editor-in-chief. 2003. *Encyclopedia of Food and Culture.* 3 vols. New York: Thompson Gale.

Katz, Solomon, M. Hediger, and L. Valleroy. 1974. "Traditional Maize Processing Techniques in the New World." *Science* 184:765–773.

Katz, Solomon, and William Woys Weaver, eds. 2003. *Encyclopedia of Food and Culture.* New York: Scribner's.

Kearney, Michael. 1996. *Reconceptualizing the Peasantry.* Boulder, CO: Westview.

Keeley, Lawrence. 1998. "Use of Plant Foods among Hunter-Gatherers: A Cross-Cultural Survey." In *Prehistory of Agriculture: New Experimental and Ethnographic Approaches,* edited by Patricia Anderson, 6–14. Monograph no. 40. Los Angeles: Institute of Archaeology, University of California, Los Angeles.

Kelly, Robert L. 1995. *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways.* Washington, DC: Smithsonian Institution Press.

Kennedy, Diana. 1998. *My Mexico: A Culinary Odyssey with More than Three Hundred Recipes.* New York: Random House/Clarkson Potter.

Keys, Ancel. 1980. *Seven Countries.* Cambridge, MA: Harvard University Press.

Khare, R. S. 1976a. *Culture and Reality.* Simla: Indian Institute of Advanced Study.

———. 1976b. *The Hindu Hearth and Home.* Durham, NC: Carolina Academic Press.

———, ed. 1992. *The Eternal Food: Gastronomic Ideas and Experiences of Hindus and Buddhists.* Albany: State University of New York Press.

Khayyam, Omar. 1942. *The Rubaiyat of Omar Khayyam*, translated by Edward Fitzgerald. Roslyn, NY: Walter J. Black.

Kingsbury, Noel. 2010. *Hybrid: The History and Science of Plant Breeding.* Chicago: University of Chicago Press.

Kiple, Kenneth, and Kriemhild C. Ornelas, eds. 2000. *The Cambridge World History of Food.* Cambridge: Cambridge University Press.

Klatsky, Arthur L. 2003. "Drink to Your Health?" *Scientific American* (February): 75–81.

Klindienst, Patricia. 2007. *The Earth Knows My Name: Food, Culture, and Sustainability in the Gardens of Ethnic Americans*. Boston: Beacon.

Kniep, E. H., and P. T. Young. 1931. "Studies in Affective Psychology, XII: The Relation between Age and Affective Reactions to Odors." *American Journal of Psychology* 43:406–421.

Koenig, Walter D., and Ronald L. Mumme. 1987. *Population Ecology of the Cooperatively Breeding Acorn Woodpecker.* Princeton, NJ: Princeton University Press.

Kohn, Livia. 1993. *The Taoist Experience.* Albany: State University of New York Press.

Kortlandt, Adriaan. 1978. "The Ecosystems in Which the Incipient Hominines Could Have Evolved." In *Recent Advances in Primatology,* vol. 3, *Evolution,* edited by D. J. Chivers and K. A. Jaysey, 503–506. London: Academic Press.

Kotchen, Theodore A., and Jane Morley Kotchen. 1999. "Nutrition, Diet, and Hypertension." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James Olson, Moshe Shike, and A. Catharine Ross, 1217–1227. Philadelphia: Lippincott Williams & Wilkins.

Kottak, Conrad Philip. 2003. *Cultural Anthropology.* 10th ed. New York: McGraw-Hill.

Kovacs, Maureen Gallery, trans. 1985. *The Epic of Gilgamesh.* Stanford, CA: Stanford University Press.

Kramer, S. N. 1955. "Sumerian Myths and Epic Tales." In *Religions of the Ancient Near East: Sumero-Akkadian Religious Texts and Ugaritic Epics,* edited by Isaac Mendelsohn, 11–16. New York: Liberal Arts Press.

Krech, Shepard. 1999. *The Ecological Indian: Myth and Reality.* New York: Norton.

Kroes, Robert, and J. H. Weisburger. 2000. "Nutrition and Cancer." In *The Cambridge World History of Food,* edited by Kenneth Kiple and Kriemhild C. Ornelas, 1086–1096. Cambridge: Cambridge University Press.

Krondl, Michael. 2007. *The Taste of Conquest: The Rise and Fall of the Three Great Cities of Spice*. New York: Ballantine Books.

Kronenfeld, David B. 1979. "Innate Language?" *Language Sciences* 1:209–239.

———. 1996. *Plastic Glasses and Church Fathers: Semantic Extension from the Ethnoscience Tradition.* New York: Oxford University Press.

Kroodsma, Donald. 2005. *The Singing Life of Birds: The Art and Science of Listening to Birdsong.* New York: Houghton Mifflin.

Kupferschmidt, Kai. 2012. "Amid Europe's Food Fights, EFSA Keeps Its Eyes on the Evidence." *Science* 338:1146–1147.

Laderman, Carole. 1981. "Symbolic and Empirical Reality: A New Approach to the Analysis of Food Avoidances." *American Ethnologist* 8:468–493.

Lakoff, George, and Mark Johnson. 1999. *Philosophy in the Flesh.* New York: Basic Books.

———. 2003. *Metaphors We Live By*. 2nd ed. Chicago:University of Chicago Press.

Lang, George. 1971. *The Cuisine of Hungary.* New York: Atheneum.

Laland, Kevin N., Kim Sterelny, John Odling-Smee, William Hoppitt, and Tobias Uller. 2011. "Cause and Effect in Biology Revisited: Is Mayr's Proximate-Ultimate Dichotomy Still Useful?" *Science* 334:1512–1516.

Lang, James. 2001. *Notes of a Potato Watcher.* College Station: Texas A & M Press.

Langer, Ellen. 1983. *The Psychology of Control.* Beverly Hills, CA: Sage.

Lappé, Frances Moore. 1971. *Diet for a Small Planet.* New York: Ballantine.

Lappé, Frances Moore, and Joseph Collins. 1971. *Food First.* San Francisco: Institute for Food and Development Policy.

Laszlovszky, Jozsef, ed. 1998. *Tender Meat under the Saddle: Customs of Eating, Dinking and Hospitality among Conquering Hungarians and Nomadic Peoples.* Krems, Austria: Medium Aevum Quotidianum.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

Laudan, Rachel. 1998. *The Food of Paradise.* Honolulu: University of Hawaii Press.

———. 2004. "Slow Food, the French Terroir Strategy, and Culinary Modernism: A Review Essay on Carlo Petrini, trans. William McCuaig, *Slow Food: The Case for Taste* (New York: Columbia University Press)." *Food Culture and Society: An International Journal of Multidisciplinary Research* 7:133–144.

Laufer, Berthold. 1919. *Sino-Iranica.* Chicago: Field Museum.

Lave, Jean. 1988. *Cognition in Practice.* Cambridge: Cambridge University Press.

Lawless, H. 1991. "Effects of Odors on Mood and Behavior: Aromatherapy and Related Effects." In *The Human Sense of Smell,* edited by D. G. Laing, R. L. Doty, and W. Breipohl, 361–386. New York: Springer-Verlag.

Leach, Edmund. 1964. "Anthropological Categories of Verbal Abuse." In *New Directions in the Study of Language,* edited by Eric Lenneberg, 23–64. Cambridge, MA: MIT Press.

Lee, Richard Borshay. 1973. "Mongongo: The Ethnography of a Major Wild Food Resource." *Ecology of Food and Nutrition* 2:307–313.

Lee, Richard, and Irven Devore, eds. 1962. *Man the Hunter.* Cambridge, MA: Harvard University Press.

Lentz, Carola, ed. 1999. *Changing Food Habits: Case Studies from Africa, South America, and Europe.* Newark, NJ: Gordon & Breach.

Le Roy Ladurie, Emmanuel. 1971. *Times of Feast, Times of Famine: A History of Climate Change since the Year 1000,* translated by Barbara Bray. Garden City, NY: Doubleday.

Levenstein, Harvey. 2012. *Fear of Food: A History of Why We Worry about What We Eat*. Chicago: University of Chicago Press.

Lévi-Strauss, Claude. 1962. *La Pensee sauvage.* Paris: Plon.

———. 1964. *Le Cru et le Cuit.* Vol. 1 of *Mythologiques.* Paris: Plon. (Translated as *The Raw and the Cooked* by John Weightman and Doreen Weightman. New York: Harper & Row, 1969.)

———. 1964–1972. *Mythologiques.* 4 vols. Paris: Plon.

Lewis, Walter, and Memory Elvin-Lewis. 1976. *Medical Botany.* New York: Wiley.

Li, Lillian. 2007. *Fighting Famine in North China: State, Market, and Environmental Decline, 1690s–1990s.* Stanford, CA: Stanford University Press.

Li, Tania Murray. 2007. *The Will to Improve: Governmentality, Development, and the Practice of Politics.* Durham, NC: Duke University Press.

Li, Wen, James D. Howard, Todd B. Parrish, and Jay A. Gottfried. 2008. "Aversive Learning Enhances Perceptual and Cortical Discrimination of Indiscriminable Odor Cues." *Science* 319:1842–1845.

Lieberman, Leslie Sue. 2008. "Diabesity and Darwinian Medicine: The Making of an Epidemic." In *Evolutionary Medicine and Health: New Perspectives,* edited by Wenda Treviathan, Eric O. Smith, and James J. McKenna, 72–95. New York: Oxford University Press.

Liu, Xin. 2000. *In One's Own Shadow.* Berkeley: University of California Press.

Logue, Alexandra W. 1986. *The Psychology of Eating and Drinking.* New York: W. H. Freeman.

LoMonte, Mimmetta. 1990. *Mimmetta LoMonte's Classic Sicilian Cookbook.* New York: Simon & Schuster.

Long, Janet. 2000. "Tomatoes." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 351–358. Cambridge: Cambridge University Press.

Lorig, Tyler S., and Gary E. Schwartz. 1988. "Brain and Odor: I. Alternation of Human EEG by Odor Administration." *Psychobiology* 16:281–284.

Lovejoy, C. Owen. 1981. "The Origin of Man." *Science* 211:341–350.

Lucas, John R. 2008. "Fertility and Agriculture Accentuate Sex Differences in Dental Caries Rates." *Current Anthropology* 49:901–914.

Lustig, Robert H., Laura A. Aschmidt, and Claie D. Brindis. 2012. "The Toxic Truth about Sugar." *Nature* 482:27–29.

Lutter, Chessa K., and Randall Lutter. 2012. "Fetal and Early Childhood Undernutrition, Mortality, and Lifelong Health." *Science* 337:1495–1499.

Lyman, Bernard. 1989. *A Psychology of Food: More Than a Matter of Taste.* New York: Van Nostrand Reinhold.

MacNeish, Richard S. 1992. *The Origins of Agriculture and Settled Life.* Norman: University of Oklahoma Press.

Magdoff, Fred, John Bellamy Foster, and Frederick H. Buttel, eds. 2000. *Hungry for Profit: The Agribusiness Threat to Farmers, Food, and the Environment.* New York: Monthly Review Press.

Malinowski, Bronislaw. 1922. *Argonauts of the Western Pacific.* New York: Dutton.

———. 1935. *Coral Gardens and Their Magic.* Cincinnati, OH: American Book Company.

———. 1944. *A Scientific Theory of Culture.* Chapel Hill: University of North Carolina Press.

Mallory, Walter. 1926. *China: Land of Famine.* Special Publication no. 6. New York: American Geographic Society.

Mann, Alan E. 1987. “Diet and Human Evolution.” In *Omnivorous Primates,* edited by Robert S. O. Harding and Geza Teleki, 10–36. New York: Columbia University Press.

Mann, Charles C. 2011. “The Birth of Religion.” Photographs by Vincent J. Musi. *National Geographic* (June): 34–59.

Marks, Jonathan. 2002. *What It Means to Be 98 Percent Chimpanzee: Apes, People, and Their Genes.* Berkeley: University of California Press.

———. 2010. The Alternative Introduction to Biological Anthropology. New York: Oxford University Press.

Marks, Robert. 1997. *Tigers, Rice, Silk, and Silt: Environment and Economy in Late Imperial South China.* Stanford, CA: Stanford University Press.

Marler, Peter, and Hans Slabbekoorn, eds. 2004. *Nature's Music: The Science of Birdsong.* Amsterdam: Elsevier.

Marr, K. L., and C. S. Tang. 1992. “Volatile Insecticidal Compounds and Chemical Variability of Hawaiian *Zanthoxylum* (Rutaceae) Species.” *Biochemical Systematics and Ecology* 20:209–217.

Marx, Karl. 1986. *Karl Marx: A Reader,* edited by Jon Elster. Cambridge: Cambridge University Press.

Marzluff, John, and Russell Balda. 1992. *The Pinyon Jay.* London: Poyser.

Maslow, Abraham. 1970. *Motivation and Personality.* 2nd ed. New York: Harper & Row.

Mason, Sarah L. R., Jon G. Hather, and Gordon C. Hillman. 1994. “Preliminary Investigation of the Plant Macro-remains from Dolni Vestonice II and Its Implications for the Role of Plant Foods in Palaeolithic and Mesolithic Europe.” *Antiquity* 68:48–57.

Matalas, Antonia L., et al. 2001. *The Mediterranean Diet: Constituents and Health Promotion.* Boca Raton, FL: CRC Press.

Mattison, Julie A., George S. Roth, T. Mark Beasley, Edward M. Tilmont, April M. Handy, Richard L. Herbert, Dan L. Longo, David B. Allison, Jennifer E. Young, Mark Bryant, Dennis Barnard, Water F. Ward, Wenbo Qi, Donald K. Ingram, and Rafael de Cabo. 2012. “Impact of Caloric Restriction on Health and Survival in Rhesus Monkeys from the NIA Study.” *Nature* 489:318–321.

Maugh, Thomas H., II. 1982. “The Scent Makes Sense.” *Science* 215:1224.

———. 2007. “Study Finds Garlic ‘Just Didn't Work.’” *Los Angeles Times* (February 27): A4.

Maxmen, Amy. 2012. “Calorie Restriction Falters in the Long Run.” *Nature* 488:569.

McCartney, William. 1968. *Olfaction and Odors.* New York: Springer-Verlag.

McCay, Bonnie. 1998. *Oyster Wars and the Public Trust.* Tucson: University of Arizona Press.

McCorriston, Joy. 2000. “Wheat.” In *The Cambridge World History of Food*, edited by Kenneth Kiple and B. Ornelas, 1:158–174. Cambridge: Cambridge University Press.

McCune, Letitia M., and Harriet V. Kuhnlein. 2011. "Assessment of Indigenous Peoples' Traditional Food and Nutrition Systems." In *Ethnobiology,* edited by E.N. Anderson, D. Pearsall, E. Hunn and N. Turner, 249–266. Hoboken, NJ: Wiley & Sons.

McGee, Harold. 1984. *On Food and Cooking.* New York: Scribner's.

———. 2004. *On Food and Cooking: The Science and Lore of the Kitchen.* Rev. ed. New York: Scribner's.

McGovern, Patrick. 2009. *Uncorking the Past: The Quest for Wine, Beer, and Other Alcoholic Beverages.* Berkeley: University of California Press.

McGovern, Patrick E., Stuart J. Fleming, and Solomon H. Katz. 1996. *The Origins and Ancient History of Wine.* Amsterdam: Gordon &Breach.

McGovern, Thomas, Gerald Bigelow, Thomas Amorosi, and Daniel Russell. 1988. "Northern Islands, Human Error, and Environmental Degradation." *Human Ecology* 16:225–270.

McGrew, W. C. 2000. "Dental Care in Chimps." Letter. *Science* 288:1747.

McPhail, Deborah, Brenda Beagan, and Gwen E. Chapman. 2012. "'I Don't Want to Be Sexist But . . . ': Denying and Re-Inscribing Gender through Food." *Food, Culture and Society* 15:473–489.

McPherron, Shannon, Zeresenay Alemseged, Curis W. Marean, Jonathan G. Wynn, Denné Reed, Denis Geraads, René Bobe, and Hamdallah A. Béarat. 2010. "Evidence for Stone-Tool-Assisted Consumption of Animal Tissues before 3.39 Million Years Ago at Kikika, Ethiopia." *Nature* 466:857–860.

Mead, George Herbert. 1964. *The Social Psychology of George Herbert Mead,* edited by Anselm Strauss. Chicago: University of Chicago Press.

Médecin, Jacques. 1972. *La bonne cuisine du Comté de Nice.* Paris: Solar.

The Medieval Health Handbook: Tacuinum Sanitatis. 1976. Translated and edited by Luisa Cogliati Arano. New York: George Braziller.

Meigs, Anna S. 1984. *Food, Sex, and Pollution: A New Guinea Religion.* New Brunswick, NJ: Rutgers University Press.

———. 1997. "Food as a Cultural Construction." In *Food and Culture: A Reader,* edited by Carole Counihan and Penny van Esterik, 95–106. New York: Routledge.

Mencius. 1960. *The Book of Mencius*, translated by James Legge. Hong Kong: Hong Kong University Press.

Mennell, Stephen, Anne Murcott, and A. H. Van Otterloo. 1992. *The Sociology of Food: Eating, Diet, and Culture.* London: Sage.

Mensink, Ronald P., Peter L. Zock, Arnold D. M. Kester, and Martijn B. Katen. 2003. "Effects of Dietary Fatty Acids and Carbohydrates on the Ratio of Serum Total to HDL Cholesterol and on Serum Lipids and Apolipoproteins: A Meta-analysis of 60 Controlled Trials." *American Journal of Clinical Nutrition* 77:1146–1155.

Menzel, Peter, and Faith D'Aluisio. 1998. *Man Eating Bugs: The Art and Science of Eating Insects.* Berkeley, CA: Ten Speed Press.

Messer, Ellen. 1984. "Anthropological Perspectives on Diet." *Annual Review of Anthropology* 13:205–249.

———. 1997. "Intra-household Allocation of Food and Health Care: Current Findings and Understandings—Introduction." *Social Science and Medicine* 44:1675–1684.

Mestel, Rosie. 2000. "The Food Pyramid: Does It Miss the Point?" *Los Angeles Times* (September 1): 1, 30.

———. 2002. "Chimps May Have Something to Tell Us." *Los Angeles Times* (April 12): A1, A20.

Metchnikoff, Elie. 1908. *The Prolongation of Life*, translated by P. Chambers Mitchell. New York: G. P. Putnam's Sons.

Metchnikoff, Olga. 1921. *Life of Elie Metchnikoff, 1845–1916*. Boston: Houghton Mifflin.

Mielke, James, Lyle W. Konigsberger, and John Relethford. 2006. *Human Biological Variation*. Oxford: Oxford University Press.

Mikhail, Alan. 2011. *Nature and Empire in Ottoman Egypt: An Environmental History.* Cambridge: Cambridge University Press.

Milham, Mary Ella. 1998. *Platina on Right Pleasure and Good Health.* Tempe: Arizona State University Press.

Miller, J. Innes. 1969. *The Spice Trade of the Roman Empire.* Oxford: Oxford University Press.

Milton, Katharine. 1993. "Diet and Primate Evolution." *Scientific American* 269:86–93.

———. 2000a. "Back to Basics: Why Foods of Wild Primates Have Relevance for Modern Human Health." *Nutrition* 16:480–483.

———. 2000b. "Hunter-Gatherer Diets: A Different Perspective." *American Journal of Clinical Nutrition* 71:665–667.

———. 2000c. "Quo Vadis? Tactics of Food Search and Group Movement in Primates and Other Animals." In *On the Move: How and Why Animals Travel in Groups,* edited by Sue Boinski and Paul A. Garber, 375–417. Chicago: University of Chicago Press.

"Minty Insecticide." 2000. *Scientific American* (February): 24.

Mintz, Sidney. 1985. *Sweetness and Power.* New York: Viking Penguin.

———. 1996. *Tasting Food, Tasting Freedom.* Boston: Beacon Press.

———. 2002. "Food for Thought." In *The Globalization of Chinese Food,* edited by David Wu and Sidney Cheung, xii–xx. Richmond, Surrey: Curzon Press.

———. 2010. *Three Ancient Colonies: Caribbean Themes and Variations*. Cambridge, MA: Harvard University Press.

Mithen, Steve. 2005. *The Singing Neanderthals: The Origins of Music, Language, Mind and Body.* Weidenfeld & Nicolson.

Mo Di. 2010 [ca. 300 BCE]. *The Mozi,* translated by Ian Johnston. Hong Kong: Chinese University of Hong Kong. (Texts originally composed in Chinese.)

Moncrief, R. W. 1966. *Odour Preferences.* New York: Wiley.

Morales, Edmundo. 1995. *The Guinea Pig: Healing, Food, and Ritual in the Andes.* Tucson: University of Arizona Press.

Morales Rodríguez, María Teresa, and Juana Rosa Martínez García. 1999. *La cocina tradicional cordobesa.* Córdoba: Ateneo de Córdoba.

Morgan, Lewis Henry. 1877. *Ancient Society.* New York: Holt.

Mullins, Paul R. 2008. *Glazed America: A History of the Doughnut.* Gainesville: University Press of Florida.

Mulville, J., and A. K. Outram, eds. 2005. *The Zooarchaeology of Fats, Oils, Milk and Dairying.* Oxford: Oxbow Books.

Murcott, Anne, ed. 1984. *The Sociology of Food and Eating.* Aldershot, Hampshire: Gower.

Murton, Brian. 2000. "Famine." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1411–1427. Cambridge: Cambridge University Press.

Myers, Norman, with Jennifer Kent. 1998. *Perverse Subsidies: Tax Dollars Undercutting Our Economies and Environments Alike.* Winnipeg: International Institute for Sustainable Development.

Nabhan, Gary Paul. 2004. *Why Some Like It Hot: Food, Genes, and Cultural Diversity.* Washington, DC: Island Press.

———. 2008a. *Renewing America's Food Traditions: Saving and Savoring the Continent's Most Endangered Foods.* Foreword by Deborah Madison. White River Junction, VT: Chelsea Green Publishing Co.

———. 2008b. *Where Our Food Comes From: Retracing Nikolay Vavilov's Quest to End Famine.* Washington, DC: Island Press.

Nash, J. Madeleine. 2002. "Cracking the Fat Riddle." *Time* (September 2): 45–55.

———. 2003. "Obesity Goes Global." *Time* (August 25): 53–54.

Nasrallah, Nawal. 2003 [1999]. *Delights from the Garden of Eden: A Cookbook and a History of the Iraqi Cuisine.* N.p.: author.

National Academy of Sciences. 2002. "Report Offers New Eating and Physical Activity Targets to Reduce Chronic Disease Risk." Press release, September 5. Washington, DC: National Academy of Sciences.

National Research Council. 1989. *Lost Crops of the Incas.* Washington, DC: National Academy Press.

———. 1996. *Lost Crops of Africa.* Vol. 1, *Grains.* Washington, DC: National Academy Press.

———. 2006. *Lost Crops of Africa.* Vol. 2, *Vegetables.* Washington, DC: National Academy Press.

Nature. 2007. "Food for Thought: Science Needs to Be Better Applied to the US Food-Safety System." 445:683–684.

Navarrete, Ana, Carel P. van Schaik, and Karin Isler. 2011. "Energetics and the Volution of Human Brain Size." *Nature* 480:91–94.

Naylor, Audrey. 1997. *The Impact of Breastfeeding on Long-Term Health Outcomes Worldwide,* 5 pages. Washington, DC: Wellstart International.

Neergaard, Lauran. 2007. "Little Milk, Exercise Hurts Children's Bones." *Associated Press Online* (November 26), www.highbeam.com/doc/1A1-D8T5I2EO1.html.

Nestle, Marion. 2002. *Food Politics: How the Food Industry Influences Nutrition and Health.* Berkeley: University of California Press.

Netting, Robert. 1993. *Smallholders, Householders.* Stanford, CA: Stanford University Press.

Newall, Virginia. 1971. *An Egg at Easter.* Bloomington: Indiana University Press.

Nijveldt, Robert J., E. van Nood, D. E. van Hoorn, P. G. Boelens, K. van Norren, and P. A. van Leeuwen. 2001. "Flavonoids: A Review of Probable Mechanisms of Action and Potential Applications." *American Journal of Clinical Nutrition* 74:418–425.

Nishida, Toshisada, Hajime Ohigashi, and Koichi Koshimizu. 2000. "Tastes of Chimpanzee Foods." *Current Anthropology* 41, no. 3:431–438.

Nissenbaum, Stephen. 1980. *Sex, Diet, and Debility in Jacksonian America: Sylvester Graham and Health Reform.* Westport, CT: Greenwood.

Noakes, Timothy, and Michael Spedding. 2012. "Run for Your Life." *Nature* 4387:295–296.

Nohl, Johannes. 1961. *The Black Death.* London: Unwin.

Norman, Barbara. 1972. *Tales of the Table.* New York: Prentice-Hall.

Nunn, John. 1996. *Ancient Egyptian Medicine.* Norman: University of Oklahoma Press.

Nunney, Leonard. 1998. "Are We Selfish, Are We Nice, or Are We Nice Because We Are Selfish?" [Review of Sober and Wilson 1999.] *Science* 281:1619–1620.

Nyerges, Christopher. 1995. *In the Footsteps of Our Ancestors: Guide to Wild Foods.* 4th rev. ed. Los Angeles: Survival News Service.

O'Brien, Eileen M., and Charles R. Peters. 1999. "Landforms, Climate, Ecogeographic Mosaics, and the Potential for Hominid Diversity in Pliocene Africa." In *African Biogeography, Climate Change, and Human Evolution,* edited by Timothy Bromage and Friedemann Schrenk, 115–137. New York: Oxford University Press.

Ohnuki-Tierney, Emiko. 1993. *Rice as Self.* Princeton, NJ: Princeton University Press.

Oldenburg, Ray. 1989. *The Great Good Place.* New York: Paragon House.

Orans, Martin. 1975. "Domesticating the Functional Dragon: An Analysis of Piddocke's Potlatch." *American Anthropologist* 77:312–328.

Oreskes, Naomi, and Erik M. Conway. 2010. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming.* New York: Bloomsbury Press.

Orians, Gordon, and Judith Heerwagen. 1992. "Evolved Responses to Landscapes." In The Adapted ind, edited by Jerome H. Barkow, Leda Cosmides, and John Tooby, 555–579. New York: Oxford University Press.

Ortiz de Montellano, Bernard R. 1990. *Aztec Medicine, Health, and Nutrition.* New Brunswick, NJ: Rutgers University Press.

Ott, Sandra. 1981. *The Circle of Mountains.* London: Oxford University Press.

Parsons, Jeffrey R. 2008. "Beyond Santley and Ross (1979): The Role of Aquatic Resources in the Prehispanic Economy of the Bazsin of Mexico." *Journal of Anthropological Research* 64:351–366.

Patel, Raj. 2007. *Stuffed and Starved: The Hidden Battle for the World Food System.* Brooklyn: Melville House.

Patterson, K. David. 2000. "Lactose Intolerance." In *The Cambridge World History of Food,* ed. Kenneth Kiple and K. Ornelas, 1057–1062. Cambridge: Cambridge University Press.

Peace Corps The Gambia. 1995. *Wollof-English Dictionary.* Banjul: Peace Corps The Gambia. www.africanculture.dk/gambia/ftp/wollof.pdf.

Pelto, Gretel. 2000. "Perspectives on Infant Feeding: Decision-Making and Ecology." In *Nutritional Anthropology: Biocultural Perspectives on Food and Nutrition,* edited by Alan Goodman, Darna Dufour, and Gretel Pelto, 298–311. Mountain View, CA: Mayfield.

Pennington, Jean, and Judith Spungen. 2009. *Bowes and Church: Food Values of Potions Commonly Used.* 19th ed. Philadelphia: Lippincott-Raven.

Pennisi, Elizabeth. 1999. "Did Cooked Tubers Spur the Evolution of Big Brains?" *Science* 283:2004–2005.

Perry, Charles. 2001. "Elements of Arab Feasting." In *Medieval Arab Cookery,* edited by Maxime Rodinson, A. J. Arberry, and Charles Perry, 225–232. London: Prospect Books.

Petherick, Anna. 2010. "Mother's Milk: A Rich Opporunity." *Nature* 468:S5–S7.

Petrinovich, Lewis. 1995. *Human Evolution, Reproduction, and Morality.* New York: Plenum.

Peyton, James. 1994. *La Cocina de la Frontera.* Santa Fe, NM: Red Crane.

Piddocke, Stuart. 1965. "The Potlatch System of the Southern Kwakiutl: A New Perspective." *Southwestern Journal of Anthropology* 21:244–264.

Pilcher, Jeffrey M. 1998. *Que vivan los tamales! Food and the Making of Mexican Identity*. Albuquerque: University of New Mexico Press.

Pinker, Steven. 1997. *How the Mind Works.* New York: Norton.

Piper, Charles V., and W. J. Morse. 1923. *The Soybean*. New York: McGraw-Hill.

Piperno, Dolores, and Deborah Pearsall. 2000. *Origins of Agriculture in the Neotropics.* New York: Academic Press.

Piqueras-Fiszman, Betina, and Charles Spence. 2012. "Sensory Incongruity in the Food and Beverage Sector." *Petits Propos Culinaires* 95:74–115.

Poehlman, Eric T., and Edward S. Horton. 1999. "Energy Needs: Assessment and Requirements in Humans." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James Olson, Moshe Shike, and A. Catharine Ross, 95–104. Philadelphia: Lippincott Williams & Wilkins.

Pollan, Michael. 2005. *The Omnivore's Dilemma*: *A Natural History of Four Meals.* New York: Penguin.

Pollock, Nancy J. 1992. *These Roots Remain: Food Habits in Islands of the Central and Eastern Pacific since Western Contact*. Honolulu: University of Hawaii Press.

Popkin, Barry M. 2006. "Global Nutrition Dynamics: The World Is Shifting Rapidly toward a Diet Linked with Noncommunicable Diseases." *American Journal of Clinical Nutrition* 84:289–298.

Porphyry. 2000. *On Abstinence from Killing Animals,* translated by Gillian Clark. Ithaca, NY: Cornell University Press.

Post, John. 1976. *The Last Great Subsistence Crisis in the Western World.* Baltimore, MD: Johns Hopkins University Press.

Pottier, Johan. 1999. *Anthropology of Food: The Social Dynamics of Food Security.* Cambridge: Polity Press.

Potts, Richard. 1996. *Humanity's Descent: The Consequences of Ecological Instability.* New York: William Morrow.

Prescott, Heather Munro. 2000. "Anorexia Nervosa." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1057–1062. Cambridge: Cambridge University Press.

Prescott, John. 2012. *Taste Matters: Why We Like the Foods We Do.* London: Reaktion Books.

Price, T. Douglas, and Ofer Bar-Yosef, eds. 2011. "The Origins of Agriculture: New Data, New Ideas." *Current Anthropology* 52, no. 4 (supplement). doi:10.1086/659964.

Pritchard, John. 1977. "Economic Development among the Haisla." PhD diss., Department of Anthropology and Sociology, University of British Columbia.

Profet, Margie. 1992. "Pregnancy Sickness as Adaptation: A Deterrent to Maternal Ingestion of Teratogens." In *The Adapted Mind,* edited by Jerome H. Barkow, Leda Cosmides, and John Tooby, 327–366. New York: Oxford University Press.

Psouni, Elia, Axel Janke, and Martin Garwicz. 2012. "Impact of Carnivory on Human Evolution Revealed by a New Unifying Model of Weaning in Mammals." *PLoS One* 7, no. 4 (April 18): e32452. doi:10.1371/journal.pone.0032452.

Purseglove, J. W., E. G. Brown, C. L. Green, and S. R. J. Robbins. 1981. *Spices.* London: Longmans.

Quandt, Sarah. 2000. "Infant and Child Nutrition." In *The Cambridge World History of Food,* edited by Kenneth Kiple and K. Ornelas, 1444–1453. Cambridge: Cambridge University Press.

Ramos-Elorduy, Julieta. 1998. *Creepy Crawly Cuisine: The Gourmet Guide to Edible Insects.* Photographs by Peter Menzel. Rochester, VT: Park Street Press.

Ramos-Elorduy de Conconi, Julieta. 1991. *Los insectos como fuente de proteínas en el futuro.* Mexico: Limusa.

Ramos-Elorduy, Julieta, and José Manuel Pino Moreno. 1989. *Los insectos comestibles en el México antiguo.* Mexico: AGT Editor.

Rasmussen, Knud. 1927. *Across Arctic America.* New York: Putnam.

———. 1931. *The Netsilik Eskimo.* Reports of the Fifth Thule Expedition, VIII. Copenhagen: n.p.

Rebar, Robert W. 1994. "The Breast and the Physiology of Lactation." In *Maternal-Fetal Medicine: Principles and Practice,* edited by Robert Creasy and Robert Resnik, 144–161. Philadelphia: Saunders.Redon, Odile, Françoise Sabban, and Silvano Serventi. 1991. *La Gastronomie au Moyen Âge.* Paris: Stock.

Reed, Matthew. 2010. *Rebels for the Soil: The Rise of the Global Organic Food and Farming Movement*. London: Routledge.

Reynolds, Philip Lyndon. 1999. *Food and the Body: Some Peculiar Questions in High Medieval Theology*. Leiden: Brill.

Richards, Audrey. 1939. *Land, Labor, and Diet in Northern Rhodesia*. London: Routledge.

———. 1948 [1932]. *Hunger and Work in a Savage Tribe*. Glencoe, IL: Free Press.

Richerson, Peter, and Robert Boyd. 2005. *Not By Genes Alone: How Culture Transformed Human Evolution*. Chicago: University of Chicago Press.

Richerson, Peter J., Robert Boyd, and Robert L. Bettinger. 2001. "Was Agriculture Impossible during the Pleistocene but Mandatory during the Holocene? A Climate Change Hypothesis." *American Antiquity* 66:387–411.

Ridley, Matt. 1996. *The Origins of Virtue*. New York: Viking Penguin.

Rifkin, Jeremy. 1992. *Beyond Beef: The Rise and Fall of the Cattle Culture*. New York: Dutton.

Roberts, Michelle. 2012. "Chocolate 'May Help Keep People Slim.'" *BBC News Online*, March 27.

Robertson, D. G. 1896. *The Kafirs of the Hindu Kush*. London: Lawrence & Bullen.

Robinson, Cyril D. 1998. "The Bagel and Its Origins—Mythical, Hypothetical and Undiscovered." *Petits Propos Culinaires* 58:42–46.

Rodinson, Maxime, A. J. Arberry, and Charles Perry. 2001. M*edieval Arab Cookery*. Totnes, Devon: Prospect Books.

Rodríguez-Alegría, Enrique. 2005. "Eating Like an Indian: Negotiating Social Relations in the Spanish Colonies." *Current Anthropology* 46:551–564.

Roodman, David. 1998. *The Natural Wealth of Nations*. Washington, DC: Island Press.

Root, Waverly. 1958. *The Food of France*. New York: Random House.

———. 1971. *The Food of Italy*. New York: Random House.

Roseberry, William. 1996. "The Rise of Yuppie Coffees and the Reimagination of Class in the United States." *American Anthropologist* 98:762–775.

Rosner, Fred. 1997. *Medicine in the Mishneh Torah of Maimonides*. Northvale, NJ: Jason Aronson.

Ross, Catharine. 1999. "Vitamin A and Retinoids." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James A. Olson, Moshe Shike, and A. Catherine Ross, 305–327. Philadelphia: Lippincott Williams & Wilkins.

Rosset, Peter. 2011. "Preventing Hunger: Change Economic Policy." *Nature* 479:472–473.

Rouby, Catherine, ed. 2002. *Olfaction, Taste, and Cognition*. Cambridge: Cambridge University Press.

Rourke, Mary. 2007. "Coffee Master Alfred Peet, 87, Inspired Starbucks." *Seattle Times* (September 1). http://seattletimes.com/html/businesstechnology/2003863399_peet01.html.

Rousseau, Jean-Jacques. 1983 [1782]. *On the Social Contract,* translated by Donald A. Cress. Indianapolis: Hackett. (Originally published in French.)

Rozin, Elisabeth. 1983. *Ethnic Cuisine: The Flavor-Principle Cookbook.* Lexington, MA: Stephen Greene Press.

Rozin, Paul. 1982. "Human Food Selection: The Interaction of Biology, Culture, and Individual Experience." In *The Psychobiology of Human Food Selection,* edited by Lewis M. Barker, 225–254. Westview, CT: AVI.

———. 1987. "Sweetness, Sensuality, Sin, Safety, and Socialization: Some Speculations." In *Sweetness,* edited by John Dobbing, 99–111. London: Springer-Verlag.

———. 1988. "Social Learning about Food by Humans." In *Social Learning: Psychological and Biological Perspectives,* edited by Thomas R. Zentall and Bennett G. Galef, Jr, 165–187. Hillsboro, NJ: Erlbaum..

Rozin, Paul, and April E. Fallon. 1981. *The Acquisition of Likes and Dislikes for Foods.* Unpaginated pamphlet offprinted from *Criteria of Food Acceptance,* edited by J. Solms and R. L. Hall. Zurich: Foster Verlag.

Rozin, Paul, Linda Millman, and Carol Nemeroff. 1986. "Operation of the Laws of Sympathetic Magic in Disgust and Other Domains." *Journal of Personality and Social Psychology* 50:703–712.

Rozin, Paul, and Deborah Schiller. 1980. "The Nature and Acquisition of a Preference for Chili Pepper by Humans." *Motivation and Emotion* 4:77–101.

Rubel, William. 2011. *Bread: A Global History.* London: Reaktion Books.

Rummel, Rudolph. 1998. *Statistics of Democide.* Münster: LIT Verlag.

Ryokan. 1996. *Great Fool: Zen Master Ryōkan,* translated by Ryūichi Abé and Peter Haskell. Honolulu: University of Hawai'i Press.

Sabban, Françoise, and Silvano Serventi. 1997. *La Gastronomie à la Renaissance.* Paris: Stock.

———. 1998. *La Gastronomie au Grand Siècle.* Paris: Stock.

Sachs, Jeffrey D. 2009. "Transgressing Planetary Boundaries," *Scientific American* (December): 36.

Sacks, Oliver. 1987. *The Man Who Mistook His Wife for a Hat.* New York: Harper & Row.

Sahagun, Bernardino de. 1950–1982 [mid-sixteenth century]. *Codex Florentinus,* translated by A. Anderson and Charles Dibble. Salt Lake City: University of Utah Press. (Originally published in Spanish.)

Sahlins, Marshall. 1976. *Culture and Practical Reason.* Chicago: University of Chicago Press.

Salaman, Redcliffe. 1985. *The History and Social Influence of the Potato.* Cambridge: Cambridge University Press.

Sanchez, Pedro A. 2009. "A Smarter Way to Combat Hunger." *Science* 323:148.

Saporito, Bill. 2012. "Starbucks' Big Mug." *Time* (June 25): 52–54.

Sauer, Carl. 1952. *Agricultural Origins and Dispersals.* Berkeley: University of California Press.

Scarmeas, Nikolaus, Yaakov Stern, Ming-Xin Tang, Richard Mayeux, and Jose Luchsinger. 2006. "Mediterranean Diet and Risk for Alzheimer's Disease." *Annals of Neurology* 59, no. 6: 912–921. doi:10.1002/ana.20854.

Scharfenberg, Horst. 1989. *The Cuisines of Germany.* New York: Poseidon Press.

Schlosser, Eric. 2001. *Fast Food Nation.* New York: HarperCollins.

Schmidt, Hilary J., and Gary Beauchamp. 1992. "Human Olfaction in Infancy and Early Childhood." In *Science of Olfaction,* edited by Michael J. Serby and Karen L. Chobor, 378–395. New York: Springer-Verlag.

Schoeninger, Margaret. 2012. "The Ancestral Dinner Table." *Nature* 487:42–43.

Schulz, Richard. 1976. "Some Life and Death Consequences of Perceived Control." In *Cognition and Social Behavior,* edited by John S. Carroll and John Payne, 135–153. New York: Academic Press.

Schwabe, Calvin. 1979. *Unmentionable Cuisine.* Charlottesville: University of Virginia Press.

Science. 2003. Special issue: "Obesity." 299 (February 7): 845–860.

Scrimshaw, Nevin, ed. 1995. *Community-Based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti, and Mexico.* Boston: International Foundation for Developing Countries.

Scudder, Thayer. 2005. *The Future of Large Dams: Dealing with Social, Environmental, Institutional and Political Costs.* London: Earthscan.

Scully, Terence. 1995. *The Art of Cookery in the Middle Ages.* Woodbridge, Suffolk: Boydell & Brewer.

Seeley, Thomas D., and Gene E. Robinson. 2012. "Molecular Determinants of Scouting Behavior in Honey Bees." *Science* 335:1225–1228.

Seely, Stephen. 2000. "The Cardiovascular System, Coronary Artery Disease, and Calcium: A Hypothesis." In *The Cambridge World History of Food,* ed. Kenneth Kiple and K. Ornelas, 1109–1120. Cambridge: Cambridge University Press.

Sen, Amartya. 1984. *Resources, Values, and Development.* Cambridge, MA: Harvard University Press.

———. 1992. *Inequality Reexamined.* Cambridge, MA: Harvard University Press/Russell Sage Foundation.

Serageldin, Ismail. 2002. "World Poverty and Hunger: The Challenge for Science." *Science* 296:54–58.

Serby, Michael J., and Chobor, Karen L., eds. 1992. *Science of Olfaction.* New York: Springer-Verlag.

Serventi, Silvano, and Françoise Sabban. 2002 [2000]. *Pasta: The Story of a Universal Food,* translated by Anthony Sugaar. New York: Columbia University Press. (Originally published in French.)

Seufert, Verena, Navin Ramankutty, and Jonathan A. Foley. 2012. "Comparing the Yields of Organic and Conventional Agriculture." *Nature* 485:229–232.

Shankman, Paul. 1969. "Le Rôti et le Bouilli: Lévi-Strauss' Theory of Cannibalism." *American Anthropologist* 71:54–69.

Sharman, Anne. 1991. *Diet and Domestic Life in Society.* Philadelphia: Temple University Press.

Shepard, Gordon M. 2012. *Neurogastronomy: How the Brain Creates Flavor and Why It Matters.* New York: Columbia University Press.

Sheridan, Thomas. 1995. *Where the Dove Calls.* Tucson: University of Arizona Press.

Sherman, Paul, and Jennifer Billing. 1999. "Darwinian Gastronomy: Why We Use Spices." *BioScience* 4:453–463.

Sherman, Paul, and Samuel M. Flaxman. 2001. "Protecting Ourselves from Food." *American Scientist* 89:142–151.

Shils, Maurice, James Olson, Moshe Shike, and A. Catharine Ross, eds. 1999. *Modern Nutrition in Health and Disease.* Philadelphia: Lippincott Williams & Wilkins.

Shipman, Pat. 2001. "A Worm's Eye View of Human Evolution." *American Scientist* 90:508–510.

———. 2009. Review of Richard Wrangham, *Catching Fire: How Cooking Made Us Human. Nature* 459:1059–1060.

Shiva, Vandana. 1997. *Biopiracy: The Plunder of Nature and Knowledge.* Boston: South End Press.

Simeti, Mary Taylor. 1989. *Pomp and Sustenance: Twenty-Five Centuries of Sicilian Food.* Hopewell, NJ: Ecco Press.

Simon, Stephanie. 2002. "Hope Has Dried Up on Farms." *Los Angeles Times* (September 16): A1, A10.

Simoons, Frederick. 1994. *Eat Not This Flesh.* 2nd ed. Madison: University of Wisconsin Press.

———. 1998. *Plants of Life, Plants of Death.* Madison: University of Wisconsin Press.

Simpson, Stephen J., and David Raubenheimer. 2012. The Nature of Nutrition: A Unifying Framework from Animal Adaptation to Human Obesity. Princeton, NJ: Princeton University Press.

Smartt, J., and N. W. Simmonds, eds. 1995. *Evolution of Crop Plants.* London: Longman.

Smil, Vaclav. 2000. *Feeding the World.* Cambridge, MA: MIT Press.

Smith, Andrew F. 1994. *The Tomato in America: Early History, Culture, and Cookery.* Columbia: University of South Carolina Press.

———. 2002. *Peanuts: The Illustrious History of the Goober Pea.* Urbana: University of Illinois Press.

———. 2009. *Eating History: 30 Turning Points in the Making of American Cuisine.* New York: Columbia University Press.

Smith, Eric Alder. 1991. *Inujjuamiut Foraging Strategies.* New York: Aldine de Gruyter.

Smith, Eric Alder, and Bruce Winterhalder, eds. 1992. *Evolutionary Ecology and Human Behavior.* New York: Aldine de Gruyter.

Smith, J. Russell. 1950. *Tree Crops: A Permanent Agriculture.* New York: Devin Adair.

Smith, Robertson. 1894. *Lectures on the Religion of the Semites.* London: A. & C. Black.

Sober, Elliot, and David Wilson. 1999. *Unto Others.* Cambridge, MA: Harvard University Press.

Sohn, Emily. 2012. "Taste Buds and 'Tude." *Los Angeles Times* (September 8): E8.

Sokolov, Raymond. 1981. *Fading Feast.* New York: Farrar Straus Giroux.

Solway, Jacqueline, and Richard B. Lee. 1990. "Foragers, Genuine or Spurious?" *Current Anthropology* 31:109–146.

Spencer, Herta. 2000. "Calcium." In *The Cambridge World History of Food,* ed. Kenneth Kiple and K. Ornelas, 785–797. Cambridge: Cambridge University Press.

Sponheimer, Matt, Benjamin H. Passey, Darryl J. de Ruiter, Debbie Guatelli-Steinberg, Thure E. Cerling, and Julia A. Lee-Thorp. 2006. "Isotopic Evidence for Dietary Variability in the Early Hominin *Paranthropus robustus.*" *Science* 314:980–982.

Squires, Sally. 2002. "When It Comes to Food, We Fudge a Little." *Los Angeles Times* (September 16): S4.

Stager, Kenneth. 1964. *The Role of Olfaction in Food Location by the Turkey Vulture (*Cathartes aura*).* Contributions to Science, no. 81.Los Angeles: Los Angeles County Museum of Natural History.

Stanford, Craig B., and Henry T. Bunn, eds. 2001. *Meat-Eating and Human Evolution.* New York: Oxford University Press.

Staub, Ervin. 1989. *The Roots of Evil: The Origins of Genocide and Other Group Violence.* Cambridge: Cambridge University Press.

Stearns, Justin K. 2011. *Infectious Ideas: Contagion in Premodern Islamic and Christian Thought in the Western Mediterranean.* Baltimore, MD: Johns Hopkins University Press.

Stevenson, Richard J. 2009. *The Psychology of Flavour*. Oxford: Oxford University Press.

Stevenson, Richard J., and Robert A. Boakes. 2003. "A Mnemonic Theory of Odor Perception." *Psychological Review* 110:340–364.

Stiglitz, Joseph E. 2003. *Globalization and Its Discontents*. New York: W. W. Norton.

Stobart, Tom. 1970. *Herbs, Spices, and Flavorings.* London: International Wine & Food Publishing Co.

Stoddart, D. M. 1988. "The Biological Underpinnings of Scents." In *Perfumery,* edited by Steve Van Toller and George H. Dodd, 3–17. New York: Chapman & Hall.

———. 1990. *The Scented Ape.* New York: Cambridge University Press.

Stokstad, Erik. 2003. "The Vitamin D Deficit." *Science* 302:1886–1888.

Stone, Glenn Davis. 2002. "Both Sides Now: Fallacies in the Genetic-Modification Wars, Implications for Developing Countries, and Anthropological Perspectives." *Current Anthropology* 43:611–630.

Stonich, Susan. 1993. *"I Am Destroying the Land!" The Political Economy of Poverty and Environmental Destruction in Honduras.* Boulder, CO: Westview.

Strang, Jeanne. 1991. *Goose Fat and Garlic.* London: Kyle Cathie.

Strier, Karen. 1999. *Primate Behavioral Ecology.* Needham Heights, MA: Allyn & Bacon.

Suttles, Wayne. 1985. *Coast Salish Essays.* Seattle: University of Washington Press.

Sutton, Mark. 1988. *Insects as Food: Aboriginal Entomophagy in the Great Basin.* Socorro, NM: Ballena Press.

Syrotuck, William G. 1971. *Scent and the Scenting Dog.* Rome, NY: Arner.

The Tain. 1970. Translated by Thomas Kinsella. New York: Oxford University Press.

Tan Chee-Beng, ed. 2011. *Chinese Food and Foodways in Southeast Asia and Beyond.* Singapore: NUS Press.

Thibaut-Comelade, Eliane. 1995. *La table medievale des Catalans.* Montpellier: Les Presses de Languedoc.

Tilt, Bryan. 2009. *The Struggle for Sustainability in Rural China: Environmental Values and Civil Society*. New York: Columbia University Press.

Timmer, C. Peter. 2012. "Behavioral Dimensions of Food Security." *Proceedings of the National Academy of Sciences* 109:12315–12320.

Tisserand, Robert. 1977. *The Art of Aromatherapy.* New York: Inner Traditions.

———. 1988. "Essential Oils as Psychotherapeutic Agents." In *Perfumery,* ed. Steve Van Toller and George H. Dodd, 167–181. New York: Chapman & Hall.

Torii, S., et al. 1988. "Contingent Negative Variation (CNV) and the Psychological Effect of Odour." In *Perfumery,* edited by Steve Van Toller and George H. Dodd, 107–120. New York: Chapman & Hall.

Toussaint-Samat, Madelon. 1992 [1987]. *History of Food,* translated by Anthea Bell. Oxford: Basil Blackwell. (Originally published in French.)

Trease, George Edward, and William Charles Evans. 1978. *Pharmacognosy.* 11th ed. London: Bailliere Tindall.

Treviathan, Wenda, Eric O. Smith, and James J. McKenna, eds. 2008. *Evolutionary Medicine and Health: New Perspectives.* New York: Oxford University Press.

Trivedi, Bijal P. 2012. "Hardwired for Taste." *Nature* 486, no. 7403:S7–S9.

Tuma, E. 1965. *Twenty-Six Centuries of Agrarian Reform.* Berkeley: University of California Press.

Turnbull, Colin. 1972. *The Mountain People.* New York: Simon & Schuster.

Turner, Christy, and Jacqueline Turner. 1998. *Man Corn.* Salt Lake City: University of Utah Press.

Turner, Jonathan, and Alexandra Maryanski. 1979. *Functionalism.* Menlo Park, CA: Benjamin Cummings.

Tyler, Varro, Lynn R. Brady, and James E. Robbers. 1981. *Pharmacognosy.* 8th ed. Philadelphia: Lea & Febiger.

Ungar, Peter S., and Matt Sponheimer. 2011. "The Diets of Early Hominins." *Science* 334:190–193.

Ungar, Peter S., and Mark F. Teaford, eds. 2002. *Human Diet: Its Origin and Evolution.* Westport, CT: Bergin & Garvey.

UNICEF (United Nations Children's Fund). 2002. *The State of the World's Children, 2002: Leadership.* New York: UNICEF.

Ünsal, Artun. 2004. *Nimet Geldi Ekine: Türkiye'nin Ekmeklerinin Öyküsü.* Istanbul: Yapı Kredi Yayınları.

Van Esterik, Penny. 1989. *Beyond the Breast-Bottle Controversy.* New Brunswick, NJ: Rutgers University Press.

———. 1992. *Women, Work, and Breastfeeding.* Cornell International Nutrition Monograph no. 23. Ithaca, NY: Cornell University Press.

———. 1997. "The Politics of Breastfeeding: An Advocacy Perspective." In *Food and Culture: A Reader,* edited by Carole Counihan and Penny Van Esterik, 370–383. New York: Routledge.

Van Gelder, Geert Jan. 2000. *God's Banquet: Food in Classical Arabic Literature.* New York: Columbia University Press.

Velez-Ibañez, Carlos. 1996. *Border Visions.* Tucson: University of Arizona Press.

Vico, Giambattista. 1948 [1744]. *The New Science of Giambattista Vico,* translated by Thomas G. Bergin and Max Harold Fisch. Ithaca, NY: Cornell University Press. (Originally published in Latin.)

Voltaire, F.-M. A. de. 2004 [1764]. *Philosophical Dictionary,* translated by Theodore Bestermann. New York: Penguin. (Originally published in French.)

Vrba, Elizabeth, George Denton, Timothy C. Partridge, and Lloyd H. Burckle, eds. 1995. *Paleoclimate and Evolution, with Emphasis on Human Origins.* New Haven, CT: Yale University Press.

Waines, David (ed.). 2011. *Food Culture and Health in Pre-modern Islamic Societies.* Leiden: Brill.

Walens, Stanley. 1981. *Feasting with Cannibals.* Princeton, NJ: Princeton University Press.

Waley, Arthur. 1956. *Yuan Mei.* New York: Grove Press.

Wallerstein, Immanuel. 1976. *The Modern World-System.* Vol. 1. New York: Academic Press.

Wallin, Nils, Bjorn Merker, and Steven Brown, eds. 2000. *The Origins of Music.* Cambridge, MA: MIT Press.

Walsh, Bryan. 2009. "America's Food Crisis and How to Fix It." *Time* (August 31): 30–37.

Wang, Hai-wei, Charles J. Wysocki, and Geoffrey H. Gold. 1993. "Induced Olfactory Receptor Sensitivity in Mice." *Science* 26:998–1000.

Waters, Alice. 2008. *Edible Schoolyard: A Universal Idea.* San Francisco: Chronicle Books.

Watson, James L., ed. 1997. *Golden Arches East: McDonald's in East Asia.* Stanford, CA: Stanford University Press.

Watson, James L., and Caldwell, Melissa, eds. 2005. *The Cultural Politics of Food and Eating.* Oxford: Blackwell.

Weatherford, Jack. *Genghis Khan and the Making of the Modern World.* New York: Crown, 2004.

Weaver, Connie M., and Robert P. Heaney. 1999. "Calcium." In *Modern Nutrition in Health and Disease,* edited by Maurice Shils, James Olson, Moshe Shike, and A. Catharine Ross, 141–155. Philadelphia: Lippincott Williams & Wilkins.

Weckmann, Luis. 1992 [1984]. *The Medieval Heritage of Mexico,* translated by Frances M. Lopez-Morillas. New York: Fordham University Press. (Originally published in Spanish.)

Weir, Kirsten. 2011. "Scents and Sensibility." *Monitor on Psychology* (February): 42–44.

Wellstart International. 1992. *Breastfeeding: A Natural Resource for Food Security.* Washington, DC: Wellstart International.

———. 1996. *Preamble to the U.S. Baby-Friendly Hospital Initiative Guidelines and Criteria.* Washington, DC: U.S. Committee for UNICEF and Wellstart International.

West, Paige. 2012. *From Modern Production to Imagined Primitive: The Social World of Coffee from Papua–New Guinea*. Durham, NC: Duke University Press.

Wheaton, Barbara. 1983. *Savoring the Past: French Kitchens from 1300 to 1789*. Philadelphia: University of Pennsylvania Press.

White, Ronald D. 2012. "When Fuel Eats into Food." *Los Angeles Times* (August 24): B1, B5.

Wiessner, Polly, and Wulf Schiefenhövel, eds. 1996. *Food and the Status Quest: An Interdisciplinary Perspective.* Oxford: Berghahn Books.

Wilk, Richard. 2006. *Home Cooking in the Global Village: Caribbean Food from Buccaneers to Ecotourists*. New York: Berg.

Willett, Walter. 2002. "The Food Pushers." [Review of Nestle 2002.] *Science* 297:198–199.

Willett, Walter, and Meir J. Stampfer. 2003. "Rebuilding the Food Pyramid." *Scientific American* (January): 64–71.

Williams, Roger. 1956. *Biochemical Individuality.* Austin: University of Texas Press.

Wilmsen, Edwin N., and James R. Denbow. 1990. "Paradigmatic History of San-Speaking Peoples and Current Attempts at Revision." *Current Anthropology* 31:489–524.

Wilson, Christine. 1974. "Child Following: A Technique for Learning Food and Nutrition Intakes." *Journal of Tropical Pediatrics and Environmental Child Health* 20:9–14.

———. 1977. "Research Methods in Nutritional Anthropology." In *Nutrition and Anthropology in Action*, edited by T. K. Fitzgerald, 62–68. Assen, the Netherlands: Van Gorcum.

Wohlgemuth, Eric. 1996. "Resource Intensification in Prehistoric Central California: Evidence from Archaeobotanical Data." *Journal of California and Great Basin Anthropology* 18:81–103.

Woodham-Smith, Cecil. 1962. *The Great Hunger.* New York: Harper & Row.

Woolgar, C. M. 2007. "Feasting and Fasting: Food and Taste in Europe in the Middle Ages." In *Food: The History of Taste,* edited by Paul Freedman, 163–196. Berkeley: University of California Press.

World Health Organization. 1994. *Resolution of the World Health Assembly: Infant and Young Child Nutrition*. Geneva: World Health Organization.

———. 2002. "To Improve Health and Boost Economic Development, Countries Strive for Better Food Safety." Press release, January 28. Geneva: World Health Organization. https://apps.who.int/inf/en/pr-2002-05.html.

Wrangham, Richard. 2009. *Catching Fire: How Cooking Made Us Human.* New York: Basic Books.

Wrangham, R., and Jane Goodall. 1989. "Chimpanzee Use of Medicinal Leaves." In *Understanding Chimpanzees,* edited by Paul G. Heltne and Linda A. Marquardt, 22–37. Cambridge, MA: Harvard University Press.

Wrangham, Richard, and Dale Peterson. 1996. *Demonic Males: Apes and the Origins of Human Violence.* Boston: Houghton Mifflin.

Wright, Clifford. 1999. *A Mediterranean Feast.* New York: William Morrow.

———. 2000. "Slippery as a Wet Noodle: The Impossible History of Macaroni." Lecture to Culinary Historians of Southern California, Los Angeles, November 4.

Wright, Karen. 1994. "The Sniff." *Discover* (April 1994): 60–67.

Wu, David Y. H., and Sidney C. H. Cheung. 2002. *The Globalization of Chinese Food.* London: Curzon.

Wu, David Y. H., and Tan Chee-beng. 2001. *Changing Chinese Foodways in Asia.* Hong Kong: Chinese University Press.

Yoneda, Soei. 1982. *The Heart of Zen Cuisine.* Tokyo: Kodansha International.

Young, Arthur. ca. 1900 [1792]. *Travels in France and Italy during the Years 1787, 1788, and 1789.* New York: Dutton.

Zeder, Melinda. 2012. "The Domestication of Animals." *Journal of Anthropological Research* 68:161–190.

Zeidler, Judy. 1999. *The Gourmet Jewish Cook.* New York: William Morrow.

Zohary, Daniel. 2007. "Domestication of the Southwest Asian Neolithic Crop Assemblage of Cereals, Pulses, and Flax: The Evidence from the Living Plants." In *The Emergence of Agriculture,* 2nd ed., edited by Tim Denham, 197–216. New York: Routledge.

Zohary, Daniel, and Maria Hopf. 2000. *Domestication of Plants in the Old World.* 3rd ed. Oxford: Oxford University Press.

Zubaida, Sami, and Richard Tapper, eds. 1994. *Culinary Cultures of the Middle East.* London: I. B. Tauris.

INDEX

ABOUT THE AUTHOR

E. N. Anderson is Professor Emeritus of Anthropology at the University of California, Riverside. His previous books include *The Food of China, Ecologies of the Heart,* and *The Pursuit of Ecotopia.* He lives in Riverside with his wife Barbara and three large dogs.