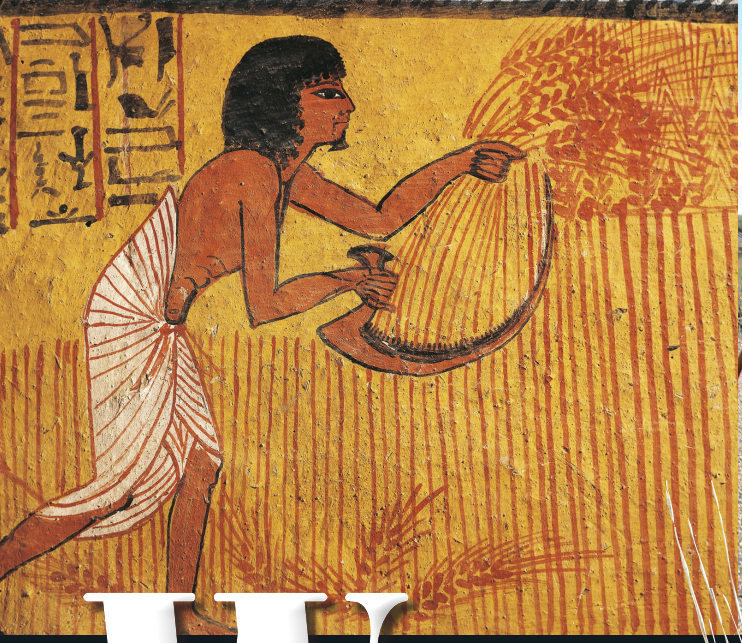

WORLD FOOD

An Encyclopedia of History, Culture, and Social Influence from Hunter-Gatherers to the Age of Globalization

Mary Ellen Snodgrass

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M.E. Sharpe, Inc.
80 Business Park Drive
Armonk, NY 10504

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Library of Congress Cataloging-in-Publication Data

Snodgrass, Mary Ellen.
World food: an encyclopedia of history, culture, and social influence from hunter-gatherers to the age of globalization / Mary Ellen Snodgrass.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-7656-8278-9 (cloth: alk. paper)
1. Food—History—Encyclopedias. 2. Cooking—History—Encyclopedias. I. Title.

TX349.S66 2013
641.303—dc23 2012014375

Printed and bound in the United States

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z 39.48.1984.

CW (c) 10 9 8 7 6 5 4 3 2

Publisher: Myron E. Sharpe
Vice President and Director of New Product Development: Donna Sanzone
Vice President and Production Director: Carmen Chetti
Executive Development Editor: Jeff Hacker
Project Manager: Laura Brengelman
Program Coordinator: Cathleen Prisco
Editorial Assistant: Lauren LoPinto
Text Design and Cover Design: Jesse Sanchez

Every social gathering and holiday is
With a feast begun and terminated;
And before our heads can have their say,
Our bellies must be fully sated.

Pellegrino Artusi
La Scienza in Cucina e l'Arte di Mangiar Bene, 1891

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Preface

World Food examines the spectrum of comestibles as they apply to history, politics, economics, medicine, nutrition, ethnicity, worship, and invention. For the convenience and edification of the teacher, student, researcher, chef, and food faddist, the text summarizes specifics of eating history—the development of humankind from hunter-gatherers to Turkish herders and German vintners, the marketing of foodstuffs at the produce stalls of Nice and the canal boats of Bangkok, and the exploitation of valuable edibles by Sri Lankan planters and Spanish conquerors. The issues of the present—improvements in the packaging, sanitation, and transportation of perishables—forecast the future of nontoxic, nourishing food for both the privileged and the have-nots.

The list of entries covers travel writers (Ibn Battuta, Herodotus, Marco Polo), growers (Thomas Jefferson, Jethro Tull), preparers (Huou, Apicius, Pierre La Varenne, Julia Child), marketers (Agnes Marshall, Luther Burbank), scientists (James Lind, Nicholas Culpeper, Carolus Linnaeus), and corporations (Swedish East India Company, Virginia Company of Plymouth, McDonald's). National tastes figure in entries on specific examples of diet and cuisine—Russian, Inca, Indonesian, Portuguese, Byzantine—and in the preparation of such ethnic specialties as tofu, bushmeat, chowder, kebabs, dal, and condiments.

Essays particularize flora and fauna that impact world events—beef and corn and maize in the settlement of North America, einkorn and emmer wheats in the evolution of bread, the buffalo in the gastronomy of Plains Indians, and tea in the socialization of Japan and China. Food processing attests to the ingenuity of cooks and industrialists and its importance in world history, notably pasta in the industrialization of Sicily, tortillas in Latin America, chutney in India, pemmican in the success of the Hudson's Bay Company, whiskey in the struggle between imbibers and abstainers, salt and vinegar to early miners and vegetable preservers, biscuits and bouillon to expeditions and military provisioners, and baby food and infant formulas for child nutritionists.

In addition to kitchen staff and grocery dealers, gastronomy overlaps the concerns of altruists and activists, including ecofeminists, the battlefield cookery of Mary Jane Seacole during the Crimean War, the relief kitchens of Alexis Soyer to mitigate the Irish Potato Famine, rationing during world wars, soup kitchen cooks, and U.S. supply airlifts to the Burma Road and war-ravaged Berlin in the 1940s. The ethical sale and consumption of food permeates entries on food taboos, halal, biopiracy, prohibition, peyote, kosher food, alcoholic beverages, and vegetarianism. Some of the most serious issues emerge under the headings of commodity riots, famine relief, and endangered species.

The role of exploration in acquainting consumers with new possibilities in table fare elevates the importance of Christopher Columbus, Captain James Cook, Amédée François Frézier, Giovanni da Verrazzano, and Hernán de Cortés. Entries on trade routes and trading vessels, caravans, clipper ships, and world trade summarize the successful conveyance of such perishables as yams, strawberries, and birch beer. From the transporters' holds, crates and bags pass to the operators of food inspection and safety, commodity regulation, public markets, food cooperatives, cooking schools, and farm subsidies and government agricultural programs. More technological matters fill essays on freeze-drying, refrigeration, monoculture, food storage, hormones in food, Count Rumford, and seed trade.

Peripheral issues stress the crucial nature of food intake to well-being, the focus of articles on obesity, nutrition, food allergies, curative foods, fads, adulterated and poisonous foods, and additives and dyes. An overview of the food preparer in grilling, barbecue, saucing, pickling, cook-offs, espaliering, animal husbandry, and milling emphasizes the continued importance of the individual in feeding the world. A thorough survey of world food would not be complete without the evolution of agriculture into agribusiness, the rise of barter as a means of negotiation, foods used as currency, garbage disposal in middens, the selection of recipes for cookbooks, the invention of cookware and blenders and food processors, the representation of dining in the arts and film, and future concerns for traditions, customs, and food in the afterlife.

Research involved delvings into a range of literature, beginning with retrospects on the Paleolithic diet, the Fertile Crescent, the Silk Road, the tea ceremony, and the fare of the Crusaders. In addition to the biographies of Charlemagne and Catherine de' Médici, food critiques derived from chronicler Garcilaso de la Vega, sugar refiner Jules Paul Benjamin Delessert, esthete Jean Anthelme Brillat-Savarin, environmentalist Rachel Carson,

ethnographer Bernardino da Sahagún, horticulturist Antoine Nicholas Duchesne, folklorist and columnist Linda West Eckhardt, encyclopedist Pliny the Elder, and infantryman Bernal Díaz. The best in pantry and dining histories came from the works of Ken Albala, Sidney C.H. Cheung, Linda Civitello, Andrew Dalby, Alan Davidson, Yiu H. Hui, Michael Krondl, Andrew F. Smith, and Maguelonne Toussaint-Samat as well as articles from *Archaeology, History, Mother Earth News, National Geographic, Saudi Aramco World, The New York Times,* and *Vegetarian Times.*

Rounding out the text, additional study aids and special sections elucidate individual foods, events, and concepts:

Topic Finder classifies the encyclopedia's more than 350 articles into general subject categories.

Chronology covers events from the origin of cooked food to the twenty-first century. Entries recognize the importance of the natural changes that coagulated yogurt and fermented grape juice and the marches and voyages that generated awareness of world cuisines and customs. Landmarks note the transplanting of New World breadfruit, publication of cookbooks, and environmental research into adulterated food and pollutants. Within events are the achievements of notable figures in related fields.

Appendix of Herbal Foods and Uses reveals the multiple applications of native flora to recipes, wellness, and alternative medical treatments. Sources include chaparral, a Mexican and South African heath plant that flavors a tea and cure for cough; ginseng, an age-old Chinese nostrum used in candy and for treating malaise and poor appetite; bergamot, an Ojibwa salad green valuable for relieving insomnia; and scurvy grass, a British salad and potherb that supplies the body with vitamin C to combat loose teeth and bleeding caused by a nutrient deficiency. The listings mention slippery elm and yarrow, two favorites of Australasians and the Cheyenne for skin disease and infected wounds, and willow, a food for beekeeping in China and a multinational ingredient in an analgesic tea once prescribed in Assyria, Egypt, Greece, and Sumer.

Glossary of terms defines the use of tagines and mandolines, invention of the bain-marie and *shaduf,* philosophies of macrobiotics and the frugivore, treatment of zoonosis and imbalance in the four humors, creation of forcemeat and gene banks, and differences among the gastronome, gourmand, epicure, and gourmet. Perspectives on food history explain value judgments concerning heritage foods, national dishes, and idiocuisine. Key terms—*terroir, fermentation, agribusiness, curing, food justice*—lend insight to such issues as where and how to grow, preserve, and market comestibles for the benefit of all.

Acknowledgments

I could not have completed this text without advice from a long list, which follows, of researchers, chemists, archivists, chefs, travelers, gourmands, farmers, and especially reference librarians, the backbone of scholarship. Historical societies, university libraries, the Library of Congress, book and film reviewers, and specialists in food preparation and marketing elucidated various details. Charity workers and church and ethnic authorities suggested variant points of view on famine in East Africa, the agricultural advances of Norman Borlaug, child malnutrition along the Sahel, and the dietary compromises between faith groups in India and China. I found particularly helpful the databases of the Alexandria Street Press, UNICEF advisories, and the additions of Laura Brengelman concerning endangered flora and fauna.

Special thanks to Martin Otts and Mark Schumacher for running down sources and bibliography information and to Eileen Lawrence and Stephen Rhind-Tutt for the use of Anthropology Online and Women and Social Movements, International, two databases hosted by Alexandria Street Press. Blessings on Mary Canrobert for answering my myriad questions about Chinese grocery stores and hot shops. As always, I rely on editor Jeff Hacker and my publicist, Joan Lail, for dissuading me from folly.

Jason Achiu, reference, Hawaii State Archives, Honolulu, Hawaii
Belk Library, Appalachian State University, Boone, North Carolina
Beth Bradshaw and Martin Otts, reference librarians, and Mary Sizemore, Patrick Beaver Library, Hickory, North Carolina
Brown University Library, Providence, Rhode Island
Burton Library, George Mason University, Fairfax, Virginia
Julie Byrd and Terri Cain, Catawba County Social Services, Hickory, North Carolina
Mark and Mary Canrobert, former residents of Souzhou, China
Bonnie Chandler, reference, Columbus Public Library, Columbus, Ohio
Sergei Demchenko, restaurateur, Odessa, Ukraine
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Susan Nahwoosky, administrative assistant to the president, Comanche Nation College, Lawton, Oklahoma
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Introduction

Food history refuses to stay in the market basket. Eating is too important to humankind for its story to boil down to tidy pantry lists and shortbread recipes. The best in dining ranges from Charlemagne's Easter feasts and exotic food club banquets to soul food pig pickins' and the *pièces montées* of nineteenth-century French master chef and author Marie-Antoine Carême. An overview of how people choose, prepare, and consume edibles strays into camel caravans, Christmas Eve, ships' galleys, potato chip factories, Aztec mano and metate, and Ramadan.

A comprehensive history of human sustenance looks back many millennia for glimpses of roasting chestnuts at the fireside of Belgian Celts and pressing wild plums for juice along the Fertile Crescent. Preceding the skills of the Halifax sea captain and Alexandrian grocer, the instincts for paddy patterns and the best weather for combining ensure ample harvests of rice and wheat. The knowledge of provisioners, meat carvers, and bakers incorporates the finer points of coopering barrels for stowing Norwegian dried cod, impaling agave and beef heart for pit roasting, and creaming lard and castor sugar for icing hot cross buns and stollen.

Tucked deep into prehistory lie the menus of Hopi, Australian Aborigines, Berbers, and Greenlanders. Stirring moments in the culinary past juxtapose the first fermentation of Greek yogurt and the clubbing of wild rice into Cree canoes with the establishment of Chinese restaurants along the path of the Union Pacific Railroad and the pioneer squeeze tubes that extruded fruit for early space crews. Improvements to oyster trading on Southeast Asian sampans parallel the development of Carnation canned milk and the debut of containerized pineapples lifted by gantry aboard Dole's transoceanic steamers. Awards for innovation extend credit to salt rinds on Dutch cheese, Ball's improved canning jar, Japan's first rice-winnowing basket, and upgraded shrink-wrap to protect Irish salmon.

Overall, the story of food consumption reveals the rudiments of human life. Like breathing and sleeping, eating sequences the regular satisfaction of needs that connects appetites to nature. The urge to sip and chew explains teatime and the coffee or *yerba buena* break and justifies the search for newer titillations of the taste buds with sashimi, passion fruit, Kaffir lime, hummus, near beer, vitamin water, deep-fried pickles—anything new or unusual. So long as the drive persists to delight in aroma and mouthfeel, the consumer will scan grocery shelves and restaurant menus and pay the price.

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Abreu, António de (ca. 1480–ca. 1514), and Francisco Serrao (?–1521)

Explorer António de Abreu, an experienced sea voyager, and his second-in-command, Francisco Serrao, introduced the Portuguese to a monopoly on cloves and nutmeg in Indonesia that broke the Arab and Venetian control of luxury spices in the early sixteenth century.

Intrigued by adventurer Ludovico de Varthema's tales of Bandanese nutmegs and Moluccan cloves in 1502, Afonso de Albuquerque, Portugal's viceroy to India at Goa, dispatched a three-ship fleet from the Bay of Bengal to Malacca in December 1511. He instructed the crew to reconnoiter the Spice Islands, where clove and nutmeg trees flourished on the five-island cluster. Buyers in London, Paris, and Rotterdam paid princely amounts for nutmeg, a preservative for meat, tranquilizer, sleep inducer, and alleged deterrent of bubonic plague. In the flagship *Santa Catarina,* de Abreu, serving as the ambassador of commerce, hired three Javanese pilots and 120 men to crew the two caravels and an Indian supply ship from the Strait of Malacca east through uncharted seas toward Java.

The fleet reached Gresik, Java, in sight of terraced rice fields and exotic fruits. The first Europeans to discover Banda and the Pacific Ocean, de Abreu's crew advanced directly to the heart of a global bonanza, spices bought cheap and sold with a 30,000 percent markup. The Portuguese sailors encountered a lively sea emporium that had drawn Chinese merchants in junks for centuries. De Abreu exchanged bells, bracelets, and trinkets for cloves, the sepals of red tubular flowers that dotted 40-foot (12-meter) trees.

Nutmeg trees grew to 50 feet (15 meters) and produced a quince-shaped fruit. Covering the nut at the center, mace had its own distinctive flavor from the kernel, which users grated for its spicy scent and tangy taste. The wholesale cost was so low that de Abreu anticipated a tenfold profit in Lisbon. De Abreu raised a stele acknowledging Portugal's annexation of the Banda Islands. He died in the Azores on his return trip to Portugal.

Before the voyage to the Portuguese home port in India in December 1512, greed inspired de Abreu to overtax his vessels. Francisco Serrao, skipper of the second caravel, the aged *Sabaia,* burned the leaky hull and purchased a junk, on which he loaded cloves, mace, and nutmegs. Another product of the islands, dead flycatchers, honeyeaters, kingfishers, and pigeons covered in elegant plumage, brought high prices on the fashion market.

On the return journey to Malacca, winds beached Serrao's junk off the island of Pude. He and his crew commandeered a pirate outrigger and sailed to Hitu, where a tribal chief treated the Portuguese to attractive women and a banquet of fowl and goat meat, cups of arak (anise liquor), and dishes of sago, the main food of the Malay people. They encountered bamboo as thick as a man's leg, a source of pure, refreshing water.

To increase their power and income, the islanders sought reliable trading partners. Clove growers on Ternate and Tidore arrived by outrigger canoes to court potential purchasers of cloves. Serrao remained in the islands as prime minister to the king of Ternate, which became the center of the Portuguese spice trade. Ferdinand Magellan, a friend and cousin who had accompanied him on the voyage, parted ways and continued sailing, eventually leading the first expedition (1519–1522) to circumnavigate the globe.

After a follow-up expedition arrived in the Moluccas in 1514, Portuguese merchants set up regular voyages between outposts in Molucca and India and collaborated with the Dutch in distributing spice to sellers along the Rhine River valley. Serrao died in Ternate in 1521 a short time before Philippine natives killed Magellan in a skirmish.

See also: House of India.

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Additives, Food

The adjustment of taste, aroma, texture, and longevity in modern food derives from some 2,800 additives. Since the seventeenth century, processors of food have relied primarily on natural additives—salt, smoke, sugar, and vinegar—to enhance the flavor and shelf life of beef, century eggs (preserved eggs), ham, herring, hominy, *kimchi,* lutefisk, salmon, and sauerkraut. The Industrial Revolution increased reliance on other modifications. A common example, carbon dioxide, a harmless gas, creates effervescence in beer, mineral water, and whipped topping. A safe and effective thickener, cellulose from cotton lint or wood pulp congeals diet food and pie filling. Casein, a milk protein, thickens sherbet. Corn syrup has the same effect in marshmallows, much as various food starches condense baby food. Citric acid flavors instant potatoes; chicory root sweetens granola. Malt ferments beer; quinine enlivens tonic water.

Some additives alter appearance, such as bleaches (chlorine), glazers (paraffin), humectants (urea), and anticaking (talc), defoaming (silicone oil), and bulking agents (nuts and arrowroot). Algae, egg yolk, kelp, pectin, whey, and other emulsifiers maintain the smooth blend of coffee creamers, cranberry sauce, jam, and mayonnaise. The beeswax that glazes cheese rounds and melons and the paraffin coating on apples, chocolates, and cucumbers prevent deterioration from the action of air, bacteria, fungi, and light. Soybeans and tapioca provide the texture in imitation meats, such as veggie burgers, faux crabmeat, and tempeh. Flavorants increase the smell and taste of familiar processed foods—apple acid in iced tea mix, esters in Juicy Fruit gum, lactic acid in cheese, and phosphoric acid in Coca-Cola.

Food dyes, a common food additive, contribute the natural shades of alfalfa, algae, blueberries, caramel, carrots, elderberries, grapes, mushrooms, peas, and turmeric to enhance the eye appeal of products such as Kool-Aid, M&Ms, popcorn, and wine. Consumers associate annatto yellow with margarine; ascorbic acid with canned peaches; beet red with icings, puddings, and yogurt; dextrose with brown bread crust; paprika with salad dressing and tomato soup; saffron yellow with rice; and strawberry red with jelly.

Carmine, the red dye in cider and chewing gum and on hot dog and sausage casings, differs from vegetable dye in that it derives from the *Dactylopius coccus,* an insect that infests the opuntia cactus in Central and North America. Because of its animal source, vegans and vegetarians avoid it. Orthodox Jews ban carmine from kosher foods. Hindus, Jains, and Muslims also demand oversight of food enhancement to restrict animal by-products, particularly rennet from the stomachs of ruminants and gelatin obtained from animal bones, hides, and hooves.

For binding and texture, packagers of ready-to-eat foods into the early twentieth century added potato and rice flour, oat fiber, and soybean products, the standard thickeners that gave authentic mouthfeel to ice cream and tomato ketchup. When a new wave of synthetics compromised food quality, the Pure Food and Drug Act of 1906 approved orange dye, the first synthetic tint. The law also allowed six other artificial colorants, ranging from red, pink, and yellow to indigo and black. Also deemed safe were dyes on orange peels and maraschino cherries and in butter and red velvet cake. In 1938, the Federal Food, Drug, and Cosmetic Act enumerated food tints such as amaranth, labeled Red No. 2.

On January 1, 1958, the Food Additives Amendment identified 700 safe food substances and banned such carcinogens as cyclamate and lead and halogenated compounds. New regulations required specific clearances for questionable additives, including binders, enzymes, gelatin thickeners, stabilizers, and texturizers. In 1960, the Color Additives Amendments delisted some of the colors previously classified as safe for use in food, notably, blue 2, green 3, orange B, red 3, and yellow 5 and 6. Thereafter, the United Kingdom reduced its approved food dyes to 16, and Canadian health officials banned azo compounds, the source of nearly 70 percent of all dyes. Norway and Sweden proscribed all colorants as health hazards. In March 2011, China forbade millers from bleaching wheat flour.

Worldwide, biochemists investigate the effects of antinutritional additives on internal organs, as well as on diabetics, hemophiliacs, and pregnant women and fetuses. Nutritional watch lists continue to question the antioxidant butylated hydroxyanisole (BHA) in cereal and oil, caffeine in cocoa and energy drinks, potassium bromate in bread and rolls, diacetyl in butter-flavored popcorn and sour cream, caramel coloring in soy sauce, and aspartame and other artificial sweeteners in diet products. All of these chemicals increase cancer risks.

In 2010, the United Nations published the findings of a global consortium on specific food additives. The group, consisting of members of the Food and Agriculture Organization and the World Health Organization, found acceptable cassia gum in cream cheese and lycopene food color from tomatoes in sauces. The consortium required more study of gum arabic and nitrous oxide in bread and recommended limited consumption of cyclamates in energy drinks, especially for children.

More recent concerns target guar gum in cottage cheese, nitrates and nitrites in cured meats such as bacon and salami, propyl gallate in chicken soup, and the use of antibiotics in cattle.

See also: Adulterated Food; Allergies, Food; Guar; Hormones in Food; Monosodium Glutamate; Organic Foods.

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Adulterated Food

Corrupt and bogus foods have threatened the well-being of the human community since prehistory. Adulterants derive from natural deterioration, domestic and industrial contamination, and extenders introduced during processing, packaging, and storage.

As a business and public relations measure, early commodities sellers recognized standards that protected consumers from spurious additives, such as the blending of fresh goods with stale or spoiled stock and the masking of foul odors. Book four of the Indian Kautilya's *Arthashastra* (*Statecraft,* ca. 300 B.C.E.), an economic advisement to the first Maurya emperor, authorized the penalizing of market cheats for adding filler to alkali, grain, oil, and salt, watering milk, or stretching flour with ground alum, bone, chalk, plaster, or stones. As described in the Confucian ritual text *Zhouli* (*Chou-li, Rites of Chou,* compiled ca. 1116 B.C.E.), similar oversight in Chinese markets confirmed the quality of goods from food processors, public kitchens, and wineries.

For the average consumer, warnings about adulterated food traditionally required more education than most possessed. Greco-Roman officials inspected wholesale goods and fined vendors for applying gypsum, lead, and lime as sweeteners in wine and soft white silt to bread. During the fifth decade of the Roman Empire, encyclopedist Pliny the Elder warned in his *Historia Naturae* (*Natural History,* ca. 77 C.E.) of grain adulteration in Tunisia, where dealers added 25 percent gypsum to emmer grain, the basis of common porridge.

Florentine merchant Francesco Balducci Pegolotti, a late medieval consumer advocate, composed *Pratica della Mercatura* (*Merchant's Handbook,* ca. 1343), a guide to measures and standards for fruit, honey, loaf and granular sugar, molasses, potash, salt fish, and wine. He warned of irregularities in packaging and weights and measures as well as the length of time goods traveled over known routes. In London, sellers of putrid meat and spice vendors who padded their stocks with extenders suffered pillorying over a fire of offensive goods. In Nuremberg, Germany, conspiracy to defraud consumers could result in defrauders suffering exile, lashing, lopping of ears or nose, blinding, poisoning, drowning, burning, or being buried alive.

Fraudulent Food

Merchants shared ill fame with professional cooks. Caterers adulterated food through menu substitutions, supplanting boar with pig, caviar with fish roe, stag with beef, veal with sturgeon, even imitation meat from almond paste and dried fruit grilled on a spit. In fifteenth-century Sicily, bakers color-coded bread quality—pure white loaves for the rich, dark to black loaves for the poor. In times of famine, the wealthy continued to eat well, but the lowest class ate loaves permeated with grain substitutes—bean husks, berries, grass, leaves, nuts, parsnips, sawdust, seeds, squash, and wild radish and asparagus. In *Historia General de las Cosas de Nueva España* (*General History of the Things of New Spain,* 1540–1585), culinary historian Bernardino de Sahagún encountered a swindler in Mexico who concocted amaranth seeds, chalk, and wax into dough and sold it as cacao beans.

Honey offered the dishonest opportunities to sell rancid or spiked goods. In England, a lawsuit over sulphurated honey set buyer against seller in 1457, with damages assessed at 40 shillings. Elizabeth I fought such faulty commodities by proclaiming a purity act of 1580 requiring bona fide labeling of honey. Those selling counterfeit produce risked a penalty of 6 shillings 8 pence. The following year, similar stringent regulations forbade the contamination of beeswax with resin, tallow, or turpentine. European standards appear to have dropped in the mid-1700s, when apothecary John Hill reported honey contaminated during collection and laced with flour. To ensure quality goods, he recommended buying only thin, transparent stock.

Worldwide, the adulteration of foodstuffs has involved innovative addition of almond oil, alum, elderberry juice, limewater, sugar, sulphuric acid, tartar salts, and turpentine to foodstuffs. Domestic manuals, including *The School of Arts,* a handbook published in 1754 by the Royal Society of Arts, suggested testing for chalk in flour by mixing a sample with vinegar or lemon juice, which generates bubbles in calcium carbonate (though an absence of bubbles does not ensure purity). When taoism influenced food selection and preparation, poet Yuan Mei, author of *Shih Tan* (*The Menu,* 1796), advocated inspection of pigs and chickens for disease. For bird's nest soup, he declared that no feathers should mar the broth. On the subject of sea slugs and sharks, he urged rinsing out sand and mud, which inflated the cost and threatened teeth with grit.

Early Food Analysis

In 1820, mineralogist and analytic chemist Friedrich Christian Accum, apothecary to George III, issued *A Treatise on the Adulterations of Food and Culinary Poisons.* The jeremiad, subtitled "There is Death in the Pot," exposed sham Chinese tea consisting of dried thorn leaves dyed with toxic verdigris and also warned of blancmange laced with copper arsenite, a deadly food dye. Because he named names, angry food adulterers forced him to flee to Berlin. Corroborating Accum's identification of lethal commodities, the *Edinburgh Magistrates Minute Book* from

September 7, 1847, warned that a Dalkeith veterinarian observed provisioners salting, slicing into roasts, making into pies, or grinding into sausage the carcasses of cattle felled by disease. In this same period, John Marius Wilson's *The Rural Cyclopaedia* (1849) exposed Edinburgh dairies that removed cream from milk and thickened and whitened skim milk with magnesium carbonate or rice or wheat flour. Additional milk camouflage involved adding ground almonds or hemp seed and egg whites to simulate a creamy consistency.

In the 1850s, when the Industrial Revolution made laborers more dependent on processed foods than on home gardens, Arthur Hill Hassall, another British consumer advocate, found nearly half of arrowroot in London markets to be blended with potato flour. With a microscope, Hassall identified chicory in coffee, a substitution that kept the cost low in a highly competitive market. He also uncovered irregularities in name brands—Frys and Cadbury cocoa, Crosse & Blackwell condiments, Fortnum & Mason's sauces, and J. & J. Coleman mustard. His crusade disclosed red earth in French tomato sauce and burned treacle in Indian soy. Hassall's praise for Borden's Patent Meat Biscuit so improved sales that firms sought his certification on food labels. An American contemporary, commercial beekeeper Moses Quinby of New York, complained that food tainters pumped glucose and maple syrup into honey to inflate profits and extend shelf life. Consumers rashly blamed exporters of foreign goods for polluting packaged foods, but investigators found most deception among conspirators closer to home.

During the rise of home economics to a profession in the mid-nineteenth century, the media published warnings about wheat flour adulterated with plaster of paris, copper salts in pickles and bottled fruits and vegetables, oil of vitriol in vinegar, and red lead in cayenne pepper. In 1850, Thomas Wakley, editor of *The Lancet,* England's primary medical journal, established the Analytical and Sanitary Commission, which vilified chemical enhancement of 2,500 foodstuffs. Commissioners impugned cider passed off as wine, copper and lead salts in candy, iron compounds in fish and potted meat, poisons in beer, potash lining in bottles, rancid butter, red lead in cheese, and turmeric in mustard.

Within five years of empanelment, analysts, aided by London medical officer Henry Letheby, prompted the English parliament to halt food fraud by passing the Food Adulteration Act of 1860. The commission noted that the lower class suffered from purchase of the most polluted and least authentic foods and palliatives, such as caffeine, cocaine, and opium in soda fountain drinks and morphine-laced soothing syrups for babies. The Adulteration of Food, Drink, and Drugs Act of 1872 put more bite into enforcement. By the 1890s, English market goods were purer and safer.

Pure Food Movement

Americans demanded similar strictures. As early as 1641, the Massachusetts Bay Colony protected meat and pork from impurity and appointed a bread inspector. In 1876, industrialist Henry J. Heinz guaranteed customers wholesome tomato ketchup rather than tomato sauce adulterated with turnips or wood fiber. He sold his spicy blend in glass bottles but his candor failed to protect the public from the most debased goods. In 1882, inspectors in New York City published tampering rates in the least dependable goods: coffee (90.5 percent), candy (70.0 percent), brandy (64.0 percent), and spices (62.2 percent). To alert Congress and the Federation of Women's Clubs to the danger of additives, author Ella Hoes Neville stated the difference between cheating and poisoning the public: "Give us short measure and we lose; give us adulterated food and we die."

Before the U.S. Congress authorized the federal government to inspect, test, and approve foods and food additives in 1883, Harvey Washington Wiley, chief forensic chemist of the U.S. Department of Agriculture, led a 30-year crusade for food safety and purity standards. A subsequent campaign begun by the Michigan Women's Christian Temperance Union attacked impure comestibles and drugs. Led by dietitian Ella Eaton Kellogg, author of *Science in the Kitchen* (1892), the women challenged dangerous and unhygienic foodstuffs. Echoing her concerns, the Department of Agriculture found that additives and fillers were an industry standard in processed foods.

In *Air, Water, and Food: From a Sanitary Standpoint* (1901), a classic study of the human need for safe life-giving elements, authors Ellen Swallow Richards and Alpheus Grant Woodman devoted much of their text to adulterated food. They warned of unscrupulous dealers and specified the dangers of baking powder containing alum, ginger mixed with turmeric and redwood sawdust, wood ash in rancid pork, and watered milk colored with coal tar and preserved with benzoic acid, borax, formaldehyde, or potassium chromate. Whereas they found flour and rice usually pure, ginger, mustard, pepper, and wine tended toward heavy defilement. The authors also suspected currant, grape, and raspberry jellies, which sometimes contained only processed, sugared, and colored apple cores and peelings.

In part, Richards and Woodman blamed the public for such unrealistic demands as oysters and summer fruit and vegetables out of season. They encouraged readers to be skeptical of abnormally bright colors in canned foods, such as green canned peas and pickles brightly colored by copper salt dye. An editorial in the *New England Kitchen Magazine* concurred that dishonesty would thrive as long as the consumer remained naive and unsuspecting. At the height of social activism, feminist Charlotte Perkins Gilman's *The Home: Its Work and Influence* (1903) declared that bad food found its way into homes because the housewife was untrained in identifying additives.

On June 30, 1906, at the urging of President Theodore Roosevelt, the U.S. Congress passed the Pure Food and Drug Act, which launched an interstate watchdog on fraudulent, mislabeled goods. A stronger version in 1938 opposed unwholesome food by authorizing factory inspection and seizure of proscribed goods.

Renewed Vigilance

When a new wave of synthetics compromised American foodstuffs in the post–World War II era, a congressional committee investigated for 21 months. Impaneled in June 1950 and chaired by Representative James Joseph Delaney (D-NY), the group heard testimony on chemical additives and noxious substances in food. Although the committee issued four volumes covering unwholesome foods and fluoridated water, Congress ignored the committee's recommendations for seven years. In 1958, the Food Additives Amendment banned such carcinogens as lead and halogenated compounds and required clearance of questionable additives, including binders, enzymes, gelatin thickeners, stabilizers, and texturizers.

Early in 2001, a new product for identifying dangerous levels of lead set consumers' minds at rest on the subject of toxic metals in food cans and water. Homax Products in Bellingham, Washington, began distributing LeadCheck, which identified lead in dishes, a problem that the U.S. government estimated occurred at the rate of one in seven sets. The product was the invention of chemical engineer Marcia J. Stone at Hybrivet in Reading, Pennsylvania, a diagnostician for DuPont and New England Nuclear. The kit offered test swabs and reagents that turned pink or red if they came in contact with leachable lead, which could damage brain tissue in the unborn.

See also: Disease, Food-Borne; Hormones in Food; Inspection and Safety, Food; Plant Disease and Prevention; Poisonous Foods.

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African Diet and Cuisine, Sub-Saharan

Tropical and southern African gastronomy incorporates varied tribal and language groups, each following its own culinary methods of preparing local ingredients. Because 60 percent of the area is agrarian, sub-Saharan Africa produces homegrown food and supplements fruit and vegetables with fish netted from local waterways. A model recipe for *maafé* (rice stew) with peanut, spinach, and tomato sauce derives input for each variation by Angolan, Gambian, Ivory Coast, and Wolof cooks. Ghanians contribute pierced boiled eggs, which soak up juices; Ivory Coast preparers stress tomatoes and tomato paste; Senegalese add cabbage and eggplant; the Bambara of Mali accentuate sweet potatoes and turnips. In the centuries after the slave diaspora, African American versions of maafé supplanted peanuts with peanut butter.

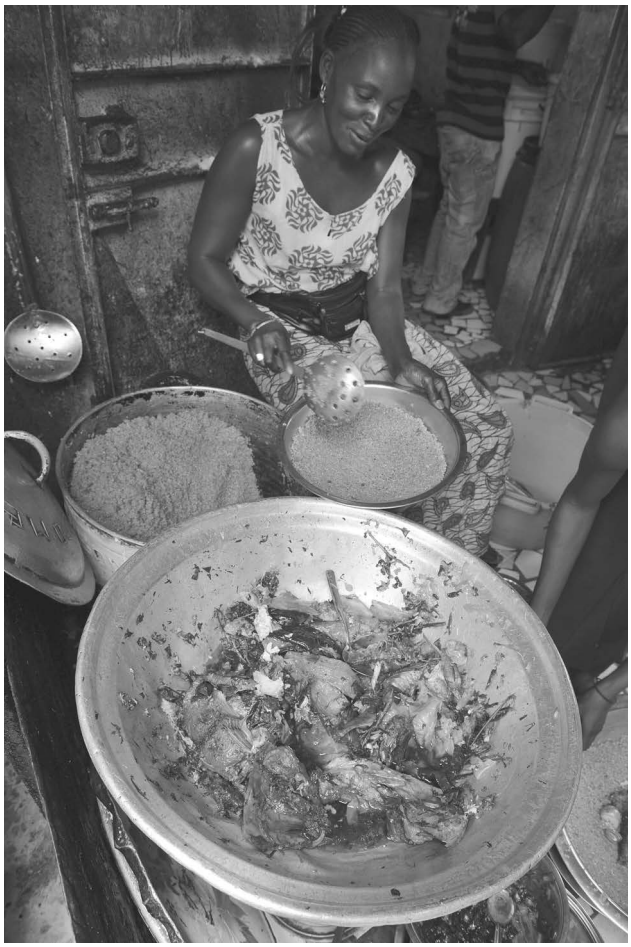
After 6000 B.C.E., continental nomads based meals on meat from cattle, goats, and sheep. Wanderers benefited from trading stock with disparate groups, thus acquiring more culinary diversity in dried fish, fruits, greens, and tubers. Unique combinations anchored societies to regions and defined ritual feast cycles, such as the yam festival that ended the Ashanti hungry time and marked the annual Ibo thanksgiving. Simple kitchen arrangement involved the balancing of a single pot on three stones over a fire. A sedentary lifestyle made possible melon patches and lettuce and nettle crops and the gathering of wild jackfruit and passionfruit.

During the slave trade in the 1800s, the importation of cassava, peanuts, and peppers made the first impact of outsiders on Congo rain forest dishes of *fonio* (millet), griddle breads, millet, and native rice. Despite the drain of human bondage on the citizenry and the introduction of European diseases, the boost to food security increased the West African population. Arab, Indian, and Portuguese traders carried hot pepper pods as handy pocket currency and a kitchen garden curiosity for buyers in São Tomé and Zanzibar. The cuisine of Africa's long shoreline profited from the long-distance swap, which added pungency to bland dishes.

Culinary Blossoming

Cassava, cocoyams, and yams added sweetness to Nigerian *patten doya* (yam pottage) and greens to *kuka* (baobab leaf stew), a heritage dish made by the mother of Sundiata, the thirteenth-century epic hero of the Mali Empire. In Ghana, cassava provided starchy roots for pounding into *fufu,* a national dish served with dried or smoked fish, guinea fowl, and *suya* (shish kebabs), a spicy Hausan grilled meat in Niger and Nigeria. Coconut, guinea pepper, néré seeds, palm oil, peanuts, and shea butter flavored sauces for chicken, corn and pea fritters, okra and pumpkin seed soup, rice, and wild bushmeat from antelopes, bush rats, crocodiles, giant snails, simians, and warthogs.

Plantain supplied a staple food crop in East Africa, but its nutritional deficiency resulted in disease and death among pregnant women and an infant mortality rate of more than 30 percent. As a result of shortened female life spans, polygynous men accumulated multiple wives. In Mozambique, a more nutritious kitchen preparation involved quartering green plantains for grating into coconut milk and lemon juice.



The cooks at a street restaurant in Dakar, Senegal, prepare a traditional dish of seasoned fish and white rice with vegetables. Fish is a dietary staple in coastal West Africa. Starchy tubers and root vegetables, peanuts, tomatoes, and palm nut oil are also common. *(Georges Gobet/AFP/ Getty Images)*

Mixtures of black-eyed or field peas, eggplant, locust beans, okra, pumpkin, and squash wrapped in banana, cabbage, plantain, or roselle (hibiscus) leaves fed families with handheld portions. The tight bundles, spiced with coriander and ginger, steamed fish and root vegetables while retaining aroma and savor. The Yoruba washed down their servings with sweet roselle juice.

The arrival of New World chili pepper and tomatoes in the sixteenth century altered recipes for dried and flaked fish and goat, the dominant meats, and steamed *moimoi,* a Nigerian bean pudding. The additions presaged the basic colors and flavors of Brazilian, Cajun, and Creole cookery. An open-ended recipe for one-pot Gambian *jollof* rice, a parallel of Arab pilaf, Iberian paella, and Louisiana jambalaya, invited the cook to improvise in apportioning the flavors of onion, pepper, and tomato. For these spicy meals, West Africans drank millet beer and palm wine as table beverages.

To the east, herders sold cattle, goats, and sheep, keeping only blood and milk for their own meals. Heavy reliance on coconut, grains, and rice anchored meals to carbohydrates, such as Ugandan *matoke,* steamed green bananas. Around 1000 C.E., when Arab traders settled among Swahili speakers, bland African fare acquired Persian flavors from cinnamon, cloves, pomegranate juice, and saffron. The introduction of Peruvian corn in the 1500s supplied the ingredient for *ugali,* a staple starch similar to fufu and eaten with meat and vegetable stews. During the diaspora, Africans bore recipes for corn mush to the West Indies.

In the early sixteenth century, fields of Mesoamerican corn along the Gold Coast attested to a continent-to-continent food transfer and stimulation of population growth. Only the coastal Axumites and residents of the Volta River delta clung to rice as the dominant cereal. Portuguese traders demonstrated pudding making and the marination, basting, and spit-roasting of pork joints in fragrant sauces. Iberian marinades relied on chilies, citrus juice, pineapples, and tomatoes, uncommon ingredients in African entrées. British influence transported Indian specialties to African colonies. By incorporating chapatis, chutney, curry, lentil soup, and pickles to gastronomy, East Africans developed indigenous flavors to new heights.

Fusion Cuisine

Farther north in Eritrea, Ethiopia, and Somalia, communal dining centered on finger food and bread as both a carbohydrate and utensil. Diners relied on *injera,* a spongy sourdough flatbread made into convenient rounds from barley, corn, sorghum, teff, or wheat. The regional complement, *hilbet,* involved the creaming of fava beans and lentils into a paste. Because of Coptic Orthodox Christian, Islamic, and Jewish food taboos, families avoided alcohol, horsemeat, pork, reptiles, shellfish, and wild birds and game. Peasants preferred dried peas, noodles, and oat porridge with honey to fresh vegetables. The more sophisticated Somali spiced basmati rice with cardamom, cinnamon, cloves, cumin, and sage and drank spiced tea Arab style.

The centrality of South Africa to world trade brought the food of outsiders to the local Sotho, Xhosa, and Zulu, an agrarian and pastoral tribal network that overran the aboriginal Khoi herders around 1000 C.E. To Khoi brewing, spit-roasting impala and ostrich, and biltong (jerky), colonists from Britain, France, Germany, Holland, and Portugal added the traditions of barbecuing, *boerewors* (sausage), and pig's feet with beans. Complementary dishes of corn mush, onion and tomato sauce, and yogurt supplied energy and vitamins. To the northeast in Zambia, the rural Bemba maintained a peasant diet of fish, game, insects, and wild fruit as additives to kitchen garden greens, gourds, and cowpeas. They farmed by the swidden system and cooked by methods passed from mother to daughter.

From the mid-eighteenth century, South African recipes displayed the venturesome combinations of innovators, especially *bobotie,* a Malaysian meatloaf with bananas, coconut, and raisins, and *isidudu,* a gruel of cabbage, liver, and pumpkin served with a milk dressing. Indian restaurateurs added bunny chow, a quarter loaf of bread hollowed and stuffed with curried vegetables. Beach communities developed recipes for fish stew and broiled and steamed crayfish, lobster, mackerel, mussels, octopus, oysters, shrimp, and tuna.

See also: African Food Trade; African Slave Diet; Bushmeat; Malnutrition; Soul Food; Swiddens; Taro.

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African Food Trade

Referred to by archaeologists as "the cradle of humanity," Africa abounds in natural resources and the age-old agropastoral wisdom of food producers. Across the Sahara and the Nile River valley beginning in 6000 B.C.E., trade in cattle, donkeys, and goats built sophistication in raising animals for sale. Informal barter enabled breeders to diversify mammals and poultry and to select the best egg, meat, and milk producers.

Serious drought in 4000 B.C.E. forced farmers south from the Sahel grasslands into the tropical lake and river territory of the Ashanti and Yoruba. Homesteaders adapted to the bushmeat and wild food to the south in Mali. In addition to hunting the gazelle and oryx, seminomadic growers domesticated guinea fowl and grew African spinach, black-eyed peas, *fonio* (a type of millet), groundnuts (peanuts), millet, okra, pigeon peas, plantains, rice, sorghum, taro, and yams. Swiddens and applied animal and green manure upgraded soil fertility and halted erosion. Gradually, journeymen ventured into promising bazaars to the north to sell fruit, tubers, and vegetables. In 2000 B.C.E., enterprising Africans exported food plants across the Indian Ocean to semiarid Asian lands.

Precolonial Africa slowly realized its economic promise as a food provider for Europe and Asia. After 200 B.C.E., Roman buyers solved their national wheat crises by looking to Berbers in Numidia for emergency provender. To accommodate the grain trade, transporters established the Nubian river corridor from Aksum (Ethiopia) to Egypt and smaller overland routes that are still in use today. By 350 C.E., Red Sea ports developed international commerce so active that it fostered a vigorous pirate culture, which preyed on African wealth. The agricultural yield declined in the sixth century from drought, overfarming, and shifts in the Nile's annual overflow.

Early Commercial Success

From the late Middle Ages into the 1870s, waystations at Gao, Jenne, and Timbuktu controlled trans-Saharan traffic in cotton, salt, and kola nuts, a sacred item from the Cameroon and Gabon. As far south as the Congo River basin, West Africans valued the kola pod as a stimulant, diviner's tool, and holy offering at Igbo and Kanuri ancestor worship and funerals. Lagos, Nigeria, on the Atlantic coast, developed into the export center for the kola nut, valued as an aphrodisiac and in the drug industry to treat migraine and neuralgia. The growth of Islam spread demand for the nut for chewing by Muslims, to whom the Koran forbade alcohol. Conveyors traversing the Upper Niger and Upper Senegal by canoe accessed Moorish kola markets in Morocco and Tripoli.

At the end of the eighteenth century, Europeans viewed Africa as a vulnerable fortress of agricultural wealth. Much of the region's unique produce traveled by canoe fleet to anchorage on the Bight of Benin to provision the transatlantic slave trade. By shipping a taste of African food to slave markets in Europe and the Americas, enslavers unwittingly introduced the Dark Continent to world food commerce in bananas, eggplant, guinea squash, manioc, melons, sesame, and taro. In 1670, planters in Barbados and Jamaica established the first New World growth of Africa's green wealth.

The transport of Bengalese, blacks, and West Indians from Nova Scotia to Sierra Leone after 1792 enabled British investors to reap proceeds from the grain trade. Bambara, Fula, Hausa, Mandinka, Soso, Wolof, and Yoruba middlemen converged on Freetown to sell bananas, cashews, castor oil, cocoa, corn, eddoes, kola nuts, millet, okra, palm wine, peanuts, plantain, potatoes, rice, sweet potatoes, and yams. The group netted immediate profits from merchandizing arrowroot, coffee, cotton, ginger, honey, nutmeg, palm oil, and pepper. Upon gaining freedom, the West African nexus built on past success. In the 1820s, Freetown flourished from connections with caravans arriving from the Sahel with food goods for global trade.

Farther south of the Congo estuary, British and German merchants exploited profits in kernel and palm oil. The Fang, who migrated from Cameroon into the forest zone, brokered the kola nut and palm oil trade as well as a complex business in guns, ivory, and slaves. As the predatory slave trade came to an end in the mid-1860s, cotton enjoyed a temporary boom along the Congo and Ubangi rivers because of the dearth of agriculture during the American Civil War.

A brisk business in cassava, coffee, gum, salt, and whitebait drew central Africans into a permanent symbiosis with free-spending European colonists. Because of

lack of education and financial backing, blacks remained passive trade partners with white Europeans. The memoirs of Danish planter Karen Blixen, captured in the biographical film *Out of Africa* (1985), characterize the racial suppression and land theft from such indigenous laborers and coffee pickers as the stateless Kikuyu of Kenya.

Empire Builders

From Zanzibar, British, French, German, Indian, and U.S. exploiters who traded in cloves, copal, cotton, and gum erected export bans, quotas, and taxes that protected their interests. Arab merchants contributed to the international fervor by offering dates in exchange for salt and spices, which they transported down the Nile to Cairo and Khartoum. In Angola in the late 1860s, Brazilian and Portuguese moguls operated press gangs to grow coffee and sugar, both dependable plantation crops. By playing one Bantu faction against the other, empire builders perpetuated political intrigue as a method of spurring profits. Gunrunners and mercenaries fostered central Africa's reputation for thuggery and violence.

By the 1870s, the hegemony of Britain in Egypt, France in Algeria, and Afrikaner (Boer) and British settlers and railroad builders of South Africa south of the Kalahari absorbed greater control of precapitalist agricultural and pastoral produce. Western technology developed uses for corn as a source of fodder and oil, thereby displacing millet and sorghum as major cash crops. European dominance of wholesale mutton and wine exports from Cape Town and Natal ensured steady returns but little reward for Swazi and Zulu producers. Overall, British deal makers undersold African competitors and used sea power to tyrannize free trade.

In 1888, the Mozambique Company, a Portuguese investment in 60,000 square miles (155,000 square kilometers) of farmland, benefited from the export of a variety of East African goods—agave, cashews, cassava, copra, corn, fruit, peanuts (groundnuts), potatoes, rice, sugar, wax, and wheat. The promising stock appealed to importers in England, France, Germany, and North America. At the beginning of the twentieth century, the peanut offered more protein for the money than any other sustainable crop in Burkina Faso, Cameroon, Congo, Mali, Zambia, or Zimbabwe and advanced to millionaire status Alhassan Dantata, a Nigerian broker. Industrialization fostered trade in flour, liquor, meat, milk, peanuts, rice, and sugar in the 1920s until the Mozambique Company's downfall in 1941.

After World War II, the rise in urbanization increased demands for fresh produce and grain. The independence of sub-Saharan Africa in 1961 buoyed population so rapidly that the continent shifted from a cereal exporter to a food importer in just four decades. Employment figures into the late 1960s varied from 33 percent in Mombasa to 60 percent in Lusaka, an indication that large numbers of central Africans continued to rely on agriculture and pastoralism for their livelihood.

Into the 1990s, world economists awaited a green revolution of the magnitude of the Chinese and Southeast Asian food markets, which based their success on government investment in small farms. Contributing to Africa's rise as a trading partner, the dismantling of commercial restrictions and trade barriers allowed new competitors to export surplus goods. Meanwhile, African farmers offered testing grounds for genetically modified cotton and other crops in Burkina Faso, Egypt, Kenya, Morocco, Senegal, Tanzania, Zambia, and Zimbabwe.

In 2004, an increase in irrigation of rice lands in Cameroon, Kenya, Mauritania, and Niger augmented Africa's ability to compete against an entrenched Asian monopoly. By 2010, however, ecologists warned that African hydrology remained dangerously unpredictable in grain fields and pasturage along the Sahel and throughout northern and southern regions. To offset shortages, urban horticulturalists planted high-value commodities—cucumbers, melons, peppers, strawberries, tomatoes—on marginal and peripheral land to heighten food security.

Recent Import-Export Trends

In 2011, global financiers noted that half of the world's ten fastest-growing economies—Algeria, Angola, Ghana, Mauritius, and Nigeria—were African. Since 2005, agricultural commerce had increased by 92 percent. More than Latin American and Pacific Rim buyers, both Canada and China courted small African markets in Burkina Faso, Ethiopia, and Malawi. To stabilize income, farmers replaced corn with drought-tolerant cassava. At the same time, Kenyan, Tanzanian, and Ugandan fishermen expanded their fresh water catch beyond Nile perch, the most seriously overharvested species; however, sabotaging regional efforts, health and pollution regulations passed by the European Union increased overhead, notably the cost of analyzing and inspecting seafood, maintaining quality control, removing pesticide residues, and tracing aflatoxins. U.S. border rejections of African foods tended toward the ridding of cereals, dried fruit, nuts, and vegetables of foreign matter and pathogens, especially botulism in canned goods.

Zambia, a landlocked entity once absorbed with the copper trade, hovers on the edge of enlarging subsistence farming into commerce in grain and diversified food staples appealing to urbanites. Like other poor countries—Kenya, Malawi, Tanzania, and Zimbabwe—Zambia has begun venturing into agribusiness by developing markets for beef, chicken, corn, eggs, fish, oil, pork, and vegetables. Government controls assist financiers in stabilizing income and protecting smallholders from the impacts of border regulations and unpredictable vicissitudes in weather and harvests.

The Islamic Food Council oversees imports of dairy products, frozen food, meat and poultry, and processed goods, such as beef and chicken from Brazil to African markets. To meet the demand for halal meat specified by Muslims, McDonalds, Nestlé, and Tesco have expanded their offerings, especially among affluent Muslims in Burkina Faso, Egypt, Guinea, Morocco, Niger, Senegal, Somalia, and Tunisia.

Niche marketing nets a smaller exchange, such as the sale of American and Canadian mead—cyser, melomel, and metheglin—in Ethiopia and South Africa, where honey wine outsells grape wines. Despite a large Muslim population, Egypt markets Canadian ice wine, a dessert beverage pressed from frozen grapes. Exporters anticipated higher wine sales in Egypt, Morocco, and South Africa but reduced expectations for North Africa after the turmoil of the "Arab spring," especially in Libya.

Farmers in Angola, like those in South Africa, produce enough subsistence crops to import beans, meat, and wine and to supply the rest of the world with bananas, beer, coffee, corn, cotton, fish, and sugarcane. On a higher economic level, Algeria tops demand for imported groceries, convenience and luxury foods for the hotel trade, diet foods, and grains and legumes, namely corn, lentils, peas, and wheat. The imports sustain Algeria's main industries, which include food processing.

Nigeria, like Algeria, offers new markets for grapes, potatoes, processed food, and wheat flour for supermarkets and convenience stores. Nigerian farmers balance trade with their output of cocoa beans and sesame seeds. Generating a high employment rate, the country's dynamic income can afford imports of baby food, beverages, and breakfast cereal.

In Accra, the financial heart of Ghana, a vibrant young population supports imports of beer, canned goods, fruit juice, ice cream, pastry, potato chips, powdered milk, sauces and seasonings, and wine. Outgoing shipments of cocoa beans and cocoa powder help satisfy the world demand for chocolate. Additional profit from arrowroot, cashews, coconuts, coffee, flour, pineapples, spice, and sweet potatoes enables a growing nation to flourish. Projections for future exports of tuna and other fish species raised in aquaculture increase interest in investments on Africa's western coast.

At a faster rate, Mauritius, off the east coast, exerts the greatest claim on dairy products, eggs, fresh and frozen foods, lentils, oil, peas, pork, rice, and soybeans. From ports on the Indian Ocean, Mauritians deal in bananas, corn, potatoes, pulses, sugarcane, and tea. In a competitive environment, entrepreneurs intend to increase the Mauritian processing of seafood and to import luxury beef cuts to feed the tourist trade.

See also: African Diet and Cuisine, Sub-Saharan; Mozambique Company; Sierra Leone Company.

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African Slave Diet

In the late 1600s, West Africans favored a largely vegetarian diet augmented with dried fish, goat, iguana, marrow bones, poultry, and shark. Women cultivated small plots and created call-and-response field chants, the music of female cooperatives. Their kitchen gardens contained indigenous plants as well as imports.

Arabs introduced onions, rice, sorghum, sugarcane, and wheat to Sierra Leone. As late as 1455, the Senegalese grew kidney beans and sesame, but no barley, corn, rye, spelt, or vine crops. From India and Malaya through Madagascar and Kenya came the banana, cocoyam, and millet. Pineapples flourished at the Gold Coast. Angola and the Congo received fruit and vegetable strains from the Americas, and New World foods—chili peppers, dasheen, tomatoes—more than doubled supplies of staples. The hybrid cuisine included molasses beer to wash down peanuts and pawpaws that the Portuguese first planted in Gambia, coconut palms and herbs that the explorers planted in Sierra Leone, and cassava and maize, imported by Portuguese traders around 1550 to Benin, Gambia, and Ghana. West African vendors propagated produce to sell to trading vessels at Cape Verde.

The new varieties supported a burgeoning African population despite losses to disease and enslavement. Transport by coffle overland or up to 30 to a canoe weakened the youngest and oldest of captives. Many died of tainted food in coastal barracoons (temporary barracks); others succumbed to contagious diseases or seasickness.

To maintain the vigor of Africans seized in the rain forest and to lessen mortality rates during the Middle Passage of transport to the New World, sea captains of British slave ships belonging to the South Sea Company and the London-based Royal African Company of England, a project begun by King William III, emulated the African diet. With ships' surgeons superintending food service, the mortality rate for transported slaves fell from as high as one-third to 13 percent by 1720.

A Familiar Diet

Key to health during slave transport were citrus fruits, coconut, millet bread, and medicinal herbs at meals, lime and water beverages throughout the day, kola nuts to combat thirst, and cleansings of the hold with vinegar. In hopes of suppressing slave revolts and hunger strikes, suppliers at Whydah on the Bight of Benin stocked corn, malagueta pepper, palm oil, and yams from Lower Guinea. Aboard the *Hannibal* in 1693, the galley crew cooked a ground slurry into porridge called *dabbadabb* (corn dumplings), varied three times a week by horse beans, which controlled the flux (dysentery). In 1707 at Cape Coast, Ghana, ships' cooks chose beans, corn, and rum as a wholesome and familiar diet. Above grain from farther west at El Mina, ships' mess staffs favored hominy, maize grown by the Fanti, red rice from Senegambia, and palm oil. The oil doubled as a skin emollient to heighten the appeal of captives to slave brokers. For the sick, the addition of sago, sugar, and wine to mutton soup roused some from malaise. Even serving an African diet, over an eight-year period the Royal African Company lost more than one-quarter of its abductees, who were buried at sea before the ships reached the Chesapeake Bay.

The importation of African slaves to the Western Hemisphere introduced a third cuisine to Indian and Iberian fare in Colombia and Brazil. Additions altered the cooking styles and foodstuffs favored by Spanish colonists and saved lives. At Cartagena, Colombia, Jesuits stopped feeding slaves heavy cereal, eggs, and salt fish, a diet that killed off the weak who awaited sale to buyers at the docks. Other slaves, exhausted by dysentery and fevers, died on the trail during transport to Lima, Peru. From 1610 to 1650, religious worker Pedro Claver Corberó, the patron saint of slaves, visited slave hospitals and pens and treated dehydration, hunger, psychological shock, and scurvy in newcomers with brandy, bread, lemons, preserves, and sweets. At San Lazaro, he fed a special diet to lepers.

European opinions about the value of slaves changed as the fame of West African farmers and herders spread among planters, particularly in Bermuda, the first island to import black slaves. Along the coastal Carolinas, West African slaves rotated cattle pasturage with rice plantings, a method of restoring soil nitrates to improve the yield. To ensure working strength and stamina, overseers allotted a daily diet of 2,500 to 3,000 calories for each slave. African field hands cooked their own breakfast and dinner. For the afternoon meal, they rebelled against the feeding of slaves at a common trough like swine.

Typical fare in Maryland at the 2 P.M. serving included beans, buttermilk, cornmeal, molasses, and poke greens, a springtime delicacy valued as a tonic. Salt herring dominated meat servings along with discarded ham hocks, hog jowls and maw, chitterlings (animal intestines boiled in vinegar and water), fatback, organ meats, and pigs' feet. In New Orleans, crawfish and shrimp produced a rich, vivid Creole cuisine. Hunting, fishing, and trapping added carp, catfish, opossums, rabbits, turtles, and wild turkeys. When masters wanted to encourage harder work during planting and harvest, they augmented slave cuisine with food gifts and rum and whiskey from the big house.

Roots of Soul Food

To combat humiliation, coercion, and homesickness, slaves craved food common to their home countries. They grew gourds and made ceramic colanders and dishes for slow-cooking rice, fanning baskets for winnowing, hoes for baking corn cakes, reed and sedge baskets for gathering root crops, and wood utensils for food cultivation and preparation of *cala* (sweet rice cakes), *jollof* (red rice), and gunger cake (molasses cookies). Women joined in the pounding of rice with mortars and pestles, a perpetuation of African sisterhood.

At Barbuda, agropastoralists staked out animals in vegetable plots and spread the drying manure to nourish plantings of dasheen, a South American famine food adaptable to many cooking needs. Amaranth and manioc leaves, collards, dasheen, mustard greens, and sorrel served as salads, nutrient-rich steamed side dishes, and extenders and thickeners of meat soup and stew. Island farmers boiled callaloo and yam, eddo, and plantain, which they flavored with salt and cayenne or red pepper. Around 1730, Virginia slaves raised watermelons to eat out of the hand like pome fruit and added African specialties to plantation menus.

Additional slave favorites—black-eyed and pigeon peas, broad beans, kola nuts, cowpeas, grits, millet, peanuts, okra, red rice—became Southern staples. Slaves adapted culinary styles and tastes from memory, including deep-fat frying of chicken and fish in peanut oil. Along the Guinea shore, cooks had anchored meals to root crops. In Cameroon, Ghana, and Nigeria, pureed potatoes and yams produced *fufu,* a basis for complex toppings and condiments that slaves duplicated in Brazil, Cuba, the Dominican Republic, and Puerto Rico. Diaspora dishes featured cornmeal for fish fries, grated ginger and pumpkin in soup, greens and mackerel in pepper pot, okra in gumbo, peas and rice in hoppin' John, peanuts in pralines, pepper in barbecue sauce, rice in meatball pilau, and later, kola nuts in Coca-Cola. At Monticello, Thomas Jefferson's Virginia home, slave farmers grew guinea corn (also called benne or sorghum), which they ate in broth, bread, greens, salads, and toasted as a soup topping.

Weekend markets held by slaves in Antigua, the Bahamas, Barbados, Jamaica, and St. John featured lima beans, cabbage, corn, ginger, mustard greens, and pumpkins. Savvy marketing raised cash to enhance the African American diet. Slaves from Nigeria protected their investment by digging cellars to protect root crops over the

winter. Using their horticultural skills at fertilizing fields, intercropping corn with peas, and weeding and topping plants, they enriched cotton, sugar, and tobacco tycoons.

See also: African Diet and Cuisine, Sub-Saharan; Language, Food; Manioc; Sierra Leone Company; Vinegar.

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Afterlife and Food

To allay the grief of death and bodily atrophy, mourners throughout history have supplied their dead with food and drinks. As early as 100,000 B.C.E., Neanderthal mourners supplied meals for the dead as nourishment for a netherworld. In contrast, the Sumerians envisioned a more austere afterlife lived in a dark, silent cave surrounded by dust. In a more uplifting philosophy, Japanese Shintoists and Koreans celebrating Chuseok offered favorite dishes to ancestors as a way of strengthening family ties.

Edible grave goods, such as the libations of milk and wine in Homer's *Odyssey* (800 B.C.E.) and Sophocles's *Antigone* (441 B.C.E.), were believed to have magical powers over the soul's destiny. Among Polynesians, the tasting of burial foods sealed the fate of the spirit, which, like the mythic Greek victim Persephone, belonged forever to the land of the dead. To the Buddhist, Hindu, and Norse, the act of eating sustained the journeyer on the road to a final destination. According to the twentieth-century Hindu swami Prabhavananda, soul hunger readies the newly deceased for the great change from human to spirit. The newcomer fasts for three days without water or sleep until the King of Death extends welcome to the world beyond.

Food as Propitiation

In the Middle East, from around 4000 B.C.E., the gift of meals to the deceased ensured reciprocity—food in exchange for guidance and protection. At Gezer, an archaeological site between Jerusalem and Tel Aviv, Canaanites poked hollow feeding tubes into headstones to guide sustenance into the mouths of the dead. At Megiddo, north of Syria, Israelites delivered liquid sustenance to burial chambers through funnels. The custom came under attack in Ecclesiasticus 30:18 around 200 B.C.E., when poet Ben Sirach mocked the waste of meals piled on sepulchres. After the evolution of shivah, a consolatory meal for mourners, family members chose round foods—bagels, eggs, lentils—as symbols of the life cycle. Modern shivah gifts shift the emphasis from the inevitability of death to reminders of earthly sweetness, such as brownies, cheesecake, fruit, rugelach (nut rolls), and wine.

Egyptians protected agrarianism by burying the dead within sight of productive fields. Families stocked funeral chambers with plows and tools for growing grain and harvesting figs and dates. After opening the mouth of the deceased to ensure speech and eating, they assembled edible grave goods to feed the remains on a boat voyage to judgment in the afterlife. Coffin paintings glimpsed a full pantry of figs and lotus, duck and ibis, gazelle and oryx, flatbread, and seafood and jars of staples alongside cooking utensils and seats at a banquet table. To ensure a vigorous sex life, the painters added lettuce, an aphrodisiac.

A hieroglyphic list from after 2600 B.C.E. at Dahshur, south of Cairo, depicts uniformed maidservants delivering appealing meals to the dead on trays. On tomb walls, menus reminded servants in the afterlife of the foods enjoyed by the deceased. Drawings of foods allegedly shapeshifted into real servings. On the fortieth day after the burial, survivors brought provisions to the cemetery. After prayers, the living distributed the edibles to the needy, a gesture propitiating favor from Horus, Maat, and Thoth, the judges of earthly behaviors.

Foods of Paradise

Scripture, sagas, and art since prehistory have illustrated visions of heavenly dining. Bas-relief and grave goods of Viking funerals depicted the dead warrior on a sea voyage. In his burial boat, provisioners placed a well-rounded diet—apples, beer, cress, hazelnuts, horseradish, mustard, oats, oxen, and wheat. Because Finns and Swedes believed that the dead remained on Earth until their bodies decayed completely, visitors offered grave foods to long-dead ancestors. Among Balto-Finns and the Sami, a ritual meal of animal hearts accompanied by magic incantations sung by a female chorus strengthened the resolve of the journeyer. As described in the Finnish epic *Kalevala* (1881), the ceremony concluded with a banquet, at which a fortune-teller predicted the destiny of each mourner.

In some societies, mock foods take the place of real dishes. In 141 B.C.E., clay models of sheep and pigs suggest meaty meals for the Chinese Emperor Jing of the Han dynasty. Around 1450 C.E., Chinese artists in Shaanxi Province made model foodstuffs on ceremonial plates. The offering of fish, goat, goose, pork, and rabbit and fresh servings of peaches, persimmons, pomegranates, steamed bread, and water chestnuts represented the common diet of the period.

World religions have typically endowed funereal meals with power and sanctity. Even though Jews believed that the dead had no need of sustenance, the Kabbala, mystical writings compiled between 100 and 1200 C.E., pictured a symbolic meal of fish, meat, and wine served in the Garden of Eden. The divine food contained "sparks of holiness," the magical power that elevated the spirit to heaven.

Pagan Rites

The living worldwide went to great lengths to honor the elite dead by accepting the cost of sacrifice. After 668 B.C.E., Ashurbanipal, the Assyrian monarch at Nineveh, acknowledged his piety with an inscription crediting him with reviving old customs of libations and meals for royal spirits. In a similar gesture to the privileged class, the Aztec ensured convivial meals of familiar foods by sacrificing cooks to accompany the noble dead to the next world. Among the Lenni Lenape of North America, women pounded corn and made unsalted loaves in outdoor ovens. Zoroastrian women spread communal food offerings to the deceased on *sufras* (funeral cloths).

For Amerindians, tobacco generated visual prayers for the dead. Plains and Pacific Coast Indians sprinkled *kinnikinnick* (herbed tobacco) or unadulterated tobacco over remains as a holy gift and propitiation of the gods while the spirit crossed over the star path from Earth to sky. The Winnebago extended the tobacco pipe to the deceased as though including them in the feasting and pleasures. At an Algonquin funeral in October 1647 in Nonanetum, Massachusetts, the corpse bore the calumet (pipe) of peace during his journey as a gesture of nonviolence to the spirit world.

African religions favored killing a goat or ox at the burial. According to the pastoral Nguni of southern Africa around 1400 C.E., the slaughtered beast made two journeys—following the deceased to the netherworld and, on Earth, feeding the bereaved who remained behind. On a more upbeat note, the Arawak of the Caribbean anticipated joy in Coyaba, a land of dancing and endless banquets, a concept they shared with the Celts. The Inca interred their dead sitting upright amid pots of food, symbols of abundance. As proof that the afterlife liberated the spirit from want, the Papago and Pima pictured their ancestors living free from hunger and thirst.

Islamic Funeral Food

Muslims observed the same sharing of food and celebration as a form of friendship and condolence. Unlike the ancient Jews, Egyptians, Greeks, Japanese, and Chinese, Islamic families directed gift meals toward the community rather than to the deceased. In the style of Cushites, the bereaved ended the day with a feast, which required slaughter of camels, cattle, and sheep to feed a large gathering. As a form of ritual almsgiving, one of the Five Pillars of Muslim worship, family mourners shared the bounty with children, the hungry, neighbors, and strangers.

Meanwhile, the Muslim dead earned their rewards in paradise, where sumptuous tables bore a perpetual supply of food and drink served on gold and silver tableware by handsome young men and women. The Koran (650 C.E.) specified the luxuries awaiting those who died in a state of grace. Lush gated gardens, angels, and streams of honey, milk, water, and wine surrounded the righteous, who won favor with God by eating only halal (permissible) food on Earth. Permeating the air were the appetizing scents of camphor, ginger, and musk and the mist of fountains.

Uniting Past and Present

Food today maintains its role as an element of life's goodness, from the Inuit vision of a warm land of plenty to the beneficent comforts of the Baha'i and Cree "good land." For Wiccans, dancing, singing, and partaking of cake and wine honor the soul as it makes its way to Summerland. Practitioners of Santeria, a pantheistic faith that originated in West Africa, offer sacrifices to spirits to maintain a reciprocal relationship with the world beyond. By feeding the deceased with artistic patterns of cornmeal and the blood of sacrificial chickens and goats, the living receive health and shielding from harm.

The peasant holiday of Día de los Muertos (Day of the Dead), celebrated on November 1 and 2, involves Roman Catholics in Ecuador, Guatemala, Mexico, and the Philippines as well as Arizona and California. In addition to candles and marigold petals, mourners honor their deceased with photographs, aniseed bread, tamales, and liquor. Like the ancient Maya, communities bury sustenance to feed the spirits on their way to the afterlife, which they entered through caves to eat wild birds, which were no long taboo. Home altars bear heaps of *atole,* cocoa, egg bread, fruit, peanuts, sugarcane, tortillas, and turkey mole. A folk art confection introduced during the colonial period, sugar skulls release the sweetness that death fails to conquer. All-night vigils bring celebrants together in an effort to direct souls home again.

See also: Breadfruit; Jerky; Pasta.

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Agribusiness

The totality of buying and selling involved in bringing food crops to the table, agribusiness forms a vast network of farmers and herders, financiers, equipment manufacturers, seed suppliers, livestock marketers, and food processors, advertisers, and distributors. In the mid-1800s, the mechanization of plowing by Cyrus McCormick and John Deere preceded a U.S. refrigerated rail network that sped grain, citrus fruit, potatoes, and meat to emerging processors, notably, Armour, Campbell's, Del Monte, Heinz, and Swift. After establishment of the U.S. Department of Agriculture in 1862 and the building of land grant colleges, contract farming replaced subsistence farms with more advantageous methods of sharing risk.

An American model, contract poultry began in 1929 at the collapse of post–Civil War sharecropping and tenancy. Rural sociologist Rupert Vance surveyed agribusiness at the onset of the Great Depression when Georgia cotton growers abandoned their traditional monocrop for chicken coops. Educated by the federal home demonstration service and guided by county agents, poultry growers supported a food industry based on hatcheries, feed mills, and chicken-processing plants.

During World War II, demand for eggs and meat solidified the fate of the American small farm with reciprocal contracts and indebtedness to the poultry speculator. In 1955, John H. Davis, a Harvard professor of agriculture and marketing, created the term *agribusiness* to describe the evolution of subsistence farming into a business complex.

Efforts to curb corporate power mongering involved growers as well as laborers and truckers. In 1960, journalist Edward R. Murrow presented the television documentary *Harvest of Shame,* a graphic view of the bottom rung of the agrifood hierarchy. In the 1970s, César Chávez and Dolores Huerta organized the United Farm Workers, the first effort of migrant labor to battle U.S. exploitation of the disempowered. The set-to between union members and illegal immigrant strikebreakers revealed to consumers the cost in human terms of cheap grapes and lettuce from corporate farms.

To supply the growing demand for convenience foods, such as powdered eggs and ready-to-fry chicken, transnational corporations in the 1980s stepped up involvement in world agriculture. The era's low commodity prices spurred land speculation and rising property taxes, which strapped family farms, ranches, and rural communities. A complex interaction, agribusiness coordinated the efforts of genetic seed modification to increase yields and food transportability and the addition of corn ethanol and palm oil to tractor fuels to stretch the costly supply of fossil energy. Entrepreneurs and seed patenters targeted fruit, vegetables, and seafood from Third World producers for financial exploitation. To the dismay of smallholders, corporate farming placed huge markets under the control of micromanagers and biotechnologists. The top earners for agrifood—bananas, cocoa, coffee, grain, oil—remained chiefly in the purview of a handful of companies, including Bunge, Cargill, Carrefour, ConAgra, Danone, Dole, General Foods, Huanong, Kraft, Nabisco, Nestlé, Parmalot, Ralston-Purina, and Tesco.

In 2007, Brazil flexed its agrarian muscle as an emerging producer of citrus fruit, corn, cotton, soybeans, and sugar, and cattle, pork, and poultry. Rated third in corporate clout behind China and India, Brazil competed against China's food moguls at a vulnerable point in food security following the adulteration of Chinese baby food, soy products, and pet food with melamine. The mounting threat of farm takeovers increased following the formulation of international food purity and safety standards. Costs lay beyond the grasp of smallholders, such as producers of leafy greens, Mexican tomatoes, and organic grapes and strawberries.

Beside purity concerns, a variety of global issues impact agribusiness and agrofinance today, including control of pesticide-resistant insects, buyout attempts between European food giants, and the growing power of women in microfinance and corporate farming. Layered situations create a domino effect: The Australian investment outlook remains cautiously optimistic, depending on the U.S. settlement of its debt ceiling and Indonesia's postcyclone cattle imports from Queensland.

The collapse of Soviet Communism allowed some nations to regain traction in the world food market. In July 2011, farmers formed a customs union of Belarus, Kazakhstan, and Russia. Simultaneously, after the "Arab spring" of 2011, Egypt, the most populous Arab nation and a major player in the wheat market, fielded a record crop. With political control still unpredictable and the Middle East teetering on upheaval, farmers projected growth into 2015 in dairying and the cultivation of beets, which reduce the natural salinity of Egyptian fields.

See also: Commodity Regulation; Farm Subsidies and Government Agricultural Programs; Genetically Modified Food; Greenhouse Horticulture; Hanna, Gordie C.

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Agriculture

A basis for civilization, agrarianism tied the support of a clan or tribe to the output of herding, orchardry, seed and tuber planting, and viticulture (the cultivation of grapes), all sources of portable trade commodities. During the Neolithic revolution around 12,000 B.C.E., hunter-gatherers embraced a settled life by planting wild einkorn wheat, an annual hulled grain that thrived at the western end of the Fertile Crescent. Threshers collected the hulled seeds to roast at campfires into digestible, satisfying grains. Low yielding, but protein rich, einkorn wheat cooked into a low-fiber gruel suitable for invalid and weaning meals.

After the establishment of Abu Hureyra and Mureybit, east of Aleppo in western Mesopotamia (Syria), in 11,050 B.C.E., a thousand-year drought forced early Palestinians to irrigate plantings of comestibles and water sheep herds. To feed the most people, workers selected animal and grain traits, particularly dependable milking from cows and sheep and sturdy grain heads on slender stalks for the largest crop. Growers planted seeds in fertile fields and cached harvests. In the Neolithic Levant, Natufian villagers fenced out gazelles and broadcast seeds in open spots among wild almond, pistachio, and plum groves and berry bushes. Because of the ease of threshing wild wheat stands growing 36 inches (91 centimeters) tall, in three weeks, a clan could garner a year's supply of grain.

As farms thrived, population density rose from one to 15 persons per square mile. To feed all, protofarmers across the east-west Fertile Crescent naturalized self-pollinating, early-maturing founder crops—barley, bitter vetch, chickpeas, einkorn and emmer wheat, flax, lentils, and peas. Blacksmiths tempered blades for cutting grain; stonemasons nested grinding stones and mortars and pestles for reducing grain into a fine grist for flatbread and beer. Cultivation in Jordan, North Africa, and the Taurus and Zagros valleys of Turkey spread across the Balkans to Serbia, the Danube River delta, the mouth of the Rhine as far as northern Italy and Valencia, Spain, and north to proto-Celtic enclaves.

Grain-Based Diet

The acceptance of grain as a daily staple paralleled the cultivation of wild figs and the domestication of dogs, goats, pigs, and sheep for fiber, meat, and milk. In southeastern Turkey in 9000 B.C.E. and Jericho in 8000 B.C.E, innovations of Neolithic, or New Stone Age, cuisine shifted focus from a meat-only diet to cooked legumes. Herders in India raised zebu for meat and evolved dairy foods from cows. Cooks chose from barley, corn, millet, oats, rice, sorghum, and wheat the appropriate grains for bread, flour, noodles, and pasta. In the Chihuahua Desert on the Tex-Mex border around 7500 B.C.E., paleo-Indian farmers hunted less and consumed more domesticated cheese, grain, meat, and milk.

From this era, agriculture evolved formalized methods and strategies. Syrian agrarianism flourished at Damascus, where planned cultivation rapidly replaced the more rigorous and hazardous hunting-and-gathering lifestyle. In Papua, practical farmers raised root crops and sugarcane alongside pigs, useful recyclers of green wastes. The seeding of barley and wheat spread to the Aegean isles, Egypt, the Harappan culture of the Indus Valley, Kurdistan, and Pakistan in 7000 B.C.E. and to Argissa, Greece, Germany, Iberia, and Crete in 6000 B.C.E. India's farmers domesticated the jujube (date) for drying and pickling, trained elephants for heavy lifting, and penned chickens to supply eggs and meat. Harappans also drained bogs and diverted sewage from irrigation water. Growers gained sophistication at seed selection by choosing emmer wheat and barley for cultivation in clay and marl soils. Meanwhile, in the Far East, Chinese and Indonesian crop tenders developed a more integrated diet of adzuki beans, rice, soy, and taro as accompaniments to chicken and the fish they netted from rivers. The broad-based diet fueled a population explosion.

At the same time that proto-Americans were reaping arrowroot, corn, and manioc around 5500 B.C.E., Irish growers at Céide Fields became the first to raze forests and surround permanent croplands with rock walls. Agrarianism reached Macedonia, Thessaly, and Thrace after 5200 B.C.E., when food control began to generate exciting possibilities. Sumerians, the empire builders at the Tigris and Euphrates delta, bred cattle and sheep and irrigated fields after 5000 B.C.E. The advances coincided with the growing of oranges in the Indus Valley, where farmers gradually added apples, barley, cotton, grapes, mangos, peas, plums, rice, and sesame seeds to their harvests and butter and cheese from their herds. In the Ukraine in about 4500 B.C.E., herders tamed the horse, a major contribution to streamlined sod breaking.

Agrarianism and Civilization

The improvement of nutrition and farm yield aided cities in recruiting and maintaining standing armies on grain and vegetable surpluses. The nourishment of soldiers allowed the Egyptians to found a 3,000-year series of dynasties, to advance in architecture and technology, and to triple their territory through conquest via a standing army fed by farms along the Nile. The Sumerians reached a height of urbanization at Ur, where farmers produced enough food crops to sustain the world's first bureaucracy. The city employed granary workers and accountants, overseers, and harvest foremen, who supervised the harnessing of onagers and oxen to plows. Also around 4000 B.C.E., the Chinese tamed the water buffalo, Arabians herded dromedaries, and Eurasians bred the dray horse. Simultaneously, beekeeping produced a new dimension in raising flowering plants to yield nectar for honey and wax.

In this same period, the Andean Inca terraced vegetable gardens to produce beans, coca, pepper, potatoes,

A mural from the tomb of Sennedjem, an ancient Egyptian artisan of the Nineteenth Dynasty (ca. 1298–1187 B.C.E.), depicts the harvesting of wheat along the banks of the Nile. Egyptian civilization was one of the first to practice agriculture on a large scale. *(De Agostini/ Getty Images)*

squash, and tomatoes. For meat, they stocked their farms with alpacas, guinea pigs, and llamas. Farther north, Central Americans turned cocoa into a dominant crop and domesticated the wild turkey, a bird found only in the Western Hemisphere. Northeastern Americans made their own agricultural strides by grooming maple groves for sugar sap collection and harvesting pecans, strawberries, sunflowers, wild grapes, and wild rice, a specialty of the Anishinabe, Menominee, Ojibwa, and Winnebago of the Great Lakes region.

Not until 3,300 B.C.E., on the slopes of the Alps, did northeastern Europeans evolve a three-grain cultivation of barley and einkorn and emmer wheat. In another burst of agrarian innovation, the mid-fourth millennium B.C.E. saw rapid improvements in agricultural technology, followed by formal poultry farming in India and Pakistan and the domestication of ducks, geese, and rock pigeons in China. The ard or frame plow replaced the dibble, a simple pointed digging stick. The buffalo, camel, and donkey took the lead in carving furrows and trampling weeds in moist subsoil. British and Scandinavian plowmen organized their efforts by heaping dislodged stones in clearance cairns, evidence of farm ownership and cyclical tillage of land.

The taming of more animals for proto-ranching required securing winter fodder and raising and trading excess stock for slaughter. In Russia in 3000 B.C.E., reindeer herds provided both milk and meat as well as hides for clothing and shelters. In Egypt, the goose became a specialty food and layer of protein-rich eggs. By 2500 B.C.E., central Asians had added both the Bactrian camel and the yak to agrarian investments. Southeast Asians in Borneo, Burma, and Java raised two distinct relatives of oxen, the banteng and gayal. Adventurers later relayed the animals to Arnhem Land in northern Australia to procreate feral herds.

In 161 B.C.E., Romans evaded the Lex Fannia, an anti-gluttony law, by colonizing rabbits and castrating roosters to produce capons, a meatier form of poultry. The *latifundia* (plantation) employed slave labor and tenant farming to grow edibles for a densely populated empire. Artisanal training readied specialized laborers to press olive oil and ferment *garum* (fish pickle) and wine. All three products traveled by two-wheeled cart to ports for loading on cargo vessels bound for Marseilles, Iberia, North Africa, Egypt, and the Middle East.

Medieval Farming

The Middle Ages advanced less labor-intensive watering systems employing dams and weirs, norias, waterwheels, windmills, and shadoofs, the pole-and-dipper method that irrigated vegetable plots along the Nile, the world's original ecosystem. Roman texts reveal the refinements of the classical era, in which vineyards and orchards coordinated with apiculture and the gathering of honey and beeswax for use and export.

Agroecologist Jia Sixie, a governor in Shandong Province, compiled an indexed guide to progressive Chinese farming, *Qimin Yaoshu* (Skills for Peasants, 534 C.E.), one of the world's oldest agricultural monographs. Out of pity

for poor yeomen, Jia traveled to Hebei, Henan, and Shanxi provinces to record up-to-date methods of soil cultivation and list 86 varieties of millet according to insect and wind resistance and early ripening. He took notes on monoculture for export, crop rotation, green manures, caching, animal husbandry, and selective breeding. He also summarized yam cultivation and cited the leading farm treatises of his day on orchardry, thinning bottle gourds, drying and pickling pomegranates, fermenting soybeans, and raising fish in rice paddies. Jia divided rice into mucilaginous and dry types. Among 31 common vegetables, he focused on calabashes, cucumbers, dropwort (meadowsweet), eggplant, garlic and onion, Japanese pepper, mallow, muskmelon, mustard, radish, and rutabagas. For grafting pears onto crab apple trees, he recommended an upward limb thrust to allow orchards to thrive near buildings. His text, which recommended methods of selecting and cooking farm produce and making vinegar and yogurt, remained in print for six centuries in Chinese and Japanese editions.

In the tropics and subtropics, crop rotation and swidden agriculture reformed food production. The Olmec and Maya and the slaves of the British Caribbean torched underbrush, roots and stumps, and diseased vegetation as a quick method of denuding cropland. Seedlings, slips, and suckers from earlier swiddens at least two years old supplied transplants of select species, such as coconut palms or paper mulberry, which growers fertilized with human excrement and livestock manure.

Farmers modernized soil preparation with the invention of the horseshoe and halters for draft horses and the moldboard plow for inverting weedy clods and exposing the roots to the sun. A heavier metal-faced plow crafted around 600 C.E. improved yield and fostered a population spurt.

Exchanges and Improvements

The greatest revolution in farming occurred with the Spanish exploration of the New World after 1492. From transatlantic voyagers, European growers acquired a treasure of plant species—corn, peppers, potatoes, red beans, and sunflower oil and the titillating flavors of avocados, bergamot, blueberries, cashews, cocoa, cranberries, guavas, mangos, papayas, pecans, persimmons, pineapple, and tarragon. Exotic crops invigorated the diet with the mouthfeel and taste sensations of indigenous products. The Western Hemisphere received its share of the Columbian Exchange in coffee, spices, sugarcane, and wheat.

For the New World farmer, the arrival of the horse and hunting hound offered methods of pulling plows and travois (skin drags). In the temperate zone around 1600, rabbitries became a source of delectable fryers and roasters and older stock for stewing. In the Canadian Maritimes, marshland mixed agriculture increased pasturage and truck farming along with fish processing for export.

In 1701, English agronomist Jethro Tull invented a seed drill—a hopper and cylinder that turned against a spring-loaded tongue to sow pasture grass. By directing beans and peas through grooves into a funnel, the device regulated distribution over three rows at a time, leaving space for tillage. Tull promoted the use of horses to replace oxen as draft animals and adapted his drill for the planting of potatoes and turnips, two popular tubers of his era. He engineered a four-coultered disk plow and a horse-drawn hoe to pulverize dirt clods to release minerals into wheat and forage plants. In *The New Horse-Hoeing Husbandry* (1731), Tull proposed contour plowing to terrace the soil, retain water runoff, and limit soil erosion. A century later, the introduction of steam plows by English inventor John Fowler reduced demand for draft animals and the need to grow fodder and straw for stalls.

North American Innovations

During the agrarian phase of North American development, farmers broke more virgin land than ever in the course of history. Over half the population of Canada and the United States worked on farms. On ranches, the hybridization of the buffalo and cow in 1749 encouraged ranchers to breed hardy stock capable of weathering droughts and blizzards. For citrus and vegetable growers in Orange County, California, support of railways in the nineteenth century boosted profits from the rapid distribution of perishable lemons and oranges, apricots, beets, celery, grapes, lima beans, and walnuts.

An independent U.S. Bureau of Agriculture, established in 1862, salvaged heritage seeds and preserved plants and seeds. Agents purchased seeds from foreign countries and compiled statistics concerning the terroir in which crops grew best and under what climatic conditions. The new department took shape at an agrarian flash point—the death of slavery and the Southern plantation system, the expansion of greenhouse propagation, and the birth of frontier farms, orchards, vineyards, and cattle and sheep ranches. As former slaves migrated from the Carolinas and Georgia to farm the rich silt of the lower Mississippi River valley, agronomists debated the use of powdered and liquid fertilizers to revitalize depleted fields, a concept still new to farmers. The staff of 30 bureau scientists analyzed soil, introduced resilient varieties and livestock, tested farm implements, answered citizens' questions, and forecast farm needs.

North and South American ranching methods allowed calves to forage the grassland outside of villages and settlements, particularly in Argentina. Science and technology assisted the postwar agrarians with drought and other cyclical obstacles. In Hawaii in 1861, King Kamehameha IV imported honeybees, experimented with new hybrid rice seed, and added a waterworks to ensure even distribution of fresh water. On the truck farms of Dayton, Nevada, horticulturists stored water in ponds and

underground and earned top dollar for fresh vegetables sold in railroad camps and mining communities. In New Mexico, the construction of log flumes channeled irrigation water to cornfields, enriching the San Juan River valley from the sale of forage and stock. Russian Mennonites purchased 100,000 acres (405,000 hectares) around Topeka and initiated the planting of "Turkey Red" wheat, the hardy winter variety that turned Kansas into America's breadbasket.

Abraham Lincoln's progressivism fostered both livestock and farming throughout the rapidly growing West. On July 2, 1862, congressional ratification of the Morrill Land Grant Act authorized federal distribution of 17.4 million acres (7.0 million hectares) of public land at the prorated acreage of 30,000 (12,150 hectares) per legislator. The Civil War threatened grain farming by raising the price of implements and seed and by reducing the acreage farmable by cash-strapped smallholders. The decimation of South Carolina and Louisiana rice plantations shifted cultivation to California's Sacramento River valley, the nation's new rice bowl, propagated by immigrants from Guangdong Province, China. Wisconsin farmers experimented with alfalfa, a digestible fiber for stock; the Dakotas and Minnesota dominated trade in flaxseed, a source of linseed oil. Sonoma, California, produced hops for brewing beer. By 1879, as corn developed into the world's top feed grain, American yields reached 1 million bushels. After passage of the Dominion Land Act of 1872 in Canada, North America led the world in the increase of alfalfa, canola, oats, and wheat harvests. In 1873, U.S. corn cultivation expanded to more than 34 million acres (13.8 million hectares).

During the Indian Wars, the U.S. military's need for beef increased the profitability for stockmen and homesteaders. On the northern Texas border at Guthrie in 1870, Samuel Burk Burnett of the Four Sixes Ranch interbred longhorns with Durhams and Herefords. Captain Richard King of Corpus Christi bought up the King Ranch, which grew to 860,000 acres (348,000 hectares), the world's largest ranch. Burnett and King plotted drives to East Coast cities, where hotels and restaurants increased the demand for beef.

Large-Scale Farming

Ambitious Oregon ranchers took advantage of the Desert Land Act, passed on March 3, 1877, to promote the irrigation and cultivation of 640-acre (260-hectare) plots of semiarid public land at a cost of $1.25 per acre ($3.09 per hectare). Agronomists in Nevada guarded turf and waterways as the life-or-death resources to support grasslands and livestock. The fencing of free prairies led to protracted range wars over independent foraging rights. Overgrazing plus a disastrous blizzard in 1886 drove some ranchers out of business and forced others to diversify. Those reduced to subsistence farming gained a labor advantage in 1892 with the advent of the gasoline-powered tractor.

With the Great Plains of Canada and the United States thoroughly settled by 1920, agronomists heightened yields by breeding more productive animal varieties, developing cattle vaccines, and growing disease-resistant plant species, notably, durum and marquis wheat. Farm cooperatives lowered costs from the purchase of balers and pickers. Colombia and Panama developed resilient sheep herds; Saskatchewan produced half of Canada's wheat. In 1926, hybrid corn seed suited individual varieties to climate and soil. Long-distance refrigerated trucking linked consumers with dairy and vegetable perishables. By 1930, Americans exported $2 billion per year in farm goods. Pre–World War II collaboration with South American agronomists enhanced diversity throughout the hemisphere.

Exigencies of World War II in Europe and the Pacific forced American and European farmers to develop new technologies, such as the harvesting of kelp as a military foodstuff. Enhancing the demand for contract staples, food stamps and the 1946 National School Lunch Act guaranteed markets for agrarian commerce. Keeping pace with conventional farming, such innovations as the growing of mussels, oysters, and salmon by New Zealand aquaculturists broadened the definition of farming to include hydroponics and controlled pisciculture.

With liquid fertilizers, chelated plant nutrients, herbicides, and pesticides, agriculture boosted yields into the 1970s. The quick-freezing of edibles for transportation on cargo planes and trains maintained affordability of produce and citrus juices in inner cities and increased the outsourcing of surplus crops to the Soviet Union, Jamaica, the Dominican Republic, and other parts of Latin America. In the 1990s, charitable outreaches diverted infant formula and dried milk to the needy in developing nations.

Tomorrow's Food Supply

By the twenty-first century, farming dynamics raised controversies about world food security. Advanced farming strategies—selective breeding, satellite weather tracking, biotech crops and livestock, Internet agriculture courses, and patented seeds—augmented yields. China, the world's most populous nation, enhanced traditional farm crops by harvesting 33.7 million tons (30.6 million metric tons) of fish from aquaculture in 2004. Mariculture added algae, cobia, oysters, prawns, and seaweed to exports in Australia, Chile, China, France, Ireland, Italy, Japan, Mexico, and Norway. Theories of "sea ranching" proposed controlled methods of salvaging endangered species of seafood. At the same time, global warming foretokened flooding and disastrous storms that displaced topsoil and destroyed family farms, pastures, and orchards.

Other issues infringed on the traditional farming model. Monoculture threatened food diversity by earmarking large parcels of farmland for the top staples—corn, soybeans, and wheat. Hive beetles and viruses

reduced bee colonies. Government aid to farmers reached 9 percent in the United States and 4 percent in Australia, compared with 52 percent in Korea and 61 percent in Norway, the most subsidized national agriculture. Surprisingly, global crop choices remained similar to those of Neolithic farms. Cereals and pulses far outranked vegetables and tubers in importance; grains outpaced sugar sources, with Saskatchewan producing 77 percent of the world's poultry feed. Dairy products held first place, preceding sales of fruit and meat.

Ironically, the dominance of agribusiness slumped in the public's estimation following revelations of unjust farm subsidies, burgeoning greenhouse gases, and pollution of groundwater with pesticides, veterinary antibiotics, and chemical fertilizers. Grassroots actions by locavores reclaimed the farmers' market and popularized heirloom varieties and Slow Food, a resurgence in artisanal cheeses, eggs from free-range hens, herb blends, pastries, and wines. Health warnings about the cumulative effects of additives and dyes in processed foods called for a re-evaluation of purity standards, the regulations begun in the Middle Ages.

On the eve of fossil fuel collapse, venturesome farmers increased their incomes by jettisoning scientific wizardry and embracing organic produce, intercropping, and biomass crops—corn, fruit wood, sorghum, palm, and sugarcane, the sources of ethanol and hybrid fuels. In a model of agrarian cooperation, Australian farmers upped farm sustainability to 88 percent and bolstered environmental protection by 75 percent. Nonetheless, Greenpeace foresaw abandonment of capitalistic excesses as the only means of restoring healthful food to local markets. Irish agrarians predicted that agrifood was the "sleeping giant" of investment potential. International financiers looked to microponics (backyard farming) and distribution of farm surpluses among the have-not nations as two means of reducing poverty and elevating wellness worldwide.

In 2011, the United Nations (UN) envisioned restored interest in the food supply, especially in Ghana, Rwanda, and Tanzania. According to the UN Food and Agriculture Organization, Africa may hold the key to world food security. Forecasts of the continent's role as food grower for the world pictured a profound shift toward modernization and a reversal of cyclical famine in Ethiopia, Somalia, and Sudan, where desertification and drought have defeated field agriculture. According to population projections for 2050, the 986 million people in industrialized nations will face huge political and economic challenges in raising food security for the 7.987 billion who will populate developing countries, the locales that generate an average hunger rate of 6 percent.

The UN set as an interim goal the halving of hunger by 2015 and the reduction of child mortality by 66.6 percent. By 2030, poor nations will have to engineer a 20 percent boost in arable land and installation of aquaponics in Third World deserts, notably, sub-Saharan Africa. Desertification, erosion, salinization, trade deficits, and water shortages will worsen, as will the undernourishment of the most vulnerable. Hopeful indicators in Benin, Burkina Faso, Ghana, Mali, Mauritania, and Nigeria foretell rapid increases in the cultivation of cereals, roots, and tubers as the underclasses raise self-sufficiency.

See also: Agribusiness; Aquaponics; Einkorn Wheat; Emmer Wheat; Fertile Crescent Diet and Food Trade; Greenhouse Horticulture; Irrigation; Monoculture; New World Commodities; Organic Foods; Sicilian Diet and Cuisine; Slow Food; Swiddens; Vegetarianism.

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Agroecology

By allying scientific knowledge of natural systems with farming, herding, and orchardry methods, agroecology integrates food production into a sustainable whole. Unlike dogmatic philosophies of monoculture, organic farming, and technological harvesting, agroecology balances all methods to ensure a stable, equitable distribution of food worldwide without damaging nature.

The task of agroecologists begins with the management of both traditional and innovative approaches within the land and water resources of communities, such as the use of farmer's markets and urban vegetable beds to supply Cubans in Havana. Among modern-day priorities, specialists name halting the replanting of Amazonian rain forests with herd pasturage, diverting fresh water to drought-stricken regions of northeastern Africa, overcoming poverty in Guatemala and Haiti with cheaper cereals and grains, engineering new power sources to replace nonrenewable fossil fuels, and preventing China's industrial complex from poisoning air, earth, and waterways with chemicals and heavy metals.

Since 1911, farming pioneers have analyzed the best locales and methods for saving seeds and growing crops. In 1961, 34 countries convened the Organisation of Economic Co-operation and Development (OECD) as a means of stimulating world trade and global prosperity. Inspired by the Marshall Plan, which rebuilt Europe after World War II, the consortium defined areas of concern,

particularly maximizing coffee harvests in India, Indonesia, and Vietnam and stemming bribery and graft at distribution points, a major source of starvation in Afghanistan, Bosnia, Ethiopia, Rwanda, Somalia, and Sudan. Jolting members to action, conservationist Rachel Carson's book *Silent Spring* (1962) warned that humankind had a limited time to reverse the damage that industrial agriculture did to the environment.

The OECD resolved to raise standards of health and nutrition by furthering democratic market economies. Target areas included the least developed areas of Africa, Eastern Europe, Indonesia, the Middle East, and much of Central and South America. Methods began with educating farmers on rotating crops for maximum food diversity and planting legumes under fruit trees to upgrade soil fertility. Educators taught smallholders to make full use of land by interplanting lentils with sorghum and by developing complementary herding and horticulture—for example, raising chickens and guinea fowl alongside melon patches as a natural pest control. Demonstrators presented methods of mulching and nutrient recycling, soil aeration, and no-till field preparation to lower costs of producing corn and soybeans. Geneticists proposed new sources of rice seeds for farms in Bohol, the Philippines, and Ghats, India.

Early in the twenty-first century, rural sociologist Frederick H. Buttel, a professor at Cornell University and editor of *Society and Natural Resources,* promoted agricultural activism as a means of shielding the environment while ensuring fair distribution of the world's food supply. By applying ethical and political fairness to modern agriculture, his disciples intend to monitor population growth and the use of air, land, and water to satisfy the needs of remote indigenous peoples. The task of feeding the world's people requires cooperation among specialties—agronomy, biology, demography, genetics, and geochemistry. The immediate goal is to maintain the well-being of nature, animal and human populations, and soil.

See also: Aquaponics; Ecofeminism.

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Airlifts, Food

Since the advent of long-range air transportation in the 1920s, the deployment of cargo planes and helicopters to world catastrophes has relieved hunger in situations approaching starvation and genocide.

In April 1942, the U.S. Air Force, at the command of President Franklin Delano Roosevelt, launched air relief over the eastern Himalayas to supply Chiang Kai-shek's troops. After the Japanese halted supply trains along the Burma Road, American planes began a 43-month rescue operation delivering 650,000 tons (590,000 metric tons) of goods over 500 miles (800 kilometers) from Assam, India, to Chinese Nationalists in Yunnan Province. Navigating the perils of mountain updrafts, ice, and bombing and strafing by the Japanese, the cargo planes ferried weapons, medical supplies to treat dysentery and malaria, tons of beer, cigarettes, iodine for water purification, and C rations in tins. Each tin contained biscuits, chocolate, instant coffee, and sugar cubes.

Berlin Airlift

In the aftermath of World War II, the Berlin Airlift overcame a Soviet blockade of barge, rail, and road traffic into Germany's divided capital. The effort began with the resolve of U.S. President Harry S. Truman to halt the advance of Communism into a war-devastated city. On June 24, 1948, lacking coal, food, and electricity, 2 million Berliners looked to the skies for aid from the same military forces that had supplied Chiang Kai-shek. American radio lifted spirits by guaranteeing rations. Until help arrived, families snared songbirds for fresh meat. Truckers from the west delivered loads of oranges along the autobahn and tossed them to children on the roadside. Black marketers smuggled in edibles to Potsdammerplatz.

Although the Allies had scaled back their occupation forces, in the face of 1.5 million Russian troops primed for attack, General Curtis LeMay, assisted by Major General William Henry Tunner, organized a rescue dubbed Operation Vittles. On June 28, the first sortie of 32 Douglas C-47 Skytrains delivered 80 tons (73 metric tons) of flour, medicine, and milk, along with CARE (Cooperative for Assistance and Relief Everywhere) packages. Children named the four-prop transport planes "raisin bombers." The choice of dehydrated foodstuffs eased the burden for deliveries made by Douglas C-54 Skymasters, additional transports that rendezvoused at Rhein-Maine Air Base every four minutes for a half hour's unloading. On return flights, the planes carried a total of 1,113 malnourished children to aid stations.

With the aid of Australian, British, Canadian, and French crews and planes, American fliers pledged to supply 1,700 calories per person each day. In a gesture of forgiveness to Germans for causing world war, the Allies ferried tons of wheat, dried potatoes and sugar, dehydrated

vegetables, cereal, oil, milk, and coffee. To fend off cold, the C-47 Skytrains flew 3,475 tons (3,152 metrics tons) of coal and gasoline to the makeshift depot at Tempelhof Airport, where Mayor Ernst Reuter and aide Willy Brandt superintended distribution. Each plane bore 3.5 tons (3.2 metric tons) of needed goods, including cheese, cod liver oil, deboned meat, oatmeal, powdered eggs, sausage, vitamin C tablets, and yeast. Compassionate specialty hauls brought kosher food to Jews, saccharine to diabetics, and vegetable seeds to gardeners. The total shipments per day of 750 tons (680 metric tons) required rapid reinforcements of bigger, newer planes.

As the rotation advanced to 1,500 flights per day and 5,000 tons (4,500 metric tons) of goods, canteen trucks dished up coffee, doughnuts, hamburgers, hot chocolate, and sandwiches to crews. The uplift to children brought relief from anemia, dwarfism, rickets, and tuberculosis. Pilot Gail Halvorsen, the "Chocolate Uncle," treated German children to handkerchief parachute drops of chocolates and gum, dubbed Operation Little Vittles. With donations from confectioners, additional gifts of 3 tons (2.7 metric tons) of candy to children boosted morale and quashed tyrant Josef Stalin's plan to sweep Berlin into his empire.

On August 1, Soviet propagandists tried to lure Berliners to the eastern sector with offers of free rations. In another ploy to overrun the capital, Russian harassment began with antiaircraft guns and escalated to bomb and rocket attacks on Allied planes. A half million Berliners massed at the Brandenburg Gate to express thanks to their deliverers and to plead for further assistance against the Soviet siege.

Winter increased the demand for coal and the exhaustion of pilots and ground crews. In a logistical miracle, ex-Luftwaffe repair crews kept the heavy schedule on time; civilian volunteers repaired overtaxed runways with asphalt. Female laborers completed a new airport in the French sector. The upgraded airdrop enabled the Allies to sustain a daily caloric intake of 1,880 per person. By outflanking the Soviets, the Allies maintained the airlift until September 30, 1949, at a total cost of $224 million.

Later Efforts

The Berlin Airlift set a precedent for subsequent humanitarian relief efforts. Altruistic aid produced mixed success in Biafra, Nigeria, in 1969. Although Nigerian officials banned Red Cross deliveries, an efficient mix of corn, soybeans, and powdered milk along with canned milk and dried fish arrived from Caritas and the World Council of Churches, which maintained warehouses on the Portuguese island of São Tomé. Despite food drops, 1 million people died from combat or starvation. In 1975, loads of rice relieved embattled defenders of Phnom Penh, Cambodia, the blockaded capital of the Khmer Republic, a holdout against Communism in Southeast Asia. Daily mercy flights in November 1990 to Asmara, Eritrea, attempted to relieve those suffering from the drought cycle in the Horn of Africa. A parallel effort in Somalia in winter 1992–1993 involved U.S. military planes in extending a food lifeline to East Africa.

From July 3, 1992, to January 9, 1996, a multinational effort supplied 180,000 tons (163,000 metric tons) of goods from Ancona, Italy, and Frankfurt, Germany, to tens of thousands of war-beleaguered residents in Sarajevo, Bosnia. In 1993, the addition of airdrops in besieged Muslim enclaves dispatched 20,000 tons (18,000 metric tons) of food to the hungry. United Nations (UN) supervisors, led by Major General Lewis W. MacKenzie of Canada, offered hope to Sarajevans. Victims cowered beneath artillery, mortar, and sniper fire and surface-to-air missiles, too terrified to venture into local markets. At the end of the feeding project, UN officials proclaimed the effort the longest humanitarian air bridge in history. The success prefaced renewed flights of food, water, and cholera treatments to central Africa in July 1994, when U.S. forces aided refugees from genocide in Goma, Zaire.

Further taxing international aid networks, on July 29, 2005, the UN began a 23,000-ton (21,000-metric-ton) food airlift to Maradi, Niger. Flown from Italy to Niamey, goods required a truck convoy to convey supplies to some 80,000 starving people who were victims of drought and locust invasion of pastures. Survivors scoured the bush for edible grass and leaves. Even with the intervention of Médecins Sans Frontières (Doctors Without Borders) and gifts of thousands of tons of food and $512 million in financial aid from the World Bank, cholera and malaria limited the chances for survival. The crisis threatened to spill over into Burkina Faso, Ethiopia, Kenya, Mali, Mauritania, and Uganda.

The next half decade saw Lockheed Martin C-130 Hercules transport planes and Boeing CH-47 Chinook helicopters bound for airdrops to war-torn Katanga, Congo, in 2007; for flood relief in Bihar, India, in 2008; for war relief in Sri Lanka in 2009; and for earthquake relief in Haiti and posthurricane aid in Guatemala in 2010. On July 11, 2011, news of a lethal food and water crisis in Nairobi and Turkana, Kenya, described the plight of 380,000 refugees of drought on the Horn of Africa. Some 12 million victims in Ethiopia and Somalia faced parched fields and no food. At camps in Dadaab, Kenya, child deaths multiplied sixfold from a malnutrition rate of 30 percent. On July 18, UNICEF (the United Nation's Children's Fund) began shipping nutrition and water to Baidoa, Somalia; on July 21, Kuwait Red Crescent Society dispatched two planeloads of medicine, tents, and 20 tons (18 metric tons) of food.

Within the week, the UN urged donors to send immediate relief. Aid workers scrambled to serve nourishing Unimix porridge to preschoolers and beans, corn, and millet to adults arriving over "roads of death." On July 25, a world airlift began importing emergency

rations to Mogadishu, Somalia, and to border airports in Dolo, Ethiopia, and Wajir, Kenya. An Islamic backlash against Western charities—CARE and the World Food Program—blocked efforts to transport aid to endangered Africans.

See also: Famine Relief; International Food Aid.

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Alcoholic Beverages

From the Stone Age to the present, alcoholic drinks have increased conviviality at social gatherings and promoted euphoria and spirituality at festivals and rituals. By definition, ethanol is more drug than nourishment. By suppressing psychological controls on behavior, foods containing ethanol have freed interaction to include ecstatic dance and singing and enjoyment of card playing, dining, and sports. Yet, nations enjoying the release of intoxication have acknowledged the liabilities of "ardent spirits."

The sources of intoxication range from fermented agave hearts in Mesoamerican tequila and gentian root in the Angostura Bitters made in Tobago and Trinidad to sugarcane in Indian and Malay rum and fruit must and peppermint in European akquavit or schnapps. Ingredients have seemed as innocuous as molasses in Caribbean rum, lemon peel in Italian limoncello, pear pulp in English perry, antimalarial quinine in Dubonnet, and rice, hawthorn, and honey for drinks in Jiahu in Henan, China, in 7000 B.C.E. More complex drinks incorporated spice in Old English metheglin and vinegar in oxymel, beets and bitter oranges in Cointreau, coconut in Japanese and Sri Lankan arrack and Filipino vodka, and agave in mescal, a specialty in Oaxaca, Mexico.

Early Innovations

Alcohol originally served consumers as curatives. In 2100 B.C.E., Egyptian, Hindu, and Sumerian physicians advised patients on dosages. The Sanskrit Rig Veda (ca. 1200 B.C.E.) and epic *Ramayana* (ca. 400 B.C.E.) affirmed the fermenting of honey into Indian mead and refining ephedra into soma, a Zoroastrian hallucinogen. After 300 B.C.E., Turkish physicians at Cnidus listed hydromel, mulsum, and oxymel as cures of acute ailments.

Since 200 C.E., the Aztec served *aguamiel* (sweet water), which they fermented from thick, frothy agave sap. Collectors siphoned juice and scrapings from the leaves through a gourd tube. Fermentation for 10–15 days resulted in *pulque,* a ritualistic forerunner of tequila reserved for the clergy and royalty. During the colonial era, Spanish authorities licensed *pulquerias* and forbade consumption by mixed assemblies of men and women. Jesuit priests usurped distilleries and used the proceeds to build Catholic academies.

In the 800s, Slavic distillers turned grain into vodka, a bracing hard liquor that encouraged trade between Poland and Russia for service in Polish pubs. Healers recommended vodka as an aphrodisiac and cure for infertility. In 1386, Genoan legates introduced a grape drink in Russia. Trade relations between Krakow and Poznan bottlers and Silesian importers spread to Austria, Bulgaria, Germany, Hungary, Romania, and the Ukraine. The introduction of potato vodka in the 1810s increased demand, which by 2003 had risen to 5.3 million gallons (2 billion liters), one-quarter of the world's distilled spirits.

Gin emerged at Monte Cassino near Salerno in 1100, when Benedictine monks, instructed by translations of Arabic and Greek medical texts by Avicenna and Galen, distilled the juice of juniper berries. Across Europe during the Black Death in the 1300s, the fearful turned to gin as a remedy. Sold in pharmacies, the drink reputedly lessened the pain of arthritis, gallstones, gastric ills, gout, and kidney stones. Bootleg hooch inflicted debauchery and dependence on the Dutch and English, who besotted themselves with *jenever* and gin in the 1660s. By 1727, when consumption grew over the previous 37 years from 500,000 gallons (1.9 million liters) annually to 3.5 million gallons (13.2 million liters), crime waves ensued. Colonial authorities invented the gin and tonic, an effervescent mixer laced with quinine to prevent malaria.

In the 1200s, Europeans avoided cholera epidemics by drinking fermented grape pulp, small beer, and spirits. Monasteries produced floral and herbal bitters, digestives, and tonics, the bases of aperitifs and liqueurs such as Bénédictine from Normandy and Chartreuse, a Carthusian concoction from Vauvert, France, containing 130 herbs. Aromatics and flavorings included artemisia (wormwood) leaves in absinthe, a heady curative and intoxicant called "the green fairy" for its psychogenic effects. Opponents of absinthe claimed it turned men into bruisers and caused consumption and fits. Louche, the milky emulsion in Greek ouzo, a liqueur distilled from anise, extended into an adjective used to describe debauched, risqué behavior.

Simultaneous with the gin, pulque, and vodka industries, in the 1620s, Barbadian slaves at Holetown turned molasses into rum, a source of summery drinks. Healers used rum as a treatment for smallpox and a cleanser for corpses. Along with sugar, bottled rum boosted profits, with 102,000 gallons (386,000 liters) exported to Great

Britain in 1884. In literature, rum fueled scenes of male debauchery and bar ditties in Robert Louis Stevenson's pirate classic *Treasure Island* (1883).

On a more genteel scale, cream liqueurs, including Chambord raspberry liqueur, crème de cacao, and crème de menthe, concentrated the sugar content to produce syrups for flavoring ice or cakes. Additional cream liqueurs took their fundamental aroma and taste from almonds, apricots, bananas, cherries, citrus fruits, coconuts, currants, goji berries, lotus, lychees, melons, prickly pears, sloes, and strawberries as well as the blossoms of elder, roses, and violets. Jamaican Tia Maria and Mexican Kahlúa, two coffee-infused liqueurs, added savor to cheesecakes, eggnog, and mixed drinks.

Society and the Imbiber

Much as they had in classical Athens, Rome, and Pompeii, village taverns anchored social life in colonial North America. Binge drinking burgeoned in the urban United States in 1829, among reservation Indians in the 1860s–1880s, and in the Russian military in the 1940s. Spirits dehydrated the body and depleted stores of vitamin B1, causing beri-beri, the source of cardiac arrhythmia and numb lips and tongue. Globally, drunkenness posed new dangers for drivers and pedestrians and influenced the outcomes of elections until cities closed saloons during voting hours. Teen overconsumption resulted in alcohol poisoning from episodes of "chugging" (gulping) spirits.

Long-term effects of overconsumption include alimentary and throat cancers, diabetes, gastritis, heart disease, impotence, mental illness, and pancreatitis. Because some 90 percent of alcohol metabolism occurs in the liver, heavy drinkers incur alcohol hepatitis, cirrhotic liver, and hepatic jaundice. The unborn children of alcoholic mothers may suffer fetal alcohol syndrome, an irreversible destruction of brain neurons and cause of behavior impairment. Because of liabilities of drinking hard liquor, tippling dropped after 1980 except in Japan, where consumption increased. As of early 2012, "white drinks"—gin, rum, tequila, and vodka—outdistanced brown whiskies in sales.

See also: Beer; Cider; Honey; Potatoes; Prohibition; Rice; Soft Drinks and Juices; Temperance; Vegetarianism; Whiskey; Wine; Yeast.

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Allergies, Food

An adverse physiological reaction to food, a food allergy results from an autoimmune response to a harmless protein that antibodies identify as toxic. From prehistory, a simple feeding of infants with breast milk bolstered immunity and reduced health risk from allergies. Around 400 B.C.E., Hippocrates, the Greek "Father of Medicine," recognized mealtime reactions as a human incompatibility with common foods.

In 1905, Francis Hare, an Australian psychiatrist at Brisbane Hospital, developed theories of headache treatment in his two-volume treatise *The Food Factor in Disease,* which blamed the inability to metabolize starches and sugars for acute and chronic ailments. By extension, he cited food as the source of asthma, dyspepsia, eczema, gout, and nerve disorders. A year later, pioneer immunologist Clemens Freiherr von Pirquet of Vienna, Austria, named these hypersensitivities "allergies."

Allergies to such common food components as gliadin in wheat, ovalbumin in egg white, parvalbumin in cod, and ripening agents in strawberries currently strike an estimated 6–8 percent of children under age three and 2 percent of adults. Abnormal reactions can be as mild as burning on the tongue, flatulence, itching eyes, tingling, and urticaria (skin eruptions or hives). More serious hyperactivity in the body may produce bloating and swelling, diarrhea, fainting, migraines, panic attacks, and wheezing. Sudden death is rare.

Dermatologists and immunologists attempt to isolate the cause of unidentified anaphylaxis. Clinicians test individuals by skin pricks and blood tests that re-create the physiological response. More exacting tests for life-threatening allergies that trigger heart arrhythmia and shock may involve feeding the patient a capsule of the suspected ingredient. A doctor monitors evidence of anaphylaxis, particularly celiac disease, irritable bowel syndrome, throat constriction, and vomiting.

Treatment for food intolerance may require desensitization or eliminating harmful ingredients from the diet. The most common culprits include chocolate, eggs, milk, peanuts, shellfish, tree nuts (almonds, cashews, hazelnuts, pecans, pine nuts, pistachios, walnuts), and yeast. The allergens in cow's milk, casein and whey protein, may vary from the makeup of goat's and sheep's milk, two possible substitutes. Infant food formulators have attempted a similar protection of babies by making hypoallergenic infant formula from predigested hydrolyzed protein. For

adults, treatment with antihistamines, epinephrine, and steroid creams and nasal sprays seeks to restore breathing and heart rate to normal levels and reduce inflammation in eyes, mucus membranes, and skin.

In 1975, Seattle gastroenterologist Walter Lyle Voegtlin, author of *The Stone Age Diet,* promoted the foods eaten by caveman as ideal sustenance for human wellness and stamina. He researched the Stone Age diet as a source of relief from alcoholism, allergies, and autoimmune disease. Because the Neolithic intake consisted of unprocessed foods, consumers lowered the risk of triggering responses to additives, including artificial flavorings, benzoate and sulfite preservatives in salad bars and white wines, and food dyes—Brilliant Black BN, Brown HT, Fast Yellow AB, Lithol Rubine BK, Orange B, Para Red, Sunset Yellow, Tetrazine, and Yellow 2G. In 2002, Loren Cordain, an expert in health and physiology at Colorado State University, promoted an evolutionary diet to rid humans of chronic afflictions from allergies.

Additives to processed foods generated concerns for allergies, resulting in serious reactions from monosodium glutamate, nut residue, poppy and sesame seeds, and red and yellow dyes. Because nuts can subvert the immune system, concern for lethal nut allergies demanded the monitoring of ingredients in public venues. School cafeterias shielded susceptible children from ingesting nut products. Food processors introduced voluntary labeling to alert consumers to nuts in multi-ingredient products as well as to foods produced in facilities that process nuts. In September 2006, Ronald van Ree, a researcher at Amsterdam University, predicted that genetic engineering would produce an immunotherapy vaccine for allergy sufferers within the decade.

See also: Additives, Food; Honey; Monosodium Glutamate; Nuts and Seeds; Shellfish.

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Amerindian Diet

For millennia, Amerindians survived uncertain times through the wise processing, distribution, and storage of local foods. The holistic philosophy of first peoples revered reciprocity in nature and the human place in the food chain.

During high productivity, food preparers prevented famine by dehydrating and smoking fish and venison, packing jerky with mint to discourage vermin, brining salmon and fermenting herring and salmon roe, leaching acorns for grinding into flour, and drying fruit leather on wood slabs or birch bark trays. Sedentary tribes froze salmon and cached camassia, Jerusalem artichoke, and yucca tubers in grass-lined pits. North Atlantic tribes tapped birch and maple trees for sap, which they crystallized into sugar cakes. The Haida, Nootka, and Tlingit of Vancouver Island submerged the eulachon (or candlefish) in oil to protect from insect infestation, mold, and rot and also to add fish oil to the diet.

Beans, maize (corn), and squash—the "three sisters" of Amerindian agriculture—grew interdependently. The bean vines climbed up the corn stalks and provided essential soil nitrogen. The squash plants spread along the ground to shade and protect the root system. *(North Wind Picture Archives/Associated Press)*

Pre-Columbian Native American Diets

People	Place	Staple Foods
Algonquin	Quebec	bear, bird, corn, eggs, deer, rabbit, and wild rice
Anasazi	American Southwest	amaranth greens, piñon nut, prickly pear fruit, and prairie dog
Aztec	Mexico	bee, cochineal insects, dog, duck, monkey, opossum, rodent, and turkey
Carib	Lesser Antilles	cassava, fish, lime, lobster, and pepper
Inca	Colombia and Peru	lima bean, pepper, potato, and tomato
Inuit	Alaska	beluga whale, ringed seal, seaweed, and walrus
Pawnee	Great Plains	buffalo, camassia root, chokecherry, elk, and turnip
Taíno Arawak	Greater Antilles	fish, iguana, parrot, and pepper
Tlingit	Northwestern Pacific	berries, chicory, salmon, trout, and wild celery
Tuolumne	California	clam, duck, geese, mussel, pine nut, salmon, sea otter, seal, smelt, trout, and whale
Tupi and Guaraní	Amazon River	cacao, cassava, termite, and wild boar
Warao	Guyana	cassava, caiman, dasheen, eddo, and waterfowl
Yaghan	Tierra del Fuego	cranberry, guanaco, limpet, mussel, and wild celery

Some preservation methods required special tools and containers, particularly crocks and jars for burying soapberries and smoked salmon in sand, cedar boxes holding bound berry cakes, and underwater skin bags to fill with cloudberries, cranberries, crab apples, and lingonberries. The Cherokee, Hopi, and Navajo excelled at cultivating corn and beans and storing them in baskets.

The pre-Columbian diet of Native Americans focused on indigenous fauna. Specialties indicate the adaptation of human tastes to the locale and the number and variety of staples. For instance, the Aztec ate from a full range of animal life—armadillos, frogs, iguanas, rattlesnakes, salamanders, and tadpoles. Historian Bernardino de Sahagún issued the *Historia General de las Cosas de Nueva España* (*General History of the Things of New Spain,* 1540–1569), also known as the *Florentine Codex,* a multivolume overview of Aztec life that describes their use of a variety of chilies, peppers, and corn served in tamales and tortillas. In the Andes, cooks favored the meat of llama and guinea pig. Among Arctic Greenlanders and the Inuit of Nunavut in northern Canada, narwhal and *maktaaq* (whale skin) dominated the menu with a fat-rich cuisine that provided energy for life in subzero temperatures.

Food and Wellness

European observers admired the well-being of the Western Hemisphere's hunter-gatherers, such as the Yupik of Alaska, who proportioned seal blubber and blood to maintain the balance between body and spirit, and the Inca, who kept their soldiers healthy on dried bonito and shark, animal fat, and quinoa, a common cereal grain. In the tropics in 1527, Spanish explorer Álvar Núñez Cabeza de Vaca admired the handsome Florida natives, whose diet produced a strong but spare build as well as strength and speed for running. Explorer Jacques Cartier learned from the Algonquin of Montreal how to cure scurvy. During the winter of 1534–1535, native healers provided an evergreen drink made from the white cedar, which relieved French sailors of painful joints and loose teeth resulting from a deficiency of vitamin C.

George Catlin, the nineteenth-century American painter of the Crow of the Great Plains, described six-footers endowed with well-formed frames and graceful musculature. In 1864, French explorer René Laudonnière summarized the ability of Timucua women of eastern Florida to climb trees and swim rivers while carrying their children. Even elderly females loved dancing at feasts. With the initiation of anthropological surveys, gastroethnographers revisited foodways in Machu Picchu and Chichén Itzá and restructured the kitchen gardening and cookery of the Anasazi, a people of the American Southwest who, from 1200 B.C.E. to 1300 C.E., evolved the dietary culture of the "three sisters": beans, corn, and squash, three crops that thrived when planted together.

Food studies of desert lands characterize a lifestyle devoted to survival. After service in Baja California from 1751 to 1768, Johann Jakob Baegert, a Jesuit missionary and author of *Observations in Lower California* (1771), compiled eyewitness accounts of the diet of Guaycura hunter-gatherers. He complimented them on their wellness and hardihood, despite a spartan intake of agave, fish, grubs and insects, mesquite beans, reed roots, turtles, and yucca washed down with water. They made forays every three days to areas offering more prolific scavenging and bow hunting. When hunger overwhelmed them, they sliced

rawhide shoes and hides and devoured them. To relish meat flavor, they tied a piece with string, chewed and swallowed, then pulled the meat back into the mouth a dozen times for more savoring. They retrieved any seed of the pitahaya fruit that passed in the feces in a process the Spanish ridiculed as a "second harvest." Because of their primitive culture, the Guaycura charred whole bats, birds, snakes, and voles in the flame rather than boiling or roasting them, which took too long. They quick-fried inedible pods in turtle shells; the fibrous agave required roasting in coals for half a day. Guaycura lives revolved so tightly around sustenance that their language contained little more than terms for scavenging, cooking, and eating.

Pragmatism and Syncretism

The recipes of first peoples demonstrated pragmatism toward what was available. The Blackfoot exhibited reverence for the whole animal by boiling wild onions with hooves, tongues, and udders and by consuming buffalo intestines along with the contents of semi-digested grass. They valued creamy marrow straight from cracked femurs and turned mammal intestines into casings for blood or meat sausages for roasting over coals. The Ojibwa added sassafras to boiling water for tea, poured broth over snow for a cold dish, and thickened soup with corn silk and pumpkin blossoms. The Cherokee made *sofkee* from soaked cornmeal and wrapped *nixtamal* dough in corn shucks to ferment before baking. The Narragansett one-dish meal called succotash, a bean and corn mixture, blended well with sunflower seeds, chopped pepper, pine nuts, or chunks of dog, fish, or venison. The Lakota devised *wojape* (fruit pudding) from pureed blueberries thickened with any kind of flour and water. To enhance wild rice, the Menominee boiled the grains in the broth of birds or fish and added such ingredients as cattail buds, cranberries, unfurled fern tips, honey, and wild sage.

Before contact with Europeans, the Amerindian low-fat diet produced sturdy organs and skeletons, little arthritis or dental decay, and no tuberculosis. The addition of colonial cookery to Amerindian food staples and recipes created a syncretic cuisine. For example, hominy, pumpkin seed tacos, and piki bread increased creative applications of corn; Indian pudding, a creamy corn dish, took on an Old World flavor with the addition of molasses.

At the same time, the introduction of beef, pork, pomegranates, and radishes teased the palate of first peoples. Spanish colonists added to the largely vegetarian Aztec regimen more dairy products and meat. From Basque and Portuguese settlers of the Maritime provinces, the Beothuk and Micmac learned to pack cod, venison, and oysters in barrels with generous sprinklings of rock salt. The increased sodium in the diet introduced Indians to cardiac ailments and high blood pressure.

With the displacement of tribes from traditional habitats, European colonists encouraged commercialization of plant and animal harvests and the elevation of profits above the sustenance and longevity of indigenous peoples.

See also: Aztec Diet and Cuisine; Barbecue; Cacti; Chicle and Chewing Gum; Columbus, Christopher; Curative Foods; Díaz, Bernal; Hudson's Bay Company; Hunter-Gatherers; Inca Diet and Cuisine; Jerky; Jiménez de Quesada, Gonzalo; Lapérouse, Jean François Galaup; Las Casas, Bartolomé de; London Virginia Company; Manioc; Mexican Diet and Cuisine; Pemmican; Peyote; Pit Cookery; Religion and Food; Royal Greenland Trade Department; Sauces and Saucing; Seaweed; Shellfish; Soft Drinks and Juices; Tortillas; Trade Routes; Travel Food; Vanilla; Verrazzano, Giovanni da.

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Animal Husbandry

A parallel to plant agriculture in civilized states, animal husbandry sustained a clan or community from the output of herds and poultry flocks. After 25,000 B.C.E., a time when over half the human diet derived from wild bison, caribou, horses, and mammoths, evidence suggests that feral mammals adapted to human presence as a source of protection from wild predators. Because of the contiguity of beast and humankind, hunting parties no longer had to track wild animals far from home.

In Africa, the Americas, Eurasia, and Australia, honeybees generated a sweetener and wax, a malleable repair material for pottery, and a commodity for sale or trade. Tame mammals provided dependable dairy goods and reliable sources of eggs and meat, tallow for lighting, and hides for rugs and shoes. Cooking advanced from innovations in technique and tools for grinding, pit baking, pounding, roasting, and scraping. Because of predictable flock and herd growth, the human population density rose from one to 15 persons per square mile (9 persons per square kilometer).

Prehistoric Food Sources

Before the agrarian revolution, in the Tigris River basin from 13,000 B.C.E., humans managed wild boars, an available source of meat, fat, and useful bone, bristle, hide, and intestines for food storage. During the Neolithic revolution around 12,000 B.C.E., hunter-gatherers

tamed those animals with a temperament amenable to flocking and herding and an ability to adapt to pens and barns, breed in captivity, and follow a human leader. To feed the most people during the transitional Mesolithic Age, early stockmen observed nature and selected animal traits, particularly for beekeeping, the earliest form of animal colonization. By revering nature as a beneficent source of nourishment, magico-religious ritual venerated food sources, such as bird eggs, fish, and yams.

After the formation of Abu Hureyra, Syria, in 11,050 B.C.E., a 1,000-year drought forced Natufians (early Palestinians) to settle near streams to pasture sheep, which converted grass to the first staple protein to feed human omnivores. In lieu of currency, sheep served as a medium of exchange in barter. From experimentation with ewe's milk, herders evolved highly nutritious feta and ricotta cheeses, blocks of pecorino and Roquefort hard cheeses, and *labneh* (strained yogurt), a basis of savory and sweet entrées eaten with bread, cucumbers, olives, olive oil, and onions.

Omnivores balanced their diet with foods from multiple sources. From 10,000 B.C.E., the Nordic Sami followed reindeer herds, which appeared on petroglyphs and on bone etchings as producers of milk and venison cooked over pit fires. The acceptance of grain as a daily staple paralleled the domestication of dogs, goats and ibexes, pigs, and sheep for fiber, meat, and milk. In the Zagros region of Anatolia, herders first domesticated the goat from the Bezoar strain, herbivores that lived on bark, berries, grass, and leaves. Herding clans profited from goat's milk and meat as well as dung for cooking and heating fuel, hair for fabric, hide for carafes, and sinew for sewing. Goat herding spread to Iran and Israel, where graziers developed milking and meat cutting, fiber weaving, and leatherwork as specialized crafts.

In Germany, Iraq, and southeastern Turkey in 9000 B.C.E. and Iran in 8000 B.C.E, innovations of Neolithic, or New Stone Age, cuisine advanced the taming of goats as dairy animals and the penning of pigs as a four-legged pantry. Studies of year-old animals in bone heaps attested to the sophisticated taste of meat eaters.

In this same period, North American Athabascans tamed the camp dog from the feral wolf as their only domesticated beast. The dog earned its keep as hunter, guardian, dray animal, and rodent and snake controller. The eating of dog meat paralleled similar consumption of small canids in China, Korea, and Vietnam.

Wild and cultivated beef consumption also dates to prehistory. Cave paintings at Lascaux, France, pictured the hunting of the aurochs, the ancestor of modern cattle, which flourished from sub-Saharan Africa throughout India and the Middle East. Herders in India raised another scion, the zebu, for wagon pulling and meat and evolved dairy foods from cows. In the Chihuahua Desert on the Tex-Mex border, around 7500 B.C.E., Paleo-Indian settlers grew grains and consumed quantities of milk, cheese, and meat from domesticated animals.

Husbandry as Survival Skill

Around 7000 B.C.E., during an era that saw depletion of the wild gazelle from overhunting, food growers evolved formalized methods and strategies. In Papua, practical farmers raised root crops and sugarcane alongside pigs, eager recyclers of otherwise wasted greens and stalks. In 6000 B.C.E., Indian, Iranian, Pakistani, and Thai farmers tamed elephants for lifting and pulling chores and domesticated chickens, offspring of the red jungle fowl, a tropical pheasant. In the Far East, Chinese and Indonesian crop tenders integrated the vegetable and grain diet with chicken and fish netted from rivers. The broad-based diet fueled a population explosion.

After 5200 B.C.E., animal rearing began to generate a sedentary lifestyle that prefaced the rise of city-states. Sumerians, the empire builders at the Tigris and Euphrates delta, bred cattle and sheep after 5000 B.C.E. At Ur, state-run agriculture systematized staffing, which migrated according to seasonal demands to cut grain for fodder and reeds for barn bedding. Farm foremen supervised the harnessing of onagers and oxen to plows, the caching of forage for winter feed, and professional butchery. Secondary products from cattle added 5 quarts (4.7 liters) of butter and 7.5 quarts (7.1 liters) of cheese per cow to income. In the Indus Valley, farmers enhanced their diet with butter and cheese from their herds, two sources of interregional trade. In the Ukraine about 4500 B.C.E., herders tamed the horse, a major contribution to streamlined labor and transport for warriors. Scythians milked mares to produce koumiss, a staple drink as far north as Mongolia. Europeans ate horsemeat and revered the dish as the focus of a religious propitiation of the Germanic god Odin.

Around 4000 B.C.E., the swan entered waterfowl culture in Britain, Ireland, Italy, and Portugal. Simultaneously, the Chinese tamed the duck and water buffalo, a source of mozzarella cheese and curd, while Eurasians moved plows and sledges with the aid of a pony later named Przewalski's horse. Arab nomads herded dromedaries for milk to make butter and yogurt. Persians later roasted whole camels for feasts and reserved hump meat for special occasions; Armenians wind-dried the meat for *pastirma,* a spiced travel food. In this same period, the Andean Inca raised alpacas, guinea pigs, and llamas for meat. Farther north, residents of Yucatán tamed the wild turkey, a bird found only in the Western Hemisphere.

In another burst of agrarian innovation, the mid-fourth millennium B.C.E. saw rapid improvements in farming technology, followed by the domestication of geese and rock pigeons in China, poultry farming in India and Pakistan, and the taming of the wild ass on the Black and Caspian seas. As animal power for pulling the ard or frame plow, the buffalo, camel, and donkey overturned

surface crust to access moist subsoil for seeding. In Great Britain and Scandinavia, plowmen amassed stones into barriers and markers of property lines. Pork production took prominence among stockers because pigs converted 35 percent of plant energy—acorns, beechnuts, and chestnuts—to meat, as contrasted with sheep at 13 percent and cattle at 6.5 percent. South of the Alps, religious taboos declared swine too dirty for human consumption.

Animal domestication made demands on the farmer for wintertime feed and barn straw, but provided beasts for meat during the thinning of herds. Among the Nenet, the indigenous people of the Russian tundra, in 3000 B.C.E., semidomesticated reindeer herds produced both milk and meat as well as hides for clothing and shelters. In Crete, Egypt, Israel, and Knossos, skeps (domed hives of straw) held honeycomb. The squab, a domestic pigeon, yielded succulent meat; the goose became a specialty food and layer of protein-rich eggs. Hebrews fancied the tame dove. By 2500 B.C.E., Central Asians in the Tibetan Plateau, Mongolia, and Russia added both the double-humped Bactrian camel and the yak to agrarian investments as meat animals and sources of dung for fuel and strength for caravanning. From Burma east to Borneo and Java, stockmen kept peafowl in pens and bred banteng and gayal, ox-like dray animals.

The domestication and breeding of livestock improved the human diet with nutritious cheese, meat, and milk. Among the Inca of Altiplano, Peru, alpacas and llamas provided meat deemed special to the gods. About 2000 B.C.E., stockmen domesticated the guinea pig, a fast-multiplying meat source that thrived on vegetation. Andeans cooked guinea pigs by stuffing heated stones in the carcass. They valued the entrails for flavoring gravy or sauce and for adding to potato soup.

Classical and Medieval Husbandry

In the classical era and early Middle Ages, North Africans introduced the barbary, or ringneck, dove to pen fowl. Roman texts by Columella, Hyginus, Varro, and Virgil revealed the refinements of the classical era, in which apiculture (beekeeping) and the gathering of honey and wax produced goods for the table and for export. In 200 B.C.E., Cato compiled veterinary treatments for sheep that combined lupine extract, olive oil dregs, and wine. The colonizing of rabbits on islands stocked meat for ships' larders. In 162 B.C.E., the castration of the capon produced a plumper bird than the hen or peafowl for roasting. Roman Spain produced squabs (pigeons) for meat markets. Umbrian herders bred Chianina oxen, a valuable draft and beef animal.

The propagation of animals in the first century B.C.E. increased animal diversity. On the march of Roman legions into Gaul in 52 B.C.E., provisioners took along the pheasant, a source of eggs and meat. In attempts to strengthen farmyard investments, Asian stockers practiced animal acupuncture as early as 10 C.E. Parallel to high market-quality ox breeding, the Japanese brought Wagyu cattle from the Korea Peninsula to cultivate rice fields and supply marbled beef prized for its juicy tenderness. In Peru, the Moche tamed the alpaca, llama, and vicuña, three producers of meat and soft wool. The use of llama dung as fertilizer increased the yield of Peru's green revolution.

In 534 C.E., agro-encyclopedist Jia Sixie, the prefecture of Gaoyang County in Shandong Province, compiled *Qimin Yaoshu* (*Skills for Peasants*), one of the world's oldest farming treatises. Out of concern for the underclass, Jia observed tillage techniques in Hebei, Henan, and Shanxi and summarized animal herding and feeding and methods of selective breeding and vinegar and wine fermentation. He also published an overview of contemporary monographs on fish raising in rice paddies and making yogurt.

Over the next five centuries, husbandry techniques focused on small details of food production. Medieval hunters trained falcons, ferrets, and hawks to flush rabbits from warrens into nets. Regular stalking yielded little meat but prevented leporids from overrunning gardens and devouring vegetables. By maintaining dovecotes at manor houses, stockmen kept poultry at hand to supplement pantry staples and for sale at village markets. The Japanese domesticated quail in 1100 as a source of attractive entrées and tiny eggs for exotic plate adornments and street food.

Stockers evolved more food diversity based on climate and terroir. Around 1200, Christian monks in Yorkshire and the Rhineland turned eel weirs and pond tending into a form of pisciculture that yielded bream, carp, eels, and fish milt, a nonred meat source during Lent and other meatless holy days. During the same era, because of a short growing period, the settlement of Iceland rated the tending of stock above other areas of agriculture. After deforestation, goats thrived on the underbrush, while cattle and pigs fended for themselves, often freezing in the bitter clime.

European farmers raised the peafowl for meat and ornamental feathers and followed the advice of fourteenth-century French naturalist Gaston Phoebus on the treatment of animal bites and wounds with raw wool soaked in olive oil, a source of natural anesthesia and antisepsis.

In post-Columbian Mesoamerica, European explorers introduced horses and hunting hounds. For the indigenous farmer, the new mammals pulled plows and travois, a wheelless drag useful for ferrying light loads. By the late 1500s, stockers built rabbit hutches and sold the meat for frying, roasting, and stewing.

North American Experiments

During the agrarian phase of North American development, graziers broke more virgin prairie than ever in the course of history and armed themselves against rustlers. More than half the population of Canada and the United States worked livestock by branding, neutering, and

worming their animals. On ranches after 1749, the crossbreeding of the cow and buffalo resulted in resilient herds of beefalo. Importation of Merino sheep from Britain created new opportunities for New England graziers to raise a more adaptable ruminant. Three more imports, the early maturing Berkshire, the compact Spanish Duroc, and weighty Poland-China swine, intensified North American pig breeding and raised prices for more flavorful, moist pork suited to longer cooking at high temperatures.

Cattle breeding entered a scientific phrase in 1840 after Americans imported vigorous British Ayrshire and meaty Galloway and Hereford cattle for ranches and Dutch Holstein-Friesian and Jersey milkers for dairies. Stockers began consulting husbandry manuals and displaying prize scions at county fairs and stock exhibitions. After the emancipation of slaves in 1863 and the subsequent collapse of the Southern plantation system, an independent U.S. Bureau of Agriculture oversaw the expansion of frontier cattle and sheep ranches. The staff of 30 bureau scientists introduced hardy livestock and answered questions about mad cow and other zoonotic diseases. The last half of the century saw the manufacture of the Langstroth beekeeping frame to streamline honeycomb collection and the addition of the ostrich to exotic poultry farming and the sale of feathers to decorators.

North and South American ranching methods allowed calves to forage the grassland outside of villages and settlements, particularly in Argentina, the world's third-largest beef exporter. Hollywood later romanticized the task of the cowboy, gaucho, and vaquero, the mounted wranglers of the Western Hemisphere who ensured herd safety. Science and technology assisted postwar agrarians with drought and other cyclical obstacles. The manufacture of chick incubators and farrowing pens lowered mortality rates in the young. Stampede and wildfire alarms and windmills reduced the chances of losing animals to common hazards. Navajo sheepherding in the San Juan River valley, New Mexico, ensured independence for the nation's most prosperous Amerindians.

Abraham Lincoln harbored prospects for a secure food supply from frontier ranching. On July 2, 1862, congressional ratification of the Morrill Land Grant Act authorized federal distribution of 17.4 million acres (7 million hectares) of public land. During the Indian Wars, the military increased consumption of beef, raising the profitability for stocking and homesteading on the Great Plains.

On the northern Texas border at Guthrie in 1870, Samuel Burk Burnett of the Four Sixes Ranch interbred longhorns with British shorthorns, which gained popularity in Australia, Canada, Ireland, New Zealand, South Africa, Uruguay, and Zimbabwe. Captain Richard King of Corpus Christi bought up the 860,000-acre (348,000-hectare) King Ranch, the world's largest. Under protection of Texas Rangers, Burnett and King plotted cattle drives to Kansas railheads for transfer to Chicago stockyards. Carcasses of King's American-bred Santa Gertrudis steers traveled by rail to meet the demands for beef at Atlantic Coast inns and restaurants.

Profitable Ranching

After passage of the Desert Land Act on March 3, 1877, Oregon livestock required the cultivation and watering of 640-acre (260-hectare) plots of semiarid public land at a cost of $1.25 per acre ($3.09 per hectare). Agronomists in Nevada guarded turf and waterways as the life-or-death resources to support grasslands and livestock, which generated food as well as horn for tools, hooves for glue, and blood and bone for fertilizer. Fearing ruin from quarantines, breeders agitated for cures for hog cholera, pleuropneumonia, and tick fever. Barbed wire fencing of free prairies led to protracted range wars over independent pasturing rights. Overgrazing plus a disastrous blizzard in 1886 drove some ranchers out of business and forced others to diversify. In one experiment with scaled-back stock, North Americans raised the pigeon for squab meat, a specialty market item.

In the 1900s, science professionalized animal husbandry to predict and manipulate the value of tame animals. Tuberculin tests isolated sick cattle in 35 states. With the Great Plains of Canada and the United States thoroughly settled by 1920, agronomists turned to heightened yield by breeding more productive animal varieties, cattle vaccines, and species resistant to the hoof-and-mouth virus, spread by air and fodder. Colombia and Panama, meanwhile, developed resilient sheep herds.

In 1926, long-distance refrigerated trucking linked consumers with fresh beef, chicken, pork, veal, eggs, and milk. The importation of New Zealand targhee sheep, a source of tender lamb, and British landrace hogs, producers of flavorful bacon, further diversified meat sources. In the 1940s, the addition of French Charolais cattle to North American herds raised standards for tender beef. Pre–World War II collaboration with South American agronomists enhanced diversity throughout the hemisphere and heightened surveillance against zoonotic disease. Wartime food rationing in England and northwestern Europe returned the dove, pigeon, and horse to favor as supplements to the meatless table.

Enhancing the demand for contract staples, food stamps and the 1946 National School Lunch Act guaranteed markets for eggs, meat, and milk. Keeping pace with conventional farming, such innovations as the growing of mussels, oysters, and salmon by New Zealand aquaculturists broadened the definition of farming to include hydroponics and controlled catfish and tilapia pisciculture. Electric fencing protected investments by stopping strays and warding off coyotes, hyenas, wild dingo and dog packs, and wolves. From advances in artificial insemination for genetic diversity, cloning, and embryo transfer from quality breed stock to surrogate females, animal husbandry amplified herd quality and profitability. In the 1990s, People for the Ethical Treatment of Animals (PETA)

and other animal rights groups stepped up protests of inhumane treatment of farm animals—small pens for calves and pullets, stunning devices to control bulls, and the absence of water and space during transport of animals to abattoirs and poultry processors.

Herding and Mechanization

By the twenty-first century, technology had advanced selective breeding and biotech crops and livestock, such as squab bred for breast meat in France, Italy, the Middle East, Nigeria, North Africa, and the United States. Chefs in China and global Chinatowns reserved the squab for New Year's banquets. Print and electronic advertisement prompted the health conscious to demand pigeon over chicken because of lowered microbe count. In defiance of factory farming, organic husbandry evaluated the placement of livestock on the land near flowing water to reduce pollution and animal stress while producing for sale healthful eggs, cheese, milk, and meat. Managers oversaw sanitary feedlots and housing and scheduled seasonal diet and vaccines to protect the food supply from such microbes and parasites as brucellosis, trichinosis, and tuberculosis.

Future intervention in faulty livestock management anticipated a cleaner, more sustainable universe. At Penn State University, dairy nutritionist Alexander Hristov proposed a diet to control bovine gut microbes and limit the emission of greenhouse gas. The reputation of agribusiness deteriorated in the public's esteem following revelations of unjust farm subsidies and veterinary antibiotics and growth hormones in meat. Grassroots actions by locavores reclaimed the farmer's market and popularized heirloom varieties and Slow Food, a resurgence in artisanal sausage, goat cheese and milk, and eggs from free-range hens.

By 2050, according to a 2006 United Nations Food and Agriculture Organization report, the world will risk ecosystem collapse from "Livestock's Long Shadow." Analysts itemized greenhouse and methane gases as causes of global warming and condemned deforestation and land and water damage generated by the overgrazing of livestock and the penning of poultry. A comparison of water use cited graziers for needing 21,877 cubic yards (16,726 cubic meters) of water to produce a ton of beef in contrast with potatoes, which required only 174 cubic yards (133 cubic meters). Vegans and vegetarians enlarged on lopsided use of natural resources as justification for condemning meat consumption.

See also: Agriculture; Buffalo; Hormones in Food; Manioc; Organic Foods; Slow Food.

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Aphrodisiacs

Since ancient times, consumers have classified as aphrodisiacs any food that enhances sexual pleasure and potency. To heighten fertility and performance, Phoenicians added saffron to moon cakes, which honored Ashtoreth (Astarte), the goddess of fertility and sexuality. In Mesopotamia, the hot, spicy taste of asafetida in food contributed an aromatic stimulus to romance. For Arabs, the chewing of nutmeg increased fecundity over a three-day period; in Yemen, the same effect came from eating walnuts.

Vitality from liquids and solids, such as those listed by the ancient Greek encyclopedist Theophrastus, became the source of carnal appetite and satisfaction. For strength, the Chinese preferred caterpillar fungus, ginseng tea, and bird's nest and shark fin soups. In the early 1400s, Huou (Hu Szu-hui), the chef of Kublai Khan's imperial kitchen, chose eggs and onions, the tried-and-true dish, for a self-indulgent master who had to satisfy a sizable harem. The secret to bursts of Greek energy, honey cakes bristled with poppy seeds, a source of potassium and sugar. The Greeks heightened desire by chewing thyme or mint, a stimulant that Alexander the Great denied his Macedonian army to deflect their interest from women toward war.

The Romans invented a variety of priapic aids, including chervil infusions to reduce prebedtime tension. A presex punch, hippomane, blended herbs with genital secretions from colts to lengthen male staying power. For unflagging libido, the Roman poet Ovid recommended shallots. The Emperor Tiberius preferred skirret, a tuber similar to salsify; he imported the roots from Germania to serve with vegetables to boost his lust. The satirist Martial relied on onions, a cheaper, locally available tonic crop also recommended by the gourmet Apicius and the physician Galen for its restorative juice.

Throughout the late Middle Ages and Renaissance, mystic love potions inspired aphorism, song, and verse, with ingredients varying as widely as the turtle eggs admired in Borneo and wild thyme tea steeped by the Alaskan Inuit. The Moroccan scholar and traveler Ibn Battuta relied on coconuts for marital success with multiple wives; Marco Polo returned from China with advice to warm women's hearts with mandarin duck soup. For Catherine de' Médici, artichokes spurred passion.

English herbalist William Langham's *The Garden of Health* (1579) recommended aromatic rosemary as a goad to lust. The English also revered coriander, which they added to hippocras, a wine cordial heated with a hot poker. Henry VIII preferred bedtime sherry warmed with pungent caraway seed. His daughter, Elizabeth I, added fragrant vanilla to marzipan, a stiff candy shaped into human body parts for table decorations and nuptial gifts. Sarsaparilla-flavored drinks, the first European food fad from the New World, reputedly cured impotence. In the eighteenth century, Prussian King Frederick the Great aroused his passions with a mustard concoction from his secret recipe.

Through the centuries, erogenous dishes reputedly stimulated blood to the genitals and affected coital function and conception in a variety of ways:

boost fertility: basil, bull testicles, caviar, coriander, ginger, grain, honey, kola nuts, leeks, mandrake, mustard greens, papayas, parsley, pomegranate, sage, tansy, walnuts

enhance performance: cactus flowers, cardamom, chili pepper, coconut, ginseng, honey, maple syrup, nettles, pineapple, pine nuts, purslane, shrimp, tea, turkey, yohimbe bark

inspire fantasies: artichokes, asparagus, avocado, cinnamon, cucumbers, figs, fugu (pufferfish), ginkgo, nutmeg, raspberries, strawberries, tomatoes, whipped cream

lower inhibitions: absinthe, celery, champagne, cherries, damiana tea, lavender, marijuana, pepper, pumpkin, saffron, salted peanuts, wine

stimulate passion: anise, arugula, asafetida, betel nut, celery, chocolate, coffee, fennel, garlic, gentian, licorice, *quat* (Abyssinian tea), sage, tobacco, truffles, vanilla

Foods associated with love deities, such as the Greek love icon Aphrodite's scallops and sparrows, the Greek wine god Bacchus's grapes, and the West African sky power Min and the Egyptian chaos god Seth's preference for lettuce, bore an erotic mystique. As antidotes to the over-ardent lover, chefs served beans, dill, lentils, marjoram, rue, soy, watercress, and water lily root and offered tobacco and whiskey at the end of the meal to dampen desire. Small doses of a chancy food additive, nightshade, a hallucinogen and alkaloid poison, reputedly increased sexual energy.

Foods visually associated with ova, phalli, and semen, such as almonds, bananas, carrots and parsnips, cucumbers, eels, eggs, orchid bulbs, radishes, rhinoceros horn, and river snails, engendered erotic mythology. The Aztecs viewed the avocado as a scrotal-shaped stimulant to male sensuality. Widespread global lore lauded oysters because they resembled female labia and vulva; similarly, apricot and melon halves looked like breasts. The all-purpose mandrake suggested the human groin in full stride.

See also: Ibn Battuta; Medieval Diet and Cuisine; Pliny the Elder.

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Apicius (fl. 25–45 C.E.)

The wealthy Roman gourmet and cookbook author Marcus Gavius Apicius compiled recipes from the kitchens of ancient Rome, Greece, and Egypt. A native of the Campania region in southern Italy, he flourished during the reign of the Emperor Tiberius. He earned his cognomen from Caelius Apicius, a gourmand living in 90 B.C.E. Historians surmise that the nickname may have been a generic term meaning "professional chef."

Because of Apicius's composition of an illustrated recipe book, *De Re Coquinaria* (*On Cookery,* ca. 35 C.E.), Rome became one of the few ancient cities to have codified its cuisine. Perhaps drawing on the experience of professional cooks, Apicius organized entries into ten books, beginning with a description of the chef's job and advancing to meat, garden produce, varied entrées, legumes, poultry, gourmet specialties, mammals, seafood, and fish. Missing from the compilation are chapters on pastries and desserts. For his gluttony, he earned sneers from Juvenal and Martial, imperial Rome's chief satirists.

Apicius's writing style detailed the meticulous care of a professional cook who handled sautéing, stirring, and seasoning personally, rather than supervising slave helpers. His language, the mundane Latin of the streets, lacked elegance but bristled with exact terms for forcemeat, mincing, mortaring, and trussing. His tone suggested a man intent on his work, such as whisking egg batter for pancakes, pureeing lettuce with onions, twisting heads and sinews off wild birds, skewering a sow's udder, and cooling chicken salad with snow. He advocated boiling wild boar in seawater and shaping gingered dolphin or rabbit into

meatballs and touted the blending of eight leafy greens with pulses and barley for a vegetable ragout.

Master Chef

Apicius was a hands-on cook who apparently evolved recipes by trial and error. He appeared to abjure garlic as peasant food and specified beans only from Baiae, which he served with celery, *caroenum* (wine concentrate), and *liquamen* (fermented fish sauce). His instructions avoided exact amounts. Instead of measuring spoons, he depended on the educated mouth, by which he tested sauces for balance and proper flavoring as well as for texture. His dishes earned him the regard of encyclopedist Pliny the Elder, who proclaimed Apicius "the greatest and most prodigal gourmand of all."

The writer's knowledge of flavorings extended from the usual—almonds, basil, coriander, cumin, dill, fennel, leeks, mint, and pine nuts—to the lesser known, such as fleabane, grape hyacinth bulbs, laser root (a relative of fennel), lovage, nettles, and origanum (wild marjoram). Of his 470 recipes, 349 contained pepper. He specified dried, fresh, leafy, or seed rue to flavor olives, pickles, or wine. To ensure quality ingredients, he sailed to Libya to sample North African shrimp, then rejected them as too ordinary for purchase. For everyday fare, he outlined the creaming of hot mayonnaise and the preparation of *mulsum* (honeyed wine) for travel.

Apicius favored the elitist palate. Among his extravagances, he advocated marinating red mullet to make the most expensive *garum* (fish sauce). He recommended sauces featuring sweet and sour turnips and imported Armenian plums and Jericho dates and endorsed feeding swine on figs and a final meal of *mulsum* (sherry). His stuffing for chicken and fish included cabbage and mustard, fish sauce, and tender black bryony, which resembled asparagus shoots.

His gourmet recipes and dinner arrangements earned him cash gifts from the imperial family. Although biographical details are limited, he reputedly used his professional fortune to endow a culinary training center.

Legacy

To disguise the basic flavor of fish, meat, and vegetables, Apicius compiled 270 recipes for entrées and 200 recipes for sauces. His balance of simple staples and layerings of complex flavors resulted in such recipes as lentils cooked in coriander and rue, fish sauce, honey, leeks, raisins, and vinegar. He promoted use of the cucumber with bread steeped in vinegar and the dressing of cucumber salad with honey and fish sauce.

In an aside to the thrifty, he proposed preserving quince in grape must, a sweet aperitif made from three parts grape pulp reconstituted with ten parts honey, and keeping asafetida in a container of pine nuts to extend the use of the expensive herb. In an early form of aromatherapy, his beverages featured citrus leaves and the petals of roses and violets. He favored the wealthy with cheesecakes, rice starch gruel, and exotica such as five-course meals featuring flamingo tongues, oversized prawns, and squid while demeaning such plebeian fare as cabbage.

The extant text of *On Cookery* contains anachronisms introduced later, such as description of the imperial bulimia of Apicius's disciple Vitellius, who ruled the empire briefly in 69 C.E. The emperor stuffed himself four times a day with heavy meals, then drank emetics and disgorged the excess. At one banquet, the emperor's brother Lucius served 7,000 birds and 2,000 fish. Vitellius reciprocated by dispatching battleships east to the Aegean and west to Hispania to collect ingredients for the Shield of Minerva, a complex salad of charfish liver, eel entrails, flamingo tongues, and peacock and pheasant brains. Another disciple, the epicure emperor Heliogabalus, admired Apician curiosities and acquired his own—camel heels, cockscombs, nightingale tongues, parrot heads, and partridge eggs.

These irregularities in *De Re Coquinaria* suggest that posthumous additions continued altering Apicius's original recipe collection into the fourth century C.E. Nonetheless, the fragmented text, written at Rome's height, remained a favorite at medieval monasteries and Renaissance palace kitchens.

Recipe: Sweet-and-Sour Fried Fish Fillets

Parboil four large fish fillets and save the stock. Boil six peeled parsnips or turnips and mash to a pulp. Stir-fry 1 tablespoon of flour in 1 tablespoon of olive oil. Add 1/2 cup of fish stock to the roux. Stir in 1/4 cup of white wine, 1 teaspoon of honey, 1/2 teaspoon of cumin, 1/8 teaspoon of saffron powder, and four crushed laurel berries. Bring to a slow boil, then simmer the sauce for 30 minutes. Roll the fish fillets in the vegetable pulp and fry in olive oil. Remove to a heated platter and top with the sweet-and-sour sauce and a sprinkle of red wine vinegar.

See also: Cookbooks; Grilling; Medieval Diet and Cuisine; Pliny the Elder; Pulses; Sausage; Shellfish.

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Appetizers and Hors d'Oeuvres

The service of appetizers, or starters, has a long history as a preface to the eating and digestion of a satisfying meal. In Egypt around 1450 B.C.E., tomb art depicted hand washing in aromatic unguents preceding hors d'oeuvres and grand banquets. The implied purpose, contrast of aroma, taste, texture, and appearance, encouraged chefs to import unusual foods for their color and mouthfeel.

The Greeks introduced the appetizer buffet. To encourage fellowship, they passed a loving cup, a two-handled drinking bowl, for sharing an aperitif of hippocras (spiced wine), mead, or vermouth (wine fortified with aromatic herbs). For Greek cuisine, Cypriot capers and marinated hyacinth bulbs provided savory tight buds for pickling with onions. Zingy vinegars and olive tapenade added pizzazz to rural dinners of beans and peas, lentil soup, and cups of goat's milk.

Among the Romans, the *gustatio* (salad course) consisted of platters of eggs, lettuce, mushrooms, and radishes. For more sumptuous feasts, slaves offered salvers of boiled fungus, clams, dormice, jellyfish, mussels, onions, oysters, and prawns. Hosts passed trays of such rich, bemusing tidbits as pickled fern shoots and sea urchins with *mulsum* (sherry), a sweet aperitif made from three parts sour grape must reconstituted with ten parts honey. The conversation stimulators became a prelude to six or seven courses, which filled a three-hour evening of *gustus* (tasty pleasure).

Middle Ages

For the table of Byzantine Emperor Justinian the Great in the early sixth century, the Empress Theodora aimed for dining ambience. She hired Greek, Indian, Persian, and Syrian specialists to plan an impressive variety of cold appetizers—creamed eggplant, hummus, and garlic paste on bread triangles—to complement grilled sea bass and sturgeon or roasted suckling pig. Dishes of caviar gave evidence of the host's willingness to pay for the best in seafood.

Around 900 C.E., Arab insurgents in Iberia introduced the Spanish to food sampling in the style of Jordanian and Lebanese *mezes* (appetizers) of baby spinach, melon cubes, olive paste, pickled turnips, and sardines. The charming presentation developed into tapas (Spanish for "lids"), small portions of free bar munchies set on top of glasses of beer and enjoyed in Seville and spread throughout Andalusia. The reduction of entrées to samplers of chorizo, cheese tarts, and mussels grew into a national flare for serving satisfying bites with drinks of Manzanilla sherry or sangria.

In the 1500s, the English adopted the "antepast" as a true appetite titillation, similar in panache to the French *amuse-bouche* (mouth teaser), an arty display of the chef's talent. The introduction of the term *hors d'oeuvre* (apart from the main work) in 1691 in Paris by François Massialot, premier chef of Louis XIV, indicated the passing of entremets, light extras such as artichoke hearts, served on oval trays or footed compotes to complement a main course. Beribboned baskets of table favors, such as almonds and marzipan, marked place settings. Open-faced sandwiches contrasted make-your-own service in Chile, China, and Ethiopia, where guests chose a relish to roll up hot dog– or taco-style in *injera* (flatbread).

Modern Era

In *Il Cuoco Piemontese Perfezionato a Parigi* (*The Piedmont Cook Perfected in Paris,* 1766), an anonymous testimonial to Italo-French cookery, the term *antipasto* defined a first course rather than a preliminary warm-up. Savories arrived small enough to eat in one bite without the help of a knife and fork, such as a small chunk of melon wrapped in prosciutto or a phyllo nest filled with blackberry jam. Each emphasizes a three-dimensional quality of food and the geometrics of, for example, square crackers or round vegetable patties topped with aioli, a garlicky mayonnaise.

Spanish tapas, bite-size appetizers served cold or hot at bars and social gatherings, evolved from early Arab fare. Local ingredients and cooking methods have made tapas a varied and sophisticated cuisine in their own right. *(Gallo Images/Rex Features/Associated Press)*

Nineteenth-century Europe developed the appetizer into a culinary masterstroke. In 1891, Pellegrino Artusi, the Bolognese author of *La Scienza in Cucina e l'Arte di Mangiar Bene* (*Kitchen Science and the Art of Eating Well*), characterized appetizers as "delicious trifles," a taste sensation on *crostini* (bread crusts) preceding the service of pasta. In Sweden, the smorgasbord moved away from tempting trays to a full buffet piled several layers high with butter balls and cracker and bread baskets to accompany frittatas, gravlax, hard-cooked eggs piped with creamed fish, meatballs, pots of beans, apple cake and lingonberries, carafes of aquavit and *jenever* (gin), and urns of coffee. Swedish hostesses showcased their relishes on china and crystal pedestals and silver chafing dishes. The star of the show, pickled herring, has a long history in European diet, down the coast from Finland to Portugal and inland to Polish Jews.

Worldwide, from Chinese pickled turnips, Korean *gujeolpan* (decorated pancakes), Japanese daikon radish slices, and Hausa groundnut balls in Nigeria to Cantonese dim sums (dumplings) and Hawaiian pupu platters, starters prepare the taste buds for vegetable entrées, fish stews, soups, or roast meats. In Russia, *zakuski* names the profusion of black bread, duck tartare, and marinated mushrooms and plums, a buffet array that precedes formal table service. Sicilians arrange the most visually appealing morsels—anchovies, cured ham and pecorino, figs, and preserved lemons—on an antipasto tray to lure guests from conversation toward a place at the table.

High-toned dining rooms distribute whimsical appetizers as a signature gift from the chef and a test run for a proposed entrée, such as a taste of Tahitian crab muffins, Pennsylvania Dutch cabbage rolls, or Bajun flying fish and christophene in Barbados. The sharing of finger fritters, hot crab puffs, marinated shrimp, nut nibbles, a shot glass of pepper confit, and quail eggs, such as those served on transoceanic voyages or at ambassadorial gatherings, ready the palate for the meal to come. Tiny cups of corn chowder and Gruyère puffs served by wait staff encourage relaxation and informality among friends and strangers. Venetian *cicchetti,* miniature sandwiches served with relishes, encourage bar traffic in the afternoon, a version of the American happy hour.

For residential guests, hosts circulate delicate canapés and roasted baby vegetables on trays along with flutes of champagne. At the Brown Palace in Denver, Colorado, an array of chocolate bites accompanies cups of herb or fruit tea. For televised football games and election nights, heartier fare declines in daintiness from predinner wisps of food to hearty snacks—marinated wienies on toothpicks, buffalo wings, and chips and dip.

See also: Crackers; Feasting; Finger Food; Snack Food.

Recipe: Pickled Pinwheels

Soften one block of cream cheese and blend in 2 tablespoons of dill weed, 2 tablespoons of chopped pimiento or roasted red peppers, and 1 tablespoon each of chopped celery leaves and minced bread and butter pickles. Spread a counter with slices of chipped beef or thin Danish ham. Top each slice with a heavy smear of the cheese spread. At the center of each meat slice, place a pickle spear. Roll each slice over the pickle. Place in the freezer for an hour. Remove and slice each roll into 1/2-inch pinwheels. Top each pinwheel with a dab of olive mayonnaise and secure to a snow pea or endive leaf with a cocktail pick.

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Aquaponics

The method of raising fish and growing plants in a sustainable, integrated system, aquaponics applies a simulated habitat to the controlled cultivation of organic fruit, herbs, meat, and vegetables. A combination of aquaculture (cultivation of aquatic organisms) and hydroponics (cultivation in water), aquaponics gained interest in the 1970s as a form of green farming. The system constantly filters through sand and recirculates fluids that contain clean metabolites. Extension horticulture updates Chinese and Thai paddy gardening as adjuncts to carp, eel, and pond snail gardens and emulates the planting of reed mat gardens in Inle, Burma.

To reclaim wetlands, the Aztec cultivated *chinampas,* floating gardens that farmers anchored in lake bottoms as early as 1150 B.C.E. The Mexican reach-in beds produced amaranth, beans, corn, peppers, squash, and tomatoes, along with medicinal herbs, maguey for beer, and grasses for weaving baskets and mats. The root systems of beds reaching 4 meters (13 feet) by 40 meters (130 feet) fed on sediment and sewage and flourished from constant soil moisture. When food plants matured, gardeners poled the artificial island to market at Tenochtitlán.

Essential to a life-sustaining aquaponic environment are added oxygen and the removal of slimy biofilm and

particulates, which pollute and acidify the effluent. Within the biofilter, bacteria convert toxic ammonia and nitrites from algae and fish feces into nitrates, an organic plant food. Treatment with calcium hydroxide or potassium hydroxide neutralizes the acidity. Worms liquefy solid organic wastes into humus for use by fauna and flora. Gardeners can assess needs and inject fertigation—irrigation water containing soluble fertilizer—directly into the cycle.

Aquaponics contributes to the food web such ordinary edibles as fresh water perch and bass, saltwater char and tilapia, crayfish and prawns, and bibb and leaf lettuce, chard, and basil, all grown on rafts or platforms without pesticides. In addition to common garden vegetables—cabbage, cantaloupe, cucumbers, okra, onions, peppers, sweet potatoes, strawberries, tomatoes—the systems also intercrop ornamentals, particularly portulaca and roses. Plants that do poorly include carrots and potatoes, which evolve into unwieldy shapes without soil to guide their development. Specialty greens—basil, chives, spinach, taro, and watercress—adapt well to the flowing water garden. Application of ladybugs and wasps offsets the threat of aphids and whiteflies.

Polyculture and water reuse systems increase the variety and economy of truck gardens and lower the cost of fresh foods in winter months. Because of the efficiency of a closed-loop nitrogen cycle, aquaponic gardens use 2 percent of the water necessary to grow crops in soil and avoid the waste of nondissolvable nutrients. The method also suits communities that recycle treated sewage wastewater.

Aquaculture wins converts because of its economical space needs. One acre (0.4 hectare) of space can yield 25 tons (23 metric tons) of fish and 50 tons (45 metric tons) of vegetables annually. By contrast, a steer raised for two years on 8 acres (3.2 hectares) of pasture yields only 75 pounds (34 kilograms) of marketable beef.

The concept of soilless indoor gardening shows promise for development in parched sub-Saharan Africa and in Barbados and the Virgin Islands, where crop space and irrigation water are scarce. In Australia and Canada, urban farming via aquaponics reduces the mileage that such crops as barramundi and cod travel to market, making local produce both cheaper and fresher. Gourmands question the flavor and texture of foods harvested from a closed environment. Another complaint, the rapid spoilage of aquaponic tomatoes, suggests a lack of vigor from vines grown in liquid rather than soil.

See also: African Food Trade; Fish and Fishing; Seaweed; Shellfish; Taro.

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Arab Diet and Cuisine

Spanning the Arab world from the Arabian Peninsula west to Turkey, Syria, Jordan, Egypt, Somalia, Yemen, and the Umayyad Maghreb, Arab diet and cuisine consists of a lively, palate-pleasing blend of textures, aromas, and flavors. Religious cookbooks from Mesopotamia dating to 8000 B.C.E. exhibited local enthusiasm for refined cookery of dugong, fish, shellfish, and turtles. Hospitality, a Koranic requirement, formed the bedrock of interpersonal relations.

Among the Bedouin, Berber influences coexisted with Arab cuisine. The roasting of thin sheets of dough over a convex metal griddle yielded a brittle bread, used as a utensil for scooping up dips and sauces. Loaves, broken by hand, accompanied sheep tail fat and curdled buttermilk with dates and toasted locusts for snacks. Large metal pans held several sheep carcasses for roasting whole. Cooks served festive fare to a group from a common dish.

Archaeological digs at Al-Zubara on the Qatari coast revealed a heavy meat and seafood diet prepared at low hearths from 4000 B.C.E. by pearl fishermen. At nearby Ruwayqa, date presses produced syrup for export. In Baghdad, the Muslim capital, red meat kebabs and spitted whole lamb spiced with garlic simmered over charcoal. The Persian *biryani,* a rice-based fricassee, combined spiced meat and vegetables with boiled eggs. The Indian influence added dressings of chutney and curry.

In the Middle Ages, dhow and caravan carried over sea and land the Ceylonese tea, Indonesian pepper, saffron, and sultanas sold in Persian Gulf *souks* (open-air markets). At the heart of the Arabian Gulf spice routes, emirs of Oman dipped hands in perfumed waters before seating themselves at low tables. Over incense, they conversed informally while eating olives or dates with the thumb and first two fingers of the right hand.

Meals began casually with Jordanian and Lebanese *mezes* (appetizers), consisting of baby spinach, melon cubes, olive paste, pickled turnips, sardines, and walnuts. A national dish, *masgouf,* a butterflied carp marinated with tamarind and turmeric, required a firebox and an upright

roasting grill, on which the cook burned out the fish fat. For the freshest carp, diners ate picnic style on riverbanks with lemon and salt for seasoning. Since 2007, Arabs have rejected carp from the Euphrates or Tigris rivers because of wartime pollution.

Today, the basic entrées of camel, chicken, and lamb gain variety and nutrition from combinations of goat's milk yogurt, olive oil and lemon juice, parsley with mint, garlic, and blends of cinnamon, clove, coriander, cumin, nutmeg, and paprika. Tunisians prefer *harissa,* a table condiment of caraway and coriander seeds pounded with garlic, hot pepper, olive oil, and salt. Yemeni condiments add cilantro, fenugreek seed, and green chilies. Cooks sauce red snapper with a red splash—pomegranate mixed with tomato. Iraqi meat pies feature leavened dough and celery and scallions as complements to lamb or mutton.

Consumed with hot coffee or Yemeni cardamom tea, meals frequently begin with a base of bulgur or rice or North African couscous and *samoons* (wheat flatbread). Moroccans serve couscous, the national dish, with thick *harira* (chicken soup) flavored with cinnamon and saffron. Lavish menus combine medleys of chickpeas and fava beans with eggplant or zucchini and salads of cucumbers and onions or of sauteed dandelion greens or purslane.

Algerian Muslims gather in the courtyard of a mosque to share couscous after prayer. Traditional Berber couscous—steamed semolina pasta covered with an aromatic meat or vegetable stew—has been a mainstay of North African cuisine since the 800s C.E. *(Thierry Zoccolan/AFP/Getty Images)*

Recipe: Desert Salad (Tabbouleh)

Combine 1/2 cup each of chopped lemon mint and parsley. Soften 1/2 cup bulgur by covering it with 1 cup boiling water and letting it sit for about 20 minutes—then drain and press out any excess water. Add one large tomato cut into small cubes, one minced spring onion, and one chopped cucumber. Dress the mixture with 3 tablespoons each of olive oil and lemon juice. Season with pepper and sea salt and serve with pita triangles.

Breakfast varies from light yogurt cream, dill, and olives with Somali *canjeero* (pancake bread) to lentil soup or chickpea stew, a Tunisian specialty. Palestinians set their morning tables with a shaker of *zaatar,* a staple seasoning of oregano, sesame, sumac, and thyme that accompanies foods served with sage tea. Following noon prayers, Palestinian diners favor mixed appetizers preceding basmati rice and lentils with meat and tomato sauce and a carrot salad. A dessert of baklava (paper-thin pastry with nuts and honey) or *basbousa* (a Carthaginian semolina tart) and frothy yogurt drinks refresh and round out the meal. After dinner, a fruit course features fresh peaches or oranges, an Algerian preference, or decorative Qatari cupcakes.

Palestinian snacks revolve around hummus (chickpea paste) and chili sauce. Desserts feature dates, figs, and pomegranates as well as green almonds and pistachios served with fruit juice and goat's milk or Algerian mint tea and *halwa* (hard jelly) cookies from the Maghreb. Palestinian fruit trays include apples and carob pods with Jerusalem cheeses. In Bahrain, fruit choices include bananas and mangoes; Tunisians offer apricots, cherries, and prunes. Yemenis prefer rice pudding. Dinner in open-air shops concludes with *sheesha* (sweet flavored tobaccos) smoked in hookahs, or water pipes.

See also: Cereal; Crusaders' Diet and Cuisine; Halal; Ibn Battuta; Ice Cream; Pasta; Street Food; Taboos, Food.

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Arctic Diet and Cuisine

On terrain where agriculture is impossible, Arctic dwellers rely on hunting and gathering for a well-rounded diet that suits their cultural and metabolic needs. For the Inuit of North America, the world's purest hunting society, a protein- and fat-focused regimen ranges from dried capelin and ptarmigan and kittiwake eggs to smoked bowhead whale and reindeer tongue. To transport fresh meat to camp, hunters rely on a backpack or a tumpline, a headband and dragline to pull the carcass through snow. An ulu, a semicircular carving knife, makes short work of skinning and dressing haunches.

A land-based meat from the musk-ox arrives at the table *tartare* (chopped raw). For vegetables, families save the stomach contents of browsing mammals and gather tubers and grasses as well as seasonal berries and seaweed, both sources of vitamin C. In the Arctic wetlands, evergreen rhododendron provides leaves for Labrador tea, a favorite Athabascan drink. In Greenland, brewers turn angelica and crowberries into ale.

The circumpolar staple from the marine food web comes from the ringed seal and the seasonal harp seal and walrus. After harpooning a seal or narwhal, hunters secure a stock of food that lasts for months by preserving blubber and meat as well as edible skin for raw *muktuk.* In Greenland, cooks turn sea mammal meat into *suaasat,* a soup thickened with barley or rice and flavored with bay leaves and onions. The consumption of a marine-based diet heavy in omega-3 acids and selenium protects indigenous peoples from prostate cancer.

Arctic cuisine is surprisingly varied. Ice fishing among the Siberian Nenet and the Alaskan Aleut yields char and polar cod and lake trout, which they prepare with mouse food, the tundra roots such as cottongrass that voles store in their burrows. For the Pribilof Islanders on the Bering Sea, dried salmon and eider ducks provide winter subsistence. The traditional consumption of seal blood and organ meats reputedly fortifies the body against cold weather. Diners share the kill by status, according male hunters first choice and women and children the remains. Inuit and Mackenzie River Inuvialuit villagers, including the elderly and disabled, receive an allotment, which they consume with fireweed greens and bannocks or frybread.

The fermentation of summer kill butchered into steaks requires one year for the meat to decompose in the ground, a dangerous preparation method that causes more than ten deaths per year from botulism. Called *igunaq,* cached mammal meat contributes a treat to everyday foodstuffs. In Greenland, Inuit food preservers stuff a seal carcass with up to 500 auks and press the treat under a boulder for months until the birds decay into a thick gel, a popular entrée for birthday and wedding parties. The northern Swedish *surströmming,* a rotted herring dish, served with crisp bread and chopped onion, releases so putrid a smell that people eat it outdoors.

The Yupik of the Yukon-Kuskokwim delta west of Anchorage, Alaska, fill barrels with salmon entrails and heads and bury them for a week to make a delicacy. An Icelandic equivalent, *hákarl,* requires the pressing in sand and the hang-drying of a basking shark for up to 20 weeks to cure. A masculine repast, hákarl smells of ammonia. It pairs with *akavit* (literally "water of life"), a strong liqueur made from caraway and spices.

Berries add a fruity savor to meat and fish entrées. A favorite dessert, *agutak,* or "Eskimo ice cream," blends the flavor of whipped fat or tallow with blueberries, cloudberries, cranberries, crowberries, or salmonberries. Around Kamchatka in northeastern Russia, Chukchi reindeer herders, like the Nenet of Siberia, pound into reindeer fat a similar dessert concocted from fish roe and bilberries or crowberries. In Labrador and Newfoundland, cloudberries are the basis of a wine for drinking with sweets and blue cheese.

After World War II, Icelanders popularized festivals of country fare called *thorramatur* (winter foods). A buffet of native dishes and sour specialties includes pressed rams' testicles and singed sheep heads, as well as smoked lamb and seal flippers fermented in whey to heighten the tang. The spread features blood pudding and liver sausage as well as wind-dried cod and haddock with rye bread. Dishes come to the buffet in wooden *trogs* (troughs), an antique touch.

The cuisine of some 50,000 Northern Sami of Norway and Sweden as well as Canadian menus feature lutefisk, a gelatinous entrée of cod or pollock softened and cured with lye leached from birch ash. Dating to the Renaissance, the aromatic dish requires spices or butter to enhance the mild taste. Scandinavians celebrate Christmas and Easter with servings of lutefisk. For everyday eating, salt-fermented gravlax (buried salmon), a medieval recipe, offers a mix of dill and sugar flavors in thin slices served on crackers with capers and lemon. The marine diet appears to protect the Sami as well as northern lumberjack families from ischemic heart and vascular diseases.

A threat to Arctic survival, the environmental buildup of the pesticide dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs) flows north on current and wind to infiltrate the habitats of crustaceans and squid. Within the food web, refuse from industrialized Asia, Europe, and North America has destroyed birds and mutated sex hormones and immune systems. Seabird eggs carry the world's highest concentrations of the neuro-

toxin dichlorodiphenyldichloroethylene (DDE), a contributor to Alzheimer's disease, breast cancer, and Parkinson's disease. Studies of human breast milk at Baffin Island and Nunavik, Canada, in 1988 and in the Faeroe Islands, northwest of Scotland, in the 1990s revealed methylmercury in seal, walrus, and whale blubber.

Compounding the danger, the role of fermentation in sand and gravel introduces ground and water contaminants during fermentation. Among some 13,000 Chukchi on the Russian shores of the Bering Sea, anatomical studies find one of the highest hexachlorobenzene (HCB) and hexachlorocyclohexane (HCH) rates in the Northern Hemisphere. To save themselves from chemical poisons, Arctic dwellers turn more and more to a diet of land-raised beef, poultry, fruit, grains, and vegetables.

See also: Caching; Whaling.

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Art, Food in

Kitchen work in art has furnished culinary historians with a glimpse of kitchen gardening and cooking style and method from early times to the present. The pictures of a bride offering chocolate to the Mixtec king in the *Codex Zouche-Nuttall* (1051 C.E.) and the late-sixteenth-century *Codex Tudela* demonstrate how Aztec servers generated foam on ritual pots of chocolate by twirling swizzles in the liquid. Egyptian tomb art subtly praises the fruitful Nile culture by depicting bakers at the oven and wait staff carrying baskets and heaped trays to the table. Hellenistic vase art displays the various stages of cutting and winnowing wheat, trampling grapes, and harvesting and preserving olives, the three fundamental foods of the Mediterranean diet.

Medieval wall art features monks splitting wood for the fireplace and filling bowls with stew, an embodiment of the Benedictine rule requiring daily work and domestic chores that welcomed wayfarers to the monastery table. Miniaturist Jean Pucelle honored a full calendar of peasant home labors in *Le Livre d'Heures de Jeanne d'Evreux* (*The Book of Hours of Jeanne d'Evreux,* ca. 1327), a 209-page prayer book illustrated for King Charles IV of France. Medieval stained glass art bears similar imagery of Christian virtues, daily labor and supervision, the essentials of tending to family sustenance.

From the Renaissance, artists Lubin Baugin of France, Juan Sánchez Cotán of Spain, the brothers Isaac and Jan Soreau in Germany, and Dutch master Cornelius van Ryck began spotlighting cooks in their milieu as artists of the culinary trade. As explained by food historians, these coded canvases contain the ingredients and implements needed for preparing a recipe or feast. In an ebullient woodcut by Italian scenarist Christoforo di Messisburgo-Ferrara from 1549, the glorification of entrées presented to a table set for nine captures the anticipation of diners and the pride of cooks in their profession.

Artistic Close-Ups

In precise period elements, art gives the viewer a detailed glimpse of preparing and consuming an era's gastronomy, such as Caravaggio's *Supper at Emmaus* (1601). An unidentified sketch of the industry of an orderly Tudor kitchen establishes a clear separation by gender of hearth cookery. While men loll and converse at table, three aproned kitchen maids clean game birds, skewer them on spits, and baste the carcasses as they roast on andirons over the fire. At the far edge of the scenario, a plate of fruit and a basket of carrots and greens draw little attention in a setting where meat and masculinity dominate the menu.

Hands-on work at stoves, hearths, and tables offers historians a picture of utensils, serving sizes, and accompaniments. An appealing display of sixteenth-century abundance, Vincenzo Campi's *The Fruit Vendor* (1580) presents a woman surrounded by crockery bowls of berries, baskets of fruits and legumes, plates of figs and nuts, an apron of peaches, and a piggin of grapes, from which she extracts a likely bunch. Around the outer edge, a cabbage, a bunch of asparagus, and artichokes and a woman in the distance lifting a basket of nuts extend the image of plenty.

In Annibale Carracci's *The Bean-Eater* (ca. 1585), a rustic diner leans toward an unadorned, long-handled spoon for a bite of black-eyed peas, an African import to Italy that he consumes with crusty rolls, scallions, a plate of greens, and a glass of wine. A contemporary, Paolo Veronese, painter of lavish, life-affirming historical and biblical scenes, outraged ecclesiastical purists with *The Feast in the House of Levi* (ca. 1573), a high Renaissance tableau of table riches. A decade earlier, he had adapted Christ's first miracle into a Mediterranean event for *Marriage at Cana* (ca. 1563), a food festival bustling with shared dishes, servants refreshing wine pitchers, and a complex gabble exchanged from table to table among well-dressed guests.

Food pictures articulated an era's culinary sensibilities. Influenced by naturalism, Carthusian layman Juan Sánchez Cotán's *Still Life with Game Fowl, Fruit, and Vegetables* (1602) accents shadings, light, and color as well as texture and shape, elements of menus that delighted and satisfied diners. Like the camera's eye, the artist's hand

captures the normalcy of foodstuffs in profusion. His mélange of humble but nourishing edibles in pleasing juxtaposition presages Spain's baroque realism.

One of the pervasive subjects of late Renaissance art, the still life accentuates a passive arrangement of produce on a table or window sill, along a kitchen counter, suspended from ceiling beams, or arranged in baskets, in cauldrons, or on platters. Diego Rodríguez de Silva y Velázquez's *Old Woman Cooking Eggs* (1618) overlays labor-intensive cookery with a subdued domestic tension common to seventeenth-century portraiture. The spare scene and strained profile of the cook particularize the act of brazier cookery in a peasant setting limited to common farm foods. Displayed in bold chiaroscuro, her use of mortar and pestle and stirring spoon require limited motions from a seated position. Velázquez's *bambochdas* (drinking scenes) and *badegones* (kitchen pictures), such as *The Water Carriers of Seville* (ca. 1620), highlight dignified, contented individuals set against somber earth tones of olive, silvery-gray, yellow, burnt umber, and black. He ennobles the humble with a mystery and drama that prefigure the impressionism of Claude Monet's *Luncheon at Argenteuil* (1873) and Anna Ancher's *The Maid in the Kitchen* (ca. 1883).

In *Kitchen Scene with Christ in the House of Martha and Mary* (1620), Velázquez excels at contrast, another side of drama and mystery. Drawing on the biographical details of Jesus' ministry from Luke 10:38–42, the painter illustrates the difference between sisters. The housewifely Martha pounds food in a brass mortar in preparation for cooking eggs and fish; Mary, in the inset at right, rivets her attention on the evangelist while allowing her sister to shoulder the kitchen work. The pairing illustrates the need of Christians for spiritual sustenance as well as earthly food.

Pieter Cornelisz van Ryck of Ghent produced *The Cook* (1628), a kitchen spread in chiaroscuro. As the rather generous light travels from the lower left-hand corner to the upper right, it backlights a jumble of carrots, apples, grapes, and pumpkin and a braid of onions. At the cook's level lies a haunch of meat with cut side facing out; she bears grapes and cabbage in her hands. Above her shoulder, poultry hangs from hooks. The profusion of fish on a platter, a tub at the cook's elbow, and a plated ham to the rear attest to the household's prosperity and access to a broad menu, but the noncommittal expression on the subject's face leaves open to interpretation her opinion of the job.

A view of kitchen work from the servant's vantage point appears on Jean-Siméon Chardin's canvas *Scullery Maid* (1738). A deliberately bare-walled environment strewn with a heavy-bailed copper cauldron, warming pan, cylindrical crock, and short-handled bean pot frames a single gesture by a serving woman gazing absently at the scene. Neatly dressed in white cap, wide-sleeved tunic, wide skirts, and apron, she reaches into a cask for fruit or vegetables to fill a long-handled skillet. The absence of clear food shapes and the distant focus of her eye suggest a blur of tedium. A blue ribbon dangles a gold medallion from her neck, a symbol of validation of her repetitive chores.

Food Commerce

From a commercial perspective, an illustration in Denis Diderot's *Encyclopédie* (1745) captures the labor and teamwork of an eighteenth-century pastry shop. Division of labor placed each man at a particular post. To the left, the shop boy bears a basket of fruit. At the open oven, the baker extends a wooden peel toward items surrounded by flame. At the back wall, a laborer kneads dough at a wood dresser top. The most complex part of baking occurs at the center of the picture, where racks of game birds and a haunch of meat hang over the central workstation and a servant pots a huge meat pie. In the foreground, an ax lies beneath a chopping block draped with the lifeless body of a hare. More activity at a huge pestle and counter to the right indicates that professional baking in the eighteenth century required heavy effort from all involved.

In 1770, Huguenot painter Daniel Chadowiecki sketched an anecdotal street view of a Polish market. Amid pushcarts selling stringed instruments, dolls, and wooden horses, the butcher offers splayed pig carcasses and loops of sausage and salami. The folk spirit of market day mixes strolling aristocrats among bumptious children and out-at-elbows fishmongers lifting their wares from four-legged tubs. Beyond women with market baskets and bonneted fruit sellers, the implement seller sits in the shade under a row of iron trivets amid tankards, bowls carved from layered wood, and huge wicker urns, the practical cooking equipment of every kitchen.

Late in the eighteenth century, English painter and engraver Francis Wheatley characterized the vigor of grocery sales on London streets. His popular series of folk etchings *Cryes of London* (1795), exhibited at the Royal Academy, originally carried the title *The Itinerant Traders of London.* At the core of his vision labored the cooks, hawkers, and milkmaids of rural and domestic England. In one market scene, a basket of peas lies in the foreground, admired by an urban crowd after its early morning arrival by cart from the country. The juxtaposition reflects the dependence of city folk on imported produce.

Vasili Perov's *Tea-Drinking in Mytishchi, near Moscow* (1862) uses food to make grim social commentary overblown with prerevolutionary melodrama. While a fat Russian orthodox prelate stretches grandly at an outdoor table and stuffs his rounded gut with dainties and tea from an ample samovar, an attendant sips from a saucer behind him while a maid refills the pot from a ceramic jar and pushes beggars aside. Two ragged figures dominate the right side of the canvas with humbly inclined heads and outstretched palms. A barefoot child accom-

panies the taller figure, a blind, peg legged veteran of the Crimean War, two of Russia's down-and-out in the decades preceding the fall of the Romanov dynasty.

French impressionist Edouard Manet turned wholeheartedly to kitchen and table still life in the 1880s. Vital and evocative in their details, his *Bunch of Asparagus* (1880) and *Still Life with Brioche* (1880) reprise the tender contours of vegetables bound with grocer's twine and awaiting the pot. Under a fluted brioche, the sparkling blue plate balances a single pink rose in full bloom and the perky ears and whiskers of the kitchen tabby. More dramatic, *Still Life with Salmon* (1880) produces delight in disorder with yellow lemons, raffia-clad wine carafe, and an imposing slab of fish on a bed of greens. Manet's works conveyed promise in the fragility of fresh food, provisions for the sturdy, sense-pleasing meals on which his European contemporaries fed.

See also: Afterlife and Food; Egyptian Diet and Cuisine, Ancient; Medieval Diet and Cuisine.

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Asian Food Trade

The Asian food exchange coordinated a series of multiethnic handoffs of goods as foodstuffs made their way to other nations. From the 400s B.C.E., the Scythians maintained two centuries of trade with Greek markets selling cheese, mutton, and wheat. Cambodians supplied India with rice and livestock, which increased Indian Ocean exports from 100 B.C.E. China maintained a similar relationship with Mongolia by bartering in dairy products and livestock for resale. From the late 600s C.E., as Islam fanned out from its Arabian origins, commodities of aromatics, black pepper, horses, and sugar turned port cities into world markets. Safe conduct through lands and waters evolved through sharing of profits with pirates and savvy merchants in Aden, Calcutta, Canton, Hormuz, and Malacca.

From the Bay of Bengal, Coromandel, Gujarat, Malabar, and Sri Lanka, Indian maritime commerce distributed candied fruit, dried fish, ginger, pickles, salt meat, spices, sugar, and tea across the Indian Ocean to the east through Malaysian middlemen. By land and sea, Asian trade involved power brokers in Constantinople, Venice, and Iberia. Redistribution in Portugal and Spain sped coffee and tea north to France and to the northern seas to the Hanseatic League, which formed at Lübeck, Germany, in 1159 to trade in rye, salt fish, and wheat. As European cuisine moved away from heavy medieval spicing toward sugary foods, the Polish and Russians replaced the Dutch and French as customers for Asian cinnamon, ginger, and nutmeg.

On the way to England and France, alcoholic drinks, allspice, bay leaf, cardamom, ginger, rice, sesame seed, tea, and white pepper traveled by speedy caravel and camel caravans from southern China through the Middle East and the Baltic Sea to Poland and Russia. Merging goods from India, the Philippines, Thailand, and Vietnam, another avenue arrived at the Malay Peninsula and continued east to the Spice Islands and southwest to Borneo, Mindanao, and Sumatra. The fluid exchange of Vietnamese goods came under stricter control after 1471, when loose federations of river merchants along the Jiaozhi Ocean collapsed under tyranny by Dai Viet conquerors. To the east, Chinese trade with Luzon in the Philippines in the early 1500s extended commerce in birds' nests for soup, cinnamon, ginger, and honey.

Primary Sea-Lanes

In the age of voyagers, the encounters between Eastern and Western traders extended a lively inter-Asian commerce to the rest of the world. In the 1500s, on the shortest run between Calcutta and Macau, Portuguese explorers reported steady seagoing traffic in cardamom, oil, rice, tamarind, and wine to Malacca. On a smaller scale, consumers rallied to exotica—areca nuts, durian, *jagra, maja,* and tampoy.

In 1633, the Dutch usurped Portuguese shipping and operated 4,785 vessels at dividends as high as 40 percent from cocoa, coffee, macassar oil, and rice. What Asian commerce lacked in sophisticated merchant capitalism, it made up for in manpower, its primary asset. The Strait of Malacca, the primary Asian emporium, formed a coastal "cosmopolis" of shared Java-based authorities over the sale of dried fish, pepper, rice, salt, and spices. In 1720, the Dutch lost commercial control of Bengal, Malabar, Persia, and Surat in northwestern India.

Through cyclical booms and depressions, piracy, and wars, local potentates at the Banda Islands capitalized on alum, bananas, camphor, mace, nutmeg, pepper, and sago cakes, a multi-use palm starch. A consortium set rates of exchange and weights and measures and expedited port traffic and duty levying. Foreign dealers maintained year-round quarters and warehouses, which protected shipments during monsoons. Purchases from the Philippines added to the accumulated stock of betel nuts, coconuts, copra, dried meat, lard, rice, and sesame seeds.

Technological Advances

Beginning in the 1770s, clipper ships increased the speed of east-west trade from Malayan entrepôts to distant ports at the rate of 400 miles (640 kilometers) per day. The sleek schooners carried apples and ice to Asia and

returned with allspice, cinnamon, cloves, coffee, ginger, mustard, pepper, rice, and tea. At Singapore, speculators dickered for betel nuts, cardamom, and red cane sugar, sold from Chinese and Siamese junks.

On August 29, 1842, the Treaty of Nanking opened Amoy, Canton, Fouchou, Ningpo, and Shanghai to entrepreneurs from Great Britain. The agreement gave the British a monopoly over half of global transactions in coffee, pickles, salt, tea, and wine. Lighters and sampans delivered tea chests around the clock for careful stowage away from salt air and sea water.

By the 1860s, the steel fleet of the U.S. merchant marine unseated Great Britain's hold on global commerce. In New York Harbor, the Great American Tea Company sold cut-rate Chinese and Japanese tea straight from the cargo holds. After the opening of the Suez Canal on November 17, 1869, food carriers lopped 36 days from the ocean route between London and Calcutta, metaphorically shrinking the globe and speeding Indian wheat to England at low prices.

The emergence of technological advances in milling, refrigeration, and food processing brought students from Asia to the Americas. With scientific advancement in canning, packaging, and crane lifting of goods stacked on pallets, Asian bottlers of flavorings and sauces and canners of seaweed and smoked oysters energized the food industry with new trends. After the agricultural lapses of World War II, the dissolution of European colonies increased opportunities for Asian growers of black and brown rice, melons, pineapples, and soybeans for tofu.

Jet travel introduced tourists to Indian curry and Mongolian hot pots; soldiers returning from postings in Japan, Korea, Vietnam, and Iraq developed a taste for sake, imitation crab, soy sauce, bamboo shoots, *kimchi, belachan* (shrimp spread), hummus, and *tagine* lamb pilaf. Long-distance commerce provided Asians more social mobility and gave female farmers opportunities for expanded agricultural markets, especially in postwar Vietnam. The expectations of consumers in industrialized nations increased demands for food security, genetic modification of crops, and the use of growth hormones, matters settled after 1948 by the World Trade Organization.

In October 2011, the 21-nation Asia-Pacific Economic Cooperation pledged to create the world's largest free-trade area. Members promised to fight protectionism and support green industries. The agreement focused on beef, dairy, eggs, grain, pork, soybeans, and turkeys and on competition by domestic catfish farmers with Vietnam marketing of the pangasius, which supplies 2 percent of the nation's income. By promoting seamless regional commerce, 600 CEOs from the region sought to overcome financial lapses caused by natural disasters. Specifics of their consensus included welcoming China to a stronger position in trade governance and a reduction of tariffs by 5 percent.

See also: Caravans; Clipper Ships; Coffee; Gama, Vasco da; Spices; Tea; Trading Vessels; World Trade.

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Athenaeus (ca. 170–ca. 230)

A Greek living in Egypt, Athenaeus of Naucratis gained fame as an observant writer on diet, health, leisure, and wellness. He was a product of Naucratis, a trading center in the Egyptian delta between Alexandria and Memphis. Like physicians Celsus, Galen, Rufus of Ephesus, Oribasius, Scribonius Largus, Asclepiades, and Anthimus, in response to public carousing, Athenaeus issued a treatise on more sensible lifestyles.

His 15-volume *Deipnosophistae* (*The Banquet Philosophers,* ca. 190 C.E.) ignored Roman food fads and covered the Greek love of luxury and table camaraderie, which separated dining from the *symposion* (drinking). Athenaeus divided his text into topics: a book on food in Homer's epics and other literature, two books on bread and hors d'oeuvres, a chapter on dinner courses and music, a chapter on indulgence, another on flatterers and gate-crashers, two books on fish, another on meat and poultry, a book on gluttony and wine, another on cups, a treatise on behavior and courtesies, a book on romance and women, a chapter on desserts and music, and a concluding commentary on perfumes and wreaths. Permeating the text, citations from 1,000 authors attest to the author's meticulous research of primary sources, commentaries, and glossaries. He defended table courtesy by rejecting salacious jokes in favor of wit and riddles.

In a fictional dialogue with Timocrates set between the death of Galen in 199 C.E. and the death of Ulpian in 223 C.E., Athenaeus speaks in the first person of a feast at the home of the Roman arts patron Larensius. The text describes the *andreion* (men's house) as a place for communal meals where educated guests discuss varied topics, such as the plain fare consumed by Homeric heroes. For themes, the author draws from stage comedy and from public sexual mores, hedonism, and the use of aphrodisiacs, such as *kandaulos,* a hearty collation of stewed meat, grated cheese, and bread crumbs in gravy flavored with anise. Philosophically, the diners acknowledge the civiliz-

ing aspect of cereal, by which Demeter socialized bestial meat eaters and introduced table decorum and the sharing of communal platters. The speakers honor gastronomy and refer to a cook as a free man, never a slave or a woman, who achieves professional status as a food artist.

Among gustatory concerns, Athenaeus differentiated the types of food suited to social classes, such as palm fruit for domestic slaves as opposed to the select hearts of palm presented to the slave owner. He classified 72 types of bread and introduced rare produce, including the arbutus fruit and the medlar. In references to regional cuisine, he enlarged on the breads of Sardis, lotus wine in Libya, Attic figs and small fry, and the seaside cookshops in Alexandria that sold sausage and sweetbreads. He referred to cooking contests in Sybaris, Italy, in 500 B.C.E. Under a food patent law, the winner gained commercial control of his entrée for a year.

Discussions bandied about individual responses to food as mundane as a plowman's lunch of bread and cheese and as foreign to Greek menus as dog meat and cicadas and grasshoppers as appetizers. As a symbol of luxury foods, Athenaeus named the Samian cheesecake. He had no respect for the gobbler who polished off the dishes of almond appetizers, and he demeaned the glutton as a "potbelly."

The tension between the Greek ideal of Achilles and Agamemnon and the effete gourmand infused discussion with the range of deviations from the norm. Athenaeus had to admit that macho men such as Ajax would lose stature if they valorized dainty dishes such as those admired by the Persians and Sicilians.

Athenaeus's subject matter never strays far from issues of masculinity. As his fictional discussion ebbs and flows, at a risk of seeming obsessed with dining, gastronomes of the privileged class display a passion for cooking and banqueting. They discuss obesity, health, food prices, and the service of condiments, pilafs, prized fish, and sauces. As models, the author mentions numerous recipe compendia, one on breads by Chrysippus of Tyana, another on salt fish by Euthydemus of Athens, Greco-Syracusan poet Archestratus's *Hedypatheia* (*Life of Luxury,* ca. 350 B.C.E.), and a collection by Mithaecus, the first Greek to compile a cookbook.

Athenaeus's recipes vary from stuffed grape leaves to cheesecake and Coan wine fermented in seawater, but he focused on meat cookery. He explained a concept of religious cookery in the stewing of meat for a sacrifice to the seasons. Unlike spit-roasting, stewing tenderized the entrée and brought out the best flavors. In another recipe, he explained the making of *muma,* a meat stew that began with minced meat cooked in animal blood and entrails and flavored with coriander, cumin, honey, pomegranate, poppy seeds, raisins, scallions, silphium, toasted cheese, and vinegar.

See also: Fermented Foods; Pork; Shellfish.

Recipe: Greek Sausage

Mince 4 pounds of pork or wild boar with 1/2 pound of fat. Squeeze into the meat 2 tablespoons each of black pepper and fennel seeds and 1 tablespoon of chopped garlic. Chop the mix to a fine, even texture. Add 1 cup of red wine and squeeze into the seasoned meat. Force the mix into casings and tie the ends. Suspend sausages to air-dry for three hours. Fry in light oil, turning frequently. Serve with a sprinkle of vinegar.

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Australian Diet and Cuisine

Australian diet and cuisine confirms the success of adaptation to a unique environment. Upon arrival to the island continent on January 26, 1788, the first English soldiers and transportees from jails and workhouses found Aborigines surviving on hunting and gathering. The nation's first peoples preferred a diet dominated by honey and nectars, wild spinach, and such found protein as crocodiles, snakes, and witchetties, a large white grub easily grilled into finger food. For health, the bush people inhaled eucalyptus and tea tree oils and drank rock fuchsia tea to cure respiratory ailments.

From the highly romanticized bush tucker (bush food), the kakadu plum (*Terminalia ferdinandiana*) ranked as the world's richest source of vitamin C, ahead of quandong (wild peach) and muntry berries. Additional nutrients came from gathering abalone, beefsteak fungi, limpets, and macadamia nuts. Aborigines also snared albatross and muttonbirds, robbed their nests of eggs, and caught crayfish, fish, goannas (monitor lizards), penguins, rats, and seals.

Aborigines collected paperbark for wrapping seed bread and meat portions for roasting in ground ovens. For food preservation, in Queensland, Aborigines air-dried tropical water lily roots and yams. They cached wild grain in hollow woodbins or tied *bunya-bunya* pine nuts in skin bags coated in muddy straw. Gatherers of

cycad nuts, one of the world's most ancient tropical and subtropical foods, wrapped them in tea tree bark stacked in grass-lined trenches.

In a world apart from Aborigines, the English fed themselves temporarily on a two-year stock of cheese, dried beef, flour, oatmeal, and tea. Meanwhile, they accustomed themselves to apple berries (*Billardiera scandens*), emu and kangaroo meat, *kutjera* (desert raisins), parrot pie, reef fish, wattleseed, and wild raspberries and plums. When traditional farming floundered under extreme weather conditions, the pioneers developed expertise at raising cattle and sheep, two sources of a heavy dairy and meat diet. The importation of Chinese laborers for cotton plantations and gold mines in 1851 introduced Asian vegetables, particularly Asian greens, bean shoots, bitter melon, and bok choy, a brassica plant related to cabbage and turnips.

By raising apples, grapes, sugarcane, and wheat, colonists reverted to foods from the motherland, notably ale and beer, wine, and traditional sweets, such as apple tart, for which the English were famous. From experiences in the two world wars, bakers evolved a recipe for ANZAC biscuits, a mailable oatmeal cookie intended for the Australian and New Zealand Army Corps.

In the 1950s, Australia slipped its tether to England and became Americanized, the beginning of a cosmopolitan cuisine based on the U.S. passion for Chinese food. From the influence of Asia and Oceania, Australians balanced the standard roast-and-potato menu to include lamb kebabs, stir-fried leeks and mushrooms, river finfish and ocean trout, Malaysian pork rolls, and sliced cucumbers and onion in yogurt, a Middle Eastern favorite.

Aussies embraced *yum cha,* a dumpling feast from South China, and advertised a local food craze, farmhouse cheese from Gippsland, Victoria. Pack and snack foods favored jerky, fried flake fish (shark), meat pies, native wines, and Vegemite, a bottled yeast spread that required no preparation. For bread, stockmen and trekkers baked damper, a flat soda bread cooked on hot embers or in a billy (camp oven) and eaten with tinned treacle (corn syrup).

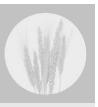
History bore out the palatability of Australian wild foods. In the 1970s, the back-to-nature movement popularized local foods, a revocation of Victorian era snobbery about European edibles and outback inedibles. After a hasty dismissal of aboriginal wild food in 1788, islanders rediscovered such indigenous plants as Chinese yams, finger limes, lotus, saltbush, warrigal greens, and Australian cashews and gooseberries. Restaurants returned kangaroo tail soup to menus and reclaimed gourmet recipes of local produce and seafood, notably, mud crabs, stuffed emu, and crocodile tail with pepperleaf.

From the clear waters off New South Wales, one of the world's least polluted stretches of ocean, Australian gourmands reclaimed less familiar delicacies, Balmain bugs (fan lobster), yabbies (crayfish), and baked latchet (sea robin) with mussels and olives. In 2004, the television series *Dining Downunder,* hosted by innovators Benjamin Christie and Vic Cherikoff, introduced grilled plank salmon flavored with lemon myrtle sprinkle and paperbark smoke oil, two distinct native savors.

Australian outdoor cookery and shore meals, especially at Christmas, lean toward barbecuing prawns and steak. In place of the stereotypical ham or turkey, cooks serve cold cuts and gherkins, curried rice, and pasta salad. Carpetbagger steak is a Sydney specialty dating to the 1950s, a beefsteak stuffed with oysters and served with fried eggs and Worcestershire sauce. For a simple lunch, shepherd's pie (ground lamb covered in mashed potatoes mixed with other vegetables) varies the usual beef entrée.

Yule dessert tables exhibit fruitcake, peach Melba, and plum pudding, a favorite holiday treat derived from England. Lamington cube cakes combine cream or jam filling with a topping of chocolate and coconut, best enjoyed with gourmet coffees. At Easter, cooks display the pavlova, or "pav," a passionfruit and kiwi dessert built on a bed of egg white and sugar meringue and named for Anna Pavlova, an early twentieth-century Russian ballerina.

Recipe: Rissoles on Buns



Mix 1 pound of ground sirloin with two eggs, 1/2 teaspoon of black pepper, and 3/4 cup of Italian bread crumbs. Shape the meat into bun-sized patties. Dust with granulated flour or powdered gravy mix. Fry or grill the patties over medium heat until they are crusty and the juices run clear. Serve on burger buns with fried eggs or pickle relish.

See also: Barbecue; Cheese; Dried Food; Grilling; Insects; Nutrition.

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Australian Food Trade

Because of Australia's varied terrain and climates, the island continent markets a wide range of foodstuffs to

world tables. When the English populated coastal Australia with convicts and soldiers in January 1788, the newcomers faced a constant struggle for subsistence. Cornish felon James Ruse of Parramatta claimed agricultural prominence in Campbelltown with his epitaph, "I sowd the Forst Grain," a source of subsequent colonial trade wealth. By 1795, flour milling of oats and wheat became the first source of island exports, followed by the sale of biscuit.

Immigrant brewers, butter and cheese makers, and meat salters at Parramatta and Sydney sustained planting styles and foodways from the motherland. In 1819, the first 1,000 agrarians adapted a stubborn terrain to herding rather than farming and opened canneries to cure game birds and rabbit in brine. To feed themselves salt pork, Australians established a triangular trade, shipping salt from Hawaii to pork farmers in Tahiti, who sent salt pork to the pioneers. Following failures with distilling, investors made their first advance in 1830 with the export of salt beef to England, followed late in the decade with cheese and potted butter sales in California.

Success with cotton in 1842 added vegetable oil to Australian food products. In September 1846, food processor Staddon and Price led the island market in banana conserves and guava and leptoma (blue fungus) jelly. Dried apple slices from Tasmania in 1850 increased the export of pome fruit. A burst of pioneering in the 1850s by some 600,000 immigrants demanded more food farming from the province of Victoria. To feed them, George Peacock, a Hobart grocer, became the first to can jam from apples, berries, and pears.

Before the decline in the salt beef trade in the 1860s, industrialist Sizar Elliott anticipated a demand for tinned meat from his factory in Sydney. By 1869, the Clarence, New South Wales, meat shippers alone marketed 14,331 cases of canned beef and processed gelatin, meat extract, and tallow for export. Simultaneously, Robert McCracken's Victoria Meat Preserving Company of Melbourne filled orders for canned meat in Japan and in England for the Royal Navy and for Jewish kosher markets.

The Industrial Revolution in New South Wales extended opportunities for processing crocodile and kangaroo bushmeat as well as mutton, plum pudding, and fresh apples and pears, which W.D. Peacock transported from Hobart, Tasmania, by sea in cold storage. On February 2, 1880, the freighter *Strathleven* brought the first frozen meat from Melbourne and Sydney to London. That November, the SS *Protos* carried frozen mutton and refrigerated butter and cheddar cheese, colored with yellow-orange annatto (*Bixa orellana*), a food dye also used in ice cream.

Colonial imports became indispensable to England, particularly frozen berries and apples and chilled meats. For the safety of families, Australian firms distributed instructions on the correct methods of thawing and cooking of raw meat. The success of Queensland meat markets resulted in competition with Argentine beef producers and a lowering of prices for the consumer.

As British agriculture declined, the working class profited from low-cost pickled and smoked beef, butter, cheese, mutton, and tinned fruit and fruit and tomato juices, which arrived in port from Australia and New Zealand in greater quantities than produce from Ireland or France. From 1890 to 1894, when Chinese laborers increased Australian food harvests, fruit and vegetables and butter imports to London alone rose in quantity from 643 tons (583 metric tons) to 11,070 tons (10,040 metric tons).

With refinements to Michael Faraday's ammonia compressor system, processing plants boosted the output of food in 1892 by adding fish to exports. In 1895, total exports of preserved meat to the United Kingdom reached 23,325 tons (21,156 metric tons), much of it directed to orphanages, schools, and workhouses. Loosening ties to the United Kingdom, Australia extended its clout in world food commerce by dealing directly with other nations rather than through London middlemen.

In 1901, with Australia providing nearly 50 percent of British commodities, the island nation became a federal commonwealth. The twentieth century saw the rise of agro-markets for abalone, Asian herbs, lychees, nashi pears, olives, potatoes, poultry, and farm-raised salmon and tuna. The promotion of Asian vegetables added bitter melon, bok choi, Chinese celery, flat cabbage, garlic chives, and mizuna (peppergrass).

In 1908, the British Board of Trade appointed four commissioners to live in Australia and promote commercial opportunities, such as the tunnel dehydration of eggs, minced mutton, and raisins. Trade with India in 1910 produced an amicable swap of wheat for tea and jute, a source of Australian gunnysacks. Bags cycled back to the United Kingdom from 1909 to 1913 bearing 2.46 million tons (2.23 million metric tons) of wheat.

By 1925, after a drop of 15 percent in farm and herd labor during World War I, 95 percent of Australian exports consisted of produce. To hold a place among other advanced economies, the Australians raised standards and policy on food safety from allergens and chemical and microbial hazards, such as widespread spraying of apple, pear, and quince orchards with toxic Paris green (copper arsenate) to control codling moth.

By 2010, the Australian economy depended on some 2,000 companies in the food and wine industries for nearly half its retail sales. At Sydney in September 2011, food purveyors displayed their goods at Fine Food Australia, the nation's largest trade show. The chief buyers, Arab and Pacific Rim nations, purchased baby food, baked goods, candied fruit, chutney and pickles, custard and milk pudding, dairy foods, desserts, honey, meats, milk, poultry, powdered drinks, sauces and soup, vegetables, and wine and cordials.

See also: Aquaponics; Markets and Marketing; Milling; Refrigeration.

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Aztec Diet and Cuisine

The foodways of the Aztec, viewed through the eyes of Spanish conquistadors, imbedded native culture with outlets for worship and the appreciation of savory native flora and fauna. The Renaissance encyclopedist, linguist, and Spanish friar Bernardino de Sahagún, the father of ethnography and culinary history, detailed for Europeans the lifestyle of the Aztec, including cooking utensils, beverages, and foods. In 1529, under orders of Charles V, Holy Roman Emperor, Sahagún posted to Tlalmanalco at Xochimilco in south-central Mexico. While cataloging language and food customs in the Nahua language, he compiled specific vocabulary for pantries, hearth cookery, kitchenware, and therapeutic herbs, which he listed in his Nahuatl dictionary and grammar book.

A drawing from the *Florentine Codex,* compiled in the sixteenth century by Spanish missionary and ethnographer Bernardo de Sahagún, shows the Aztecs eating tamales for the midday meal. The dough was made with maize (corn), the staple Aztec crop. *(The Granger Collection, New York)*

Aztec bloodletting impacted their values and customs, including food gifts of eggs and turkey sprinkled with human blood. They made ritual stews from the hearts of slaughtered criminals or prisoners of war. Beyond cannibalism, they adopted the word tortilla, Spanish for "omelet," to name the staple bread.

At the Tenochtitlán food market, street cooks prepared entrées; *curanderos* (herbalists) linked eating with curative nutrition. Sahagún's encyclopedia, the 12-volume *Historia General de las Cosas de Nueva España* (*General History of the Things of New Spain,* 1540–1569), also known as the *Florentine Codex,* compiled details in parallel columns of Nahuatl and Spanish. Concerning favorite dinners, he incorporated spiced shrimp dishes, his preference for turkey wing tips, and the visions and dreams experienced by diners on honey and psychedelic black mushrooms, a common aphrodisiac. He remarked on the fattening of the wild peccary with stall feedings of acorns, cherries, corn, and roots.

A People's Diet

For the Spanish, foodways became a basis for understanding the Aztec. At court, staff set the emperor's table with 2,000 dishes. Entrées made for the emperor alone included whipped chocolate sweetened with wild honey, avocados and cactus fruit, and the *moles* (sauces) that flavored caiman, crayfish, dog, jackrabbit, quail, and lake and sea fish. Unlike the privileged aristocracy, peasants favored raw fruits and vegetables, a contrast to the meat-heavy, alcohol-rich Spanish diet. In the Tenochtitlán market, some 50,000 people came to examine baskets and gourd dippers, cutting tools made from volcanic glass, and the griddles and *ollas* (cooking jars) displayed and sold by potters.

Aztec dietary lore contained unique elements, such as the casting of bits of food and drops of *octli* or pulque, an alcoholic drink fermented from agave sap, onto the hearth before each meal to propitiate the gods. Crafters molded and painted idols from food. At the end of a ritual, worshippers ate the images. For Xiuhtecuhtli, the fire deity, and Huitzilopochtli, the war god, the Aztec made pastries and consumed them in the god's honor, a sacrament that paralleled the Christian Eucharist. A similar obeisance to a dead monarch required a four-day presentation of flowers, food, and tobacco. On the fifth day, Aztec subjects feasted and made speeches.

In times of famine, a prophet warned the people that those with plenty must tolerate seizure of their stores of amaranth, cacao beans, corn, and seeds to share with the poor. Out of compassion for the hungry, the ruler stopped collecting taxes. In fealty to the gods, the Aztec carried

their families up the mountains and sacrificed their children to solicit rain and to make the prickly pears and amaranth greens grow, the grasshoppers return, and the gardens produce once more.

The *Florentine Codex* incorporated 1,800 illustrations drawn by Aztec scribes to capture the importance of sustenance to a culture bedeviled by attackers and drought. Central to native festivals and worship, corn in all its forms demanded reverence, sacraments, and hymn-singing to the earth mother, the giver of life. Vast storage facilities operated by food accountants and *pochteca* (distributors) mediated between urban consumers and outlying farms, where peasants used cacao beans as a medium of exchange. Book 10 summarized the bean-chili-and-corn-based diet by describing the purchase of corn in city markets for making popcorn, tortillas, and a variety of tamales flavored with beans, eggs, fruit, and honey.

Kitchen Specifics

Although the Spanish demeaned the Aztec diet as crude and pagan, kitchen masterworks—frothy cacao and vanilla drinks, poultry stew, chayote and jicama, opuntia cactus pads, and duck egg and squash dishes—displayed expertise. One example of harmonic baking began with the kneading of amaranth seed into a loaf called *alegría* (joy). The *moles* featured chili and spices, a symphony of flavors still dominant in Mexican cookery. At the heart of table service, cooks poured cups of *atole,* a beverage made of parched cornmeal and chia, a gelatinous seed so valuable that the Aztec used it as currency to pay their taxes. More than taste or nutrition, their national foods imparted feelings of patriotism, heritage, and family.

Aztec cuisine figured in major life passages, particularly funerals and weddings. As part of the cult of the dead, the devout enshrined images and proffered tamales and turkey or dog stew to feed the spirit on its journey from earth. The ritual concluded with songs and toasts of pulque. As Sahagún's illustrations showed, girls of marriageable age learned from their mothers how to soak corn kernels in ash and water to remove hulls. Grinding involved kneeling at a stone metate and pressing the mano (roller) over dried corn until it broke into meal. By adding water to the flour and shaping into a palm-sized ball, the cook readied dough to pat out a thin cake for heating on a *comal* (stone griddle).

At the heart of Aztec cooking lay distinct flavorings—green, red, and yellow peppers and the cooking of frogs, grubs, lizards, and termites with chilies, tomatoes, squash seed, and savory herbs. The food sellers at the market stalls identified peppers by color and pungency and by use as pickles or with fish, newts, tadpoles, turkey, and smoked meats. To Aztec cookery, the Spanish newcomers added black pepper, cinnamon, coriander, olive oil, oregano, and parsley as well as almonds, bananas, barley, chickpeas, eggplant, garlic, grapes, lettuce, onions, rice, sugar, and wheat. From the blending of flavors emerged Mesoamerican cuisine, a previously vegetable-rich cuisine broadened with the addition of beef, lamb, lard, milk, rice, and wheat and the blending of butter and cheese into rich cream sauces.

See also: Chicle and Chewing Gum; Díaz, Bernal; Insects; Las Casas, Bartolomé de; Peyote; Prohibition; Religion and Food; Sauces and Saucing; Tortillas; Yeast.

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Baby Food and Infant Feeding

Globally, the nourishment of infants and toddlers reflects the attitudes and means of individual cultures. The breast feeding of infants currently lowers the risk of dying in the first 12 months by 20 percent. Typically the decision of mothers, newborn feeding relied for eons on the birth parent or a wet nurse. The job of surrogate breast feeder rewarded donors with a serene life and abundant food.

Either the mother or the donor fed the child every two hours. In past ages, the first postpartum secretion, called colostrum or beestings, held such mystic powers that herders saved the colostrum from lactating animals for special needs. Human milk bolstered immunity and reduced health risks, particularly allergies, diabetes, and obesity.

For mothers of stillborn or deceased children, nursing another baby solaced the sorrow of losing a child. Among Native Americans, the sharing of breast feeding of community infants created a parental bond with all the tribe's children. In Malaysia and the Philippines, the employ of a wet nurse symbolized luxury and status. For whatever reason, the insistence on human sustenance strengthened the suckling babe through a diet of high-quality fluids that adapt naturally to the baby's needs and maturation.

For families choosing surrogate mammalian milk or supplementing breast milk for fretful or sickly babies, hard-spouted clay containers such as miniature Cypriot wine jugs from 2000 B.C.E. simplified infant feeding. A terra-cotta nurser shaped like a piglet from 450 B.C.E. suited a Greek mother, who filled it with a formula of honeyed wine. The Egyptians and Romans in 300 B.C.E. used blown glass for shaping feeding vessels. In the thirteenth century in northwestern Europe, a cow's horn capped with a chamois leather nipple served as an infant flask.

Solid Foods

Other nations standardized infant solids, the meals that sufficed for teething infants. In eastern Asia, homemakers first introduced rice gruel, followed by mashed vegetables and tofu as teeth emerged from infant gums. Japanese mothers extended weaning meals to bonito flakes, miso (soy paste), and seaweed. In India, Hindus and Parsis made a food ritual of Annaprashana, the introduction of rice porridge or a mix of milk, ghee, and honey to a baby at age six months.

In some cultures, the mother's chewing of solids macerated food for shifting to the child's mouth, often from tongue to tongue. Examples include the banana pulp that Ugandan mothers fed their babies and the chewed fish and heated water that Eskimo mothers passed to their infants from mouth to mouth. Choices of flavors affected the growing child, who established preferences as early as age two for indigenous plants, such as avocado, coconut, and pomegranate.

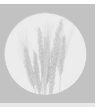
According to Thomas Phaire's *Boke of Chyldren* (1544), the first pediatric treatise in English, evil traits and an ugly complexion dated back to the "gyver of the mylke" who fed the individual in infancy. Renaissance mothers worried that substitution of goat's and sheep's milk could introduce coarse animal elements to the baby's hair and skin. For weaning, families made digestible, nutritious pap from barley, oats, or rice mixed with egg for spoon-feeding. In the 1700s, the addition of broth, butter, or oil produced panada (bread soup), a specialty in northern Italy.

Nature vs. Science

By the Industrial Revolution, mass production of infant food applied the scientific knowledge of nutritionists, who formulated feedings based on the analysis of mother's milk. Cookbooks outlined complex formulas from cream and milk, sugar, and water and listed pablum alongside menus for invalids. In 1845, New York inventor Elijah Pratt patented the vulcanized rubber teat. The concept replaced hard glass and metal nipples, yet doctors warned of the difficulty of sterilizing the inner channel.

For weanlings, American mothers ventured into cereal and meat, in part because of a pervasive suspicion of fruit and vegetables as a source of cholera. In 1854, Bostonian writer Sarah Josepha Hale, author of *The New Household Receipt-Book,* advocated "gruel alone, or mixed with cow's milk; mutton broth, or beef tea; stale bread, rusks or biscuits, boiled in water to a proper consistence, and a little sugar added." For a sickly child, she prescribed arrowroot or sago boiled in milk and flavorings of cinnamon, nutmeg, sugar, and wine. Her varied list of sickbed meals included cornmeal or egg gruel, oatmeal, rice jelly, and stewed prunes, a treatment for fever.

Recipe: Panada



Toast 1 loaf of sourdough bread in the oven. Crumble the dry bread and add crumbs to one chopped onion in a frying pan coated with butter or olive oil. Sauté and moisten with water. Keep crumbling bread and adding crumbs to the water while stirring. Add 2 quarts of beef or vegetable broth and season with pepper and sea salt. Simmer for 30 minutes. Cool and whisk in three egg yolks, chopped green herbs, and 1 tablespoon of butter or olive oil.

Massachusetts natives Joseph Bardwell Lyman and Laura Elizabeth Baker Lyman's *The Philosophy of Housekeeping: A Scientific and Practical Manual* (1859) corroborated Hale's prescription. In a summary of the best "tissue-making" infant foods, they highlighted "Flesh, milk, eggs, and wheat bread." Additional lists named fat-free servings of barley, cabbage, oatmeal, onions, and potatoes. Ironically, doubts about beans and fresh greens overlooked the most pernicious source of pathogens, the water supply.

The nineteenth-century German organic chemist Justus von Liebig emulated breast milk with proportional blends of carbohydrates, fats, and protein in a farinaceous food called Liebig's Soluble Food for Babies. Historians have called his introduction of artificial milk the world's largest uncontrolled experiment on humans. In 1867, his Registered Concentrated Milk Company in London shipped artificial mother's milk to American and European markets. He followed the liquid version with a powder of dried cow's milk, malt and wheat flour, and potassium bicarbonate for reconstitution with milk and water. A letter to the *Medical Times and Gazette* in 1877 proclaimed the formulation "a panacea to little children from birth, and in every rank of society."

A Blow to Tradition

Simultaneously with the medicalization of birthing and the revolution in liquid formula and solid baby food, mothers abandoned centuries-old concepts of pureeing food at home in favor of scientific regimens. In 1867, for babies for whom cow's, goat's, or sheep's milk proved unpalatable, German-born pharmacist Henri Nestlé of Vevey, Switzerland, formulated Farine Lactée (milk cereal), a powder of sweetened condensed milk and malted wheat rusks. In the 1870s, he marketed it in the United States as a weaning formula under the logo "Best for Babies."

In London, Danish chemist Gustav Mellin improved on Liebig's food in 1874 by inventing a portable, easily mixed powder that required no boiling or straining for dissolving in hot water and mixing with cold milk. Rich in grape sugar, the dry food received accolades from the *Boston Daily Globe.* Booklets accompanied the product to impress on women two adjectives, *scientific* and *modern.* In 1887, Mellin began marketing his breakthrough in Burma, Ceylon, and India as a scientific substitute for mother's milk.

Traditionalists rejected liquid formula and fortified pablum out of fear of contaminants. Mediators insisted that the weakness of boxed formula and cereals or canned fruits and vegetables lay in the addition of polluted water or milk. Aggressive advertisement massaged fears of early childhood death, which spiked to 20 percent in the 1890s in Europe during epidemics of cholera, diphtheria, enteritis, malaria, measles, pertussis, pneumonia, scarlet fever, and typhoid. Such verbal manipulations failed to pinpoint a common endangerment, a bottle or pap boat that became septic because the feeding channels were too narrow for thorough washing. By 1900, the reversible rubber nipple made it easier to sterilize nursers.

In 1896, Dutch industrialist Martinus van der Hagen's Nutricia foods first commercialized prepared infant foods resembling mother's milk. In Brunei, China, France, Malaysia, Singapore, Thailand, and Vietnam, he turned spin-off brands Dumex and Sari Husada, Bambix cereals, and Olvarit organic mixed fruit and entrées into top international sellers. Advertisers depicted evaporated milk and ready-to-eat baby food as a convenience to the modern mother based on science rather than home preparations.

Selling Wholesomeness

Concern for purity drove the baby food industry, which got its start before World War I. Knowledge of sepsis caused families to demand milk from herds tested for staphylococcal and tuberculin pathogens. Shoppers also watched for signs of watering milk and additions of borax and formaldehyde, pernicious dairy preservatives.

In *L'Alimentation des Enfants Malades* (*Feeding Sick Infants,* 1908), French nutritionist Maurice Péhu, a physician at the University of Lyons, advised mothers to adopt the slow simmering of beets, carrots, and spinach and straining the pulp into one quart of water. When similar manufactured food arrived in grocery stores, it was the brainchild of Daniel and Dorothy Gerber of Fremont, Michigan. The couple introduced jarred strained beef and vegetables soup, carrots, peas, prunes, and spinach in 1928 at six cans for a dollar. The popular canned food outsold Harold Clapp's formula, shipped from Rochester, New York, and distributed only by druggists since 1921. Sketches of the Gerber Baby in *Good Housekeeping* and *Ladies' Home Journal* increased the brand's market share. In one generation, the company turned *Gerber's* into a synonym for solid baby food.

Families began buying prepared foods in glass jars, a see-through container introduced by Beech-Nut featuring 13 varieties in 1931. The entrance of Heinz and Libby's foods into the infant market in 1935 did not lessen Gerber's dominance, which it still maintains. The market leaders added salt, starch, sugar, and preservatives with impunity until the 1990s, when the Food and Drug Administration mandated the listing of additives by percentage. As of 1998, Gerber topped all U.S. brands in customer loyalty. Heinz continues to dominate the market in Australia, Canada, Great Britain, Italy, and New Zealand.

Advances in Bottle Feeding

During the quarter century preceding World War II, breast feeding declined in the United States from 80 percent to 38 percent. Baby bottle kits offered the all-in-one convenience of a metal sterilizer and nesting basket for stovetop boiling. Mothers could clean bottles and nipples and prepare and store a whole day's feedings, poured into either round or hexagonal bottles. The lidded carryalls made by Therma Products of Toledo, Ohio, also held baby food packed with ice for outings and travel.

By 1956, when more than 50 percent of American infants drank home-mixed evaporated milk formulas, the La Leche League encouraged mothers to return to natural breast feeding for at least a year. The grassroots effort spread to Canada, France, Mexico, and New Zealand. By 1972, breast feeding began to advance at an average of 3 percent annually. The United Nations supported the effort in 32 nations.

Parents worried less about impure food after the introduction of boilable Pyrex nursers. The marketing of sterilized ready-to-eat formula in disposable glass bottles improved convenience. Fortification with iron and an adjusted calcium and phosphorus ratio bolstered nutrients in a basis of soy protein. Mead Johnson's Enfamil and Abbott Laboratories' Similac and other soy formulas solved some of the problems with animal milk and lactose intolerance and gained the trust of vegetarian families and women incapable of nursing their young.

Back-to-Nature Movement

The 1970s produced a revolt against industrialized, overprocessed food and wasteful packaging. In March 1974, journalist Mike Muller of the British nonprofit War on Want issued "The Baby Killer: A War on Want," an exposé of the deception of developing world mothers, such as the women of rural San Salvador, where infants died at the rate of 50 out of 1,000. In the opening paragraph, Muller charged that the children who survived remained mentally and physically stunted.

A global uprising on July 4, 1977, against Nestlé's unethical merchandizing of Lactogen to nursing mothers shamed a respectable company for misleading mothers in have-not nations. By dispatching 200 saleswomen dressed in nurses' uniforms, the company influenced women to switch from breast milk to the commercial formulas popular in industrialized nations. The missing link, literacy, made the campaign incomprehensible to the preliterate and semiliterate of Brazil, Chile, Jamaica, Jordan, India, Israel, Nigeria, Pakistan, and Sierra Leone. Subsequently, the faulty preparation of commercial foods and lack of refrigeration resulted in higher infant mortality rates from enteritis and ear and respiratory infection.

In a rebellion against overcooking and flavoring with salt and sugar and thickening with starch, mothers returned to breast feeding and to blending organic produce into baby food with food mills and processors. The World Health Organization (WHO) legitimized their concerns in 1981 by adopting the International Code of Marketing of Breast-Milk Substitutes. To increase income, baby food companies directed advertising toward African and Latino shoppers. In an effort to enhance breast feeding, Brazil in 1988 issued guidelines for marketing infant food.

Fortifying the Pantry

Because of inadequate formula mixing and contaminated water supplies worldwide, some 1.5 million infants died in 2001 alone. To save lives, WHO continued to advise mothers to breastfeed their infants for the first six months. As a substitute for human milk when the mother is weak or taking drugs for herpes, human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), or tuberculosis, communities formed human milk banks to collect and dispense breast milk. Heifer International, a nonprofit poverty relief agency begun in Little Rock, Arkansas, gained support for combating malnutrition by giving poor families milk-producing animals—dairy cows, goats, sheep, and water buffalo—as well as chickens, ducks, geese, llamas, pigs, and rabbits as sustainable livestock.

Under the Child Nutrition Act of 1966, the U.S. Department of Agriculture established the Women, Infants, and Children (WIC) Program in 1972. The third-largest national food aid program, WIC distributed iron-fortified infant formula and cereal to some 88,000 applicants in the United States. By 2010, the number of recipients exceeded 9.1 million, with a per-person average of $41.45 per month in food assistance. Parents received more sustainable infant diet from jarred produce and meat and from milk formulas that provided complex fatty acids from egg yolk and fish for the development of brain and vision.

Alternatives to standard jarred food include the organic meals from Earth's Best, which appeared on grocery shelves in the 1980s. Designer entrées, available fresh or frozen from Bohemian Baby and Whole Foods after 2005, replaced savorless jarred baby food with such gourmet entrées as asparagus risotto and Tex-Mex beans and rice. In a $3.6 billion annual industry, the creative pairing of

fruit with rice pudding and meat stew with bay leaf enhanced a discriminating palate in infants. Multicultural choices introduced dal with cinnamon and lentils with coriander. Babies learned early to recognize celeriac and to appreciate the addition of ginger and shallots to dishes.

Globally, the baby food industry remains in its infancy. Russian mothers, especially rural peasants, spend more than 80 percent of their infant food allowance on imported jarred foods. Tanzania's Lisha brand imitates nineteenth-century creative efforts by selling local corn and soy beans blended with milk and supplemental nutrients. Farmers in Costa Rica and Honduras seized the wave of interest in more natural baby feeding by marketing pureed organic bananas and tubers to sell to African immigrants to the United States.

At the same time, disparities mock the advances in infant nutrition. Angola leads the world with more than 180 deaths per 1,000 live births, compared with Singapore, with the lowest ratio of 2.31 per 1,000 live births. For the Central and South American outback peasant, such as the Yanomami of the rain forest, baby food retains the age-old simplicity of fruit or meat mashed by hand and diluted with water.

See also: Allergies, Food; Cereal; Crackers; Liebig, Justus von; Sloane, Hans.

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Bamboo

A treelike member of the grass family common to the Caribbean, East and Southeast Asia, Pacific Islands, and the Americas, bamboo impacts world cuisine as a food and a versatile raw material for making cooking and eating utensils. A miraculous perennial that can grow as much as 39 inches (100 centimeters) per day, bamboo comes in 1,400 varieties.

In prehistory, Asians used bamboo leaves as food wrappers and strips to bind raw foods together for spit roasting. Aborigines of India collected sugar crystals from the stems for trade. Koreans roasted sea salt in sections of bamboo to leach out impurities. In the 1300s, Mongol nomads taught the Chinese their *kao* cuisine, toasting meat on bamboo skewers over charcoal grills. Cooks placed individual grills on tables, offering informal diners the opportunity to roast morsels to the desired level of doneness.

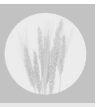
Bamboo is a cheap, lightweight, renewable resource. In Cambodia and New Guinea, kitchen staff heat greens and yams in bamboo tubes over fires; in Kerala, India, designers modify the tubes with baffles and use them to control steam arising from woks. At Vietnamese food markets, vendors of fishball soup draw customers by clapping *tok toks,* bamboo sticks that emit a hollow sound. Bamboo easily shapes into baskets for air-drying mushrooms and rice, beer carafes, brushes and scrubbers, canisters, chopsticks, cups and scoops, filters and mats, napkin rings, shelving, sieves, vegetable steamers, and winnowing trays. As a fiber, bamboo weaves into a soft, antimicrobial fabric for curtains and table linens.

On farms and in courtyards, bamboo conforms to geometric shapes and arches to support espaliered and vining plants. In the mid-1900s, Kudo Kazuyoshi, a Japanese master of bamboo implement manufacture, designed creels for draining seaweed, transporting salt for pickling eels, and trapping and storing live fish in water.

One of the world's major food sources, bamboo produces edible sap and shoots that can be baked into rice pancakes, cooked in broths, grated over salads, mixed with other vegetables, pickled into a condiment, or fermented into wine. Shoots are available fresh or canned. Fresh stalks impart a distinct savor to rice, soup, or tea.

See also: Cantonese Diet and Cuisine; Dried Food; Hearth Cookery.

Recipe: Vegetable Pork Rolls



Sauté 1/2 pound of ground pork in 1/4 cup of sesame oil. Rinse and sliver 2 cups of bamboo shoots and 1/2 cup each of chopped carrots and water chestnuts and add to the pork. Top with 1 teaspoon each of rice vinegar and soy sauce and lower heat to medium. Stir-fry for five minutes. Sprinkle on 1/4 cup of chopped curly parsley. Allow the mixture to cool and divide it into five portions. Spoon each portion onto an egg roll wrapper and roll the filled wrappers into cigar shapes. Brush with one beaten egg and bake for half an hour.

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Barbecue

An indigenous New World cooking method, barbecuing slow-cooks meat, usually a whole deer or hog, over a smoky fire.

On November 7, 1504, Christopher Columbus arrived back in Spain with details of Jamaican-style barbecuing. In 1542, Hernando de Soto's expedition along the St. Johns River, Europe's longest foray into native America, introduced Castillians to a Timucuan culinary specialty, barbecued hens. In the Caribbean in the seventeenth century, food writer Gonzalo Fernández de Oviedo observed the Arawak, Carib, and Taíno cooking alligator and fish on racks of bearded fig wood raised on saplings. During slow grilling, smoke from the wood fire drove off insects and halted putrefaction. On Hispaniola, pitmasters adapted grate grilling to whole cattle and pigs, dressed and split for maximum contact with heat. In Central America and southeastern Mexico, the Maya developed their own grilling method for iguana and turkey. A similar framework in Argentina called a *parrilla* accommodated haunches, tongue, tripe, and whole carcasses over radiant heat. Filipinos popularized the barbecuing of *criadillo* (bull's testicles) and the large intestines of pigs.

The first commercial U.S. barbecue, opened in Ayden, North Carolina, in 1830, sold smoked meat from a chuck wagon. In her epic Civil War novel, *Gone with the Wind* (1936), author Margaret Mitchell prefaced war and destruction with the barbecue at the Wilkes family's Twelve Oaks plantation, a symbolic outdoor repast that welcomed the county gentry to the cookery of Georgia domestic slaves. Before reaching the Wilkes veranda, the heroine, Scarlett O'Hara, spies barbecue pits that "had been slowly burning since last night . . . long troughs of rose-red embers, with the meats turning on spits above them and the juices trickling down and hissing into the coals." From political talk over plates of meat burst the announcement of war between North and South, a cataclysm fought over the nearly invisible slaves who cooked and served meals to Southern gentry.

After emancipation, black cooks migrating north and west took Southern barbecue styles with them and ate "'que" on Juneteenth, a celebration of the news of slave emancipation on June 19, 1863. In 1907, Henry Perry, a Tennessee-born steamboat cook, introduced the cooking style in Kansas City. Because of the availability of cattle at railheads, barbecuers in Kansas, Missouri, Oklahoma, and Texas favored beef over pork. After barbecuing over a mesquite fire, Texas-style steers fed large parties, such as the one featured in the film *Giant* (1956). Brisket arrived at the table in tender slices rather than chopped. Use of a closed pit produced a pinkish ring on the meat, evidence of a chemical change wrought by smoke. Side dishes included roasting ears of corn, baked beans, and thick slices of Texas toast.

Europeans developed a male-dominated cooking method of barbecuing meat and vegetables on a gridiron over hot coals or charcoal. In the late 1940s, Australians and New Zealanders embraced barbecuing for special occasions by grilling game or skewered chicken or lamb and sausages. The popular nationalistic gathering rejected the prim English diet of a Sunday beef roast and boiled potatoes.

A North Carolina pitmaster checks one of the whole hogs smoking in his barbecue grill. A slow-cooking method indigenous to the Caribbean and North America, barbecuing constitutes a diverse—and often competitive—subculture across the American South. *(Richard Drew/Associated Press)*

In other European colonies, cooks in Botswana, Lesotho, Namibia, South Africa, Zambia, and Zimbabwe developed the *braai,* a barbecue over a gas or wood flame of Dutch-style *boerewors* (sausages), rock lobster, and skewered *sosaties* (the Afrikaans term for spiced kebabs). Diners preferred their barbecue with cornmeal mush, *chakalaka* (hot sauce), and chutney, called "monkeygland" sauce. The regional meal acquired its own holiday, National Braai Day, which it shared with Heritage Day every September 24.

Current North American tastes favor the backyard barbecue, popularly known as 'que. The method is relaxed, especially in warm weather, when outdoor cookery directs heat and odors away from the kitchen. At a traditional "pig-pickin' " in the Pork Belt, Southeastern Americans observe regional preferences for ribs or chopped fatty pork butt or shoulder.

The melting of fat into the flames gives the barbecue its distinctive aroma and succulence. Coarse chopping breaks down tough collagen fibers and produces a satisfying mouthfeel. For its homey appeal, barbecue became a focus of county fairs and political rallies. In 1991, producer Jon Avnet filmed Fannie Flagg's *Fried Green Tomatoes at the Whistle Stop Cafe,* a Gothic comedy that depicts barbecuing of the villain as a way to hide the corpse.

All-male aficionados in the Piedmont Carolinas and Georgia construct barbecue pits from scratch or recycle fuel drums into hinged basin and lid. A natural competition emerges between "loggers" and "gassers" over the best fuel for authentic 'que. At church socials and Fourth of July community picnics, pitmasters slather a peppery, vinegar-based tomato sauce over pulled pork or chicken with a long-handled marinade mop. The sauce also seasons cabbage cole slaw, a standard accompaniment along with hush puppies (corn fritters), pickles, and sweet tea. South Carolinians add mustard to their sauce. Nearer the Atlantic Coast, cooks flavor marinade with brown sugar and molasses. Kentuckians massage seasonings directly into mutton for a presmoking dry rub.

Friendly competition, cook-offs at Kansas City, Missouri, Lynchburg and Memphis, Tennessee, and elsewhere in America feature the best regional recipes and techniques for the juiciest meat. Vying over the choice of hickory or oak hardwood or mesquite generates factions among grilling sportsmen. From these challenge meets have come a spate of barbecue cookbooks, most compiled by men.

See also: Amerindian Diet; Columbus, Christopher; Sauces and Saucing.

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Barter

A direct method of exchanging goods and services in a cooperative milieu, barter bypasses the use of currency as a medium of change. Bartering follows a number of patterns depending on location, need, and time factors. These may include:

Pure bilateral exchange of goods.

Pure bilateral exchange of goods and services.

Offset of debt or obligation with a pledge of goods.

Exchange of goods for a promissory note.

Debt swap canceling obligations bilaterally.

In a simultaneous face-to-face swap, individuals or clans set the value of one commodity in units equal to an offering that differs in kind, such as a basket of camassia tubers for a swordfish or the skin and meat of three rabbits. In times of calamity, such as the collapse of monetary systems during depressions or war, only the trading partners can establish the fairness of a swap.

In a climate of distrust, the exchange may progress in silence, with one group leaving, for example, a stack of herbs or wax for examination. A potential customer may then leave an offering, such as bananas or sea bass. The first group may accept the offering or remove the herbs or wax from the site. This type of one-to-one deal suits soldiers on the march, such as the Macedonians under Alexander the Great, who bartered for grapes and bread loaves with Bactrians who spoke no Greek nor recognized Greek coins. The invaders were more likely to receive fresh goods that had not yet gone to market. Unscrupulous Bactrians, on the other hand, could cheat soldiers by selling stale or mixed-quality foods to men who moved on to new bivouacs before examining the exchange medium for trickery.

More complex exchanges involve multiple commodities, for example, huckleberries and barley swapped for clay pots and obsidian knives. Among most North American Indians, trade in surplus corn and dried fish increased supplies of food for winter storage when red meat was scarce. The Cherokee fermented corn liquor, a valuable food or medicinal commodity on a par with Aztec cacao beans or Guatemalan *chicha.*

When the first white traders entered Plains Indian territory, they demonstrated the use of items unknown to their trading partners, such as fishing gear or work gloves to protect the hands from blisters. The Comanche rejected the gloves as well as lines and hooks, the Western world's method of catching fish one at a time. The ultimate good to both parties derived from mutual satisfaction. Thus the Comanche found use for imported grain baskets, which they paid for with deer pelts.

In modern markets, for the sale of goods and such services as plowing fields and bailing winter oats, nonmonetary transactions avoid the paper trails of banks and tax accounting. By reducing an item to its base value, such as the use of a prize bull for freshening dairy herds, reciprocity avoids inflating yearly farm income or incurring a luxury or value-added tax such as that of Bosnia, Ireland, or New Zealand. For agrarian communities, deals arranged between relatives or fellow farmers enhance long-standing relationships and offer opportunities to lower overhead costs, for example, the seasonal use of a neighbor's corn picker in exchange for the shared trucking of soybeans to a grain elevator.

A downside of barter stems from the length of time required to establish worth and to negotiate conditions of transport and delivery, a major concern in Barcelona, Spain, in deals involving herd animals and perishable fruit and seafood. If the trading partners engage a third party or broker, involvement of an outsider lessens the savings by requiring payment for arbitration. Throughout history, dickering and haggling, such as the deal-making in the bible between Laban and his son-in-law Jacob over white and black sheep, has resulted in resentment and grudges that sometimes escalated into personal and tribal vendettas.

See also: Animal Husbandry; Currency, Food as; Local Food Movement; Silk Road.

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Beans and Legumes

Beans and legumes, the world's first cultivated plants, have fed humankind since prehistory on complex carbohydrates, dietary fiber, and vegetable protein. Until the refinement of breads, dishes of bean, lentil, and pea porridge sustained much of the Mediterranean world and the Middle East. Culinary bean innovations began in Afghanistan and central Asia with wild crops and spread to Georgia, Pakistan, and India. In Africa, the viny hyacinth bean promoted rural welfare and land reclamation; Indonesians cultivated the winged bean, a trellised annual that yielded edible flowers, leaves, and tubers containing 50 percent protein.

During the Paleolithic era, milling separated kernels from pods and augmented the taste and digestibility of beans and grains for use in flatbreads and loaves. After 10,000 B.C.E., the Olmec and Maya balanced a corn-heavy diet with amaranth and beans, sources of complete proteins. Improvements in Neolithic or New Stone Age cuisine in southeastern Turkey in 9000 B.C.E. and Jericho in 8000 B.C.E. shifted focus from meat to cooked grains and legumes, which required clay pots for cooking. In Iraq as well as Chile and Peru, the bean diet altered lifestyles from nomadic herding to settled agriculture. Egyptians so reverenced legume nutrition that they chose beans as grave goods to nourish the dead in the afterlife.

Nutritional diversity placed beans at the center of global food intake. In 6000 B.C.E., Thai hunter-gatherers profited from fields of wild beans; by 5500 B.C.E., chickpeas nourished the Middle East. In the Far East, Chinese and Indonesian growers integrated a diet of fish and poultry with adzuki beans, rice, soybeans, and taro. The broad-based cuisine yielded a population spike as well as health benefits.

By 4000 B.C.E., the Andean Inca terraced vegetable gardens to produce beans and complementary flavorings from pepper and tomatoes. Around 2000 B.C.E., the grower in central China added soybeans to vital grain crops; a similar dietary advance in 1500 B.C.E. placed the pigeon pea at the disposal of cooks in Orissa, India. On the Fertile Crescent, the Akkadians dug canals to water bean fields. Around 950 B.C.E., Arabic author ibn Sayyar al-Warraq of Baghdad collected innovative recipes for beans cooked with grain and vegetables and for stews of lentils, rice, and white beans.

Staples

The incorporation of beans into basic diet stripped the legume of its cachet. Around 800 B.C.E., Hindus validated a standard diet of barley, beans, legumes, and lentils as adjuncts to rice, sesame, vetches, and wheat. For Greek farmers, dinners of beans, lupins, and pea and lentil soup featured vinegars and olive tapenade as table dressings. When legumes fell in prestige, only the poor in classical Greece served them in *etnos* (bean soup) dressed with vinegar and baked bean meal into loaves and sold split pea soup on the streets of Athens. Virgil's *Georgics* (29 B.C.E.) corroborates the ranking of kidney beans as a peasant crop.

Classic dietary advice ignored patrician trends and connected Roman staples—beans and lentils, bread, oil, olives, and wine—with sensible regimens and with noble