MODERN FOODS: SUGAR, PLANT OILS, BREAD, BEER

SUGAR

CONSUMPTION
Stats for Sugar consumption per capita in America:

Sugar Consumption in US 1830-1930

Year	Estimated Population	Consumption (tons)	Lbs. per capita
1830	12,866,020	69,711	12.1
1840	17,069,453	107,177	14.1
1850	23,191,876	239,409	23.1
1860	31,443,321	428,785	30.5
1870	38,558,371	606,492	35.3
1880	50,155,000	922,109	43.9
1890	62,979,766	1,522,731	54.0
1900	75,994,575	2,477,423	65.2
1910	91,972,266	3,467,354	75.4
1920	105,710,620	4,519,129	85.5
1930	122,775,046	6,728,073	109.6

Sources: Paul S. VOgt, “The Sugar Refining Industry of the US: Its Development & Present Condition (Philadelphia: Publications of the University of Pennsylvania, 1908), 17; Richard Daniel Weigle, “The Sugar Interest and American Diplomacy in Hawaii and Cuba, 1893-1903” (PhD diss., Yale University, 1939), 25; Historical Statistics of the United States, Colonial Times to 1970 (Washington DC; US government Printing Office, 1970,331).

Chart taken from book see references: (Ayala, César J. p. 30).

America's Sweet Tooth increased 39% between 1950-59 and 2000 as use of corn sweeteners octupled:
NOTE: These are annual averages,pounds per capita, dry weight. Totals may not add due to rounding. Edible syrups (sugarcane, sorgo, maple, and refiner's), edible molasses, and honey. Source: USDA's Economic Research Service.

Item	**1950-59**	**1960-69**	**1970-79**	**1980-89**	**1990-99**	**2000**
Total Caloric Sweeteners	109.6	114.4	123.7	126.5	145.9	152.4
Cane & Beet Sugar	96.7	98.0	96.0	68.4	64.7	65.6
Corn Sweeteners	11.0	14.9	26.3	56.8	79.9	85.3
HFCS	0.0	0.0	5.5	37.3	56.8	63.8
Glucose	7.4	10.9	16.6	16.0	19.3	18.1
Dextrose	3.5	4.1	4.3	3.5	3.8	3.4
Other caloric sweeteners	2.0	1.5	1.4	1.3	1.3	1.5

(http://www.usda.gov/factbook/chapter2.pdf, p. 20)

Consumption of Caloric Sweeteners Hits Record High in 1999

Americans have become conspicuous consumers of sugar and sweet-tasting foods and beverages. Per capita consumption of caloric sweeteners (dry- weight basis)—mainly sucrose (table sugar made from cane and beets) and corn sweeteners (notably high-fructose corn syrup, or HFCS)—increased 43 pounds, or 39 percent, between 1950-59 and 2000 (table 2-6). In 2000, each American consumed an average 152 pounds of caloric sweeteners, 3 pounds below 1999's record average 155 pounds. That amounted to more than two-fifths of a pound—or 52 teaspoonfuls—of added sugars per person per day in 2000. Of that 52 teaspoons, ERS estimates that Americans wasted or otherwise lost 20 teaspoons, resulting in an average intake of about 32 teaspoons of added sugars per person per day.

USDA recommends that the average per- son on a 2,000-calorie daily diet include no more than 40 grams of added sugars. That's about 10 teaspoons, or the amount of sugar in a 12-ounce soft drink. Sugar— including sucrose, corn sweeteners, honey, maple syrup, and molasses—is ubiquitous and often hidden. In a sense, sugar is the number one food additive. It turns up in some unlikely places, such as pizza, bread, hot dogs, boxed mixed rice, soup, crackers, spaghetti sauce, lunch meat, canned vegetables, fruit drinks, flavored yogurt, ketchup, salad dressing, mayonnaise, and some peanut butter. Carbonated sodas provided more than a fifth (22 percent) of the refined and added sugars in the 2000 American food supply, compared with 16 percent in 1970. (http://www.usda.gov/factbook/chapter2.pdf, p. 20)

"Today the average American eats three pounds of sugar every week." (Graham, Ramsey 19).

American Consumption per year:

Year	**(Consumption/Person) / Year**
1700	5 pounds
1800	23 pounds
1900	70 pounds
2000	152 pounds

(Graham & Ramsey 21).

ORIGINS

Sugar cane originated in New Guinea where it has been known since about 6000 BC. From about 1000 BC its cultivation gradually spread along human migration routes to Southeast Asia and India and east into the Pacific. It is thought to have hybridized with wild sugar canes of India and China, to produce the 'thin' canes. It spread westwards to the Mediterranean between 600-1400 AD (https://www.digitalhistory.uh.edu/active_learning/explorations/columbus/columbian_answers_grasses.cfm).

Sugar in South Asia

Sugar cane has a very long history of cultivation in the Indian subcontinent. The earliest reference to it is in the Atharva Veda (c. 1500-800 BC) where it is called ikshu and mentioned as an offering in sacrificial rites. The Atharva Veda uses it as a symbol of sweet attractiveness.

Sugar cane was originally grown for the sole purpose of chewing, in southeastern Asia and the Pacific. The rind was removed and the internal tissues sucked or chewed. Production of sugar by boiling the cane juice was first discovered in India, most likely during the first millennium BC.

The word 'sugar' is thought to derive from the ancient Sanskrit sharkara. By the 6th century BC sharkara was frequently referred to in Sanskrit texts which even distinguished superior and inferior varieties of sugarcane. The Susrutha Samhita listed 12 varieties; the best types were supposed to be the vamshika with thin reeds and the paundraka of Bengal. It was also being called guda, a term which is still used in India to denote jaggery. A Persian account from the 6th century BC gives the first account of solid sugar and describes it as coming from the Indus Valley. This early sugar would have resembled what is known as 'raw' sugar: Indian dark brown sugar or gur.

At this time honey was the only sweetener in the countries beyond Asia and all visitors to India were much taken with the 'reed which produced honey without bees'. The Greek historian Herodotus knew of the sugarcane in the 5th century BC and Alexander is said to have sent some home when he came to the Punjab region in 326 BC. Practically every traveller to India over the centuries mentions sugarcane; the Moroccan Ibn Battuta wrote of the sugarcanes of Kerala which excelled every other in the 14th century; Francois Bernier, in India from 1658-59, wrote of the extensive fields of sugarcane in Bengal.
(http://www.kew.org/plant-cultures/plants/sugar_cane_history.html).

Another source
(note that the last source referred to solid sugar coming from a Persian account in 6 BC which must be different from the crystalized sugar form that is referred to in both sources as somewhere within the first millennium BC, therefore coming about 5 centuries after the solid sugar form.)

The first use of sugarcane by humans was doubtless to chew it to obtain the sweet juice, a practice that continues, especially among children. Later, in southern Asia at some unrecorded time, efforts were begun to extract the juice with a simple mill or press and to concentrate it by boiling into a sweet, viscous mass. The first evidence of crystal sugar production appears at about 500 B.C. in Sanskrit texts that indicate it took place in northern India. They describe in rather vague terms the making of several types of sugar for which the principal use seems to have been medicinal. Knowledge of this technique spread from northern India eastward to China and (along with the cultivation of sugarcane) westward into Persia, eventually reaching the east coast of the Mediterranean about A.D. 600.

Sugar making in India and China, however, remained a technologically conservative, small-scale, largely peasant activity until the twentieth century. In China, for reasons that are not entirely clear, sugar joined, rather than displaced, its competitors, becoming one more option in a cuisine that continued to value honey, manna, maltose, and sagwire palm sugar. Clearly, the history of sugar in the East stands in marked contrast to that which unfolded in the West.

The sugar industry entered the Mediterranean basin as part of an agricultural revolution carried out by the Arabs. In the years following the founding of Islam, its adherents presided over the introduction of tropical and subtropical crops from Asia to the countries of the Mediterranean, as well as the techniques of irrigation that permitted cultivation throughout hot, dry summers.
To mill sugarcane, the burgeoning industry borrowed existing Mediterranean technology for extracting oil from olives and nuts and, in a second operation, used screw presses to obtain more juice from the bagasse. The juice was then clarified, reduced to the point of crystallization in open pans over furnaces, and the resulting syrup was placed in conical pots from which the molasses drained, leaving a loaf of sugar in each pot. The mills relied on water, animals, and men for power.

The risk of frost in the Mediterranean, together with the need for irrigation water, confined the cultivation of sugarcane to a few favored locations in the Levant, North Africa, Cyprus, Crete, Sicily, and Andalusia. Sugar production on the Atlantic islands of Portuguese Madeira and the Spanish Canaries was also Mediterranean in character. In its Mediterranean phase, however, the industry was labor-intensive, small-scale, and unable to produce large quantities of sugar, which therefore remained a luxury product. In short, there was little change in the technology of the Old World sugar industry between its introduction to the Mediterranean and its decline in the face of competition from the New World nearly 1,000 years later (http://www.cambridge.org/us/books/kiple/sugar.htm).

Early Technology for Sugar Extraction (also from source unsure about copyright regulations and if will be able to use; more info at http://www.kew.org/plant-cultures/copyright.html.):

Buddhist writings referred to the crushing of sugarcane in a yantra or machine. This machine would have been a forerunner of the kolhu. This is a system of mortar and pestle usually operated by bullocks and oxen, which is the traditional device used to extract oils and juices. References to a mortar and pestle to extract soma juice from plants occurs in the Rig Veda 3500 years ago. The kolhu is still used in the sugarcane growing regions of India to manufacture gur.

After the juice was pressed from the cane stalks in the kolhu, it was boiled down into a series of products. Sanskrit literature mentions phanita (thickened juice), then solid guda (jaggery), sharkara (brown sugar or guda crystals drained of molasses but still unrefined), matsyandika (literally 'fish eggs' perhaps a type of crystallized sugar) and khand (sugar in the form of crystalline lumps).

In 326 BC, the Greeks described 'stones the colour of frankincense, sweeter than figs or honey'. They were referring to crystallised sugar lumps called khand (now khandsari).

By 700 AD the Persians had added innovations to the process. The stems were shredded and crushed in ox-driven machinery. The expressed juice was concentrated by boiling in shallow pans. Lime was added to make proteins in the juice coagulate, and bring other impurities to the surface which were skimmed off. Further boiling removed more liquid so that the sugar began to crystallize.

ORIGINS: WHITE SUGAR

White sugar was achieved in some areas in this early period by boiling the raw sugar with lime water and bull's blood. The coagulating blood drew more impurities and removed much of the brown colour. It was skimmed, then the liquid filtered, boiled again to concentrate it, then poured into moulds to solidify. They were broken up, redissolved and purified, now with egg-white. After this long process, the sugar was white enough and pure enough to be formed into loaves and traded.

In ancient India, although lime was used in the refinement process it is doubtful that ox-blood would have been part of it. The early technology of crystallization and solidification is not fully known. Fine cloths and water distilled through aquatic weeds were used as part of the process of gentle washing to create layers of crystals forming khand. Repeated redissolution, recrystallisation and washings served to whiten the crystals, then called misri (http://www.kew.org/plant-cultures/plants/sugar_cane_food_early_technology.html).

SPREAD TO EUROPE

Sugar became closely linked to major forces in European history when the Portuguese, who, in the fifteenth century, were venturing along the west African coast, discovered that the production and sale of sugar grown on nearby islands, especially Madeira, could be a means of financing the enterprise of reaching the East Indies. In subsequent centuries, sugar became intimately associated with the European colonization of the tropical portions of the New World. The demand for labor that it created led to the transatlantic slave trade that carried millions of Africans to the Americas. These were followed by East Indians and other Asians in still more international migrations (http://www.cambridge.org/us/books/kiple/sugar.htm).

More information from another source (some of it is repetitive but with subtle differences): Arabs were responsible for much of its spread as they took it to Egypt around 640 AD, during their conquests. They carried it with them as they advanced around the Mediterranean. Sugar cane spread by this means to Syria, Cyprus, and Crete, eventually reaching Spain around 715 AD.

Around 1420 the Portuguese introduced sugar cane into Madeira, from where it soon reached the Canary Islands, the Azores, and West Africa. Columbus transported sugar cane from the Canary Islands to what is now the Dominican Republic in 1493. The crop was taken to Central and South America from the 1520s onwards, and later to the British and French West Indies(http://www.kew.org/plant-cultures/plants/sugar_cane_history.html).

The Crusaders brought it back with them to Europe in the 11th century, but it remained a rare luxury for 400 years. The Venetians, who had become powerful traders by ferrying Crusaders to the Middle East, made sugar available to the rich of other countries.
The discovery of the New World prompted Columbus to bring sugar cane there on a subsequent voyage, and soon it was being grown on many Caribbean islands and in Mexico. Subsequently, the Portugese established sugar cane in Brazil, while other European colonialists started plantations in their possessions. It was grown in Sicily, Cyprus, the Canary Islands and on other Atlantic islands. The difficulty in cultivating sugar cane in tropical climates spurred the slave trade.

In the U.S., sugar cane was introduced into several states such as Florida, Louisiana and Hawaii. In the 18th century, sugar was being extracted from sugar beets, and this source subsequently led to some decline in sugar imports from sugar cane countries. Currently, about 30% of the world's sugar comes from beets. Sugar exports now come mainly from Brazil, Australia, Europe, Thailand and South Africa (http://unitproj.library.ucla.edu/biomed/spice/index.cfm?displayID=23).

Whereas in 1909, most sugar was used in home consumption, by 1999 less than a quarter was. Sugar sourcing has shifted dramatically as well, with the establishment of commercial high fructose corn syrup (HFCS) production in the USA in 1967. In 1970, sucrose (cane and beet sugar) and corn sweeteners (corn syrup and HFCS) accounted, respectively, for 83 per cent and 16 per cent of total caloric sweetener use (Hollander 61).

Researched info on use of sugar as preservative for meats, fish, and sugars, and when this began and found no info.

HISTORIC RISE OF SUGAR

When cane sugar, from Saccharum officinarum, started to become a popular sweetener in the Renaissance, it was regarded as an exotic spice, along with all things nice. Sugar entered cooking in the 16th century.

The ancient Indians (from India) knew how to extract sugar (sarkara) from cane, but did not refine it. Marco Polo in the 13th century reported that although the Chinese used a great deal of dark sugar, they did not refine it whereas in Egypt and also in Venice purer sugar was manufactured. Over the centuries, numerous forms of sugar have been favored. When the cane is crushed it releases a sweet juice, and leaves a fibrous mass of bagasse. The crude juice is improved by removing impurities with slaked lime and carbon dioxide, and it is evaporated to form a brown syrupy product which can be readily converted into molasses. This was the source of the brown sugars (such as turbinado, Muscovado and Demarara) that were common in the 17-19th centuries. Sugar in impure form and molasses were brought to New England, and trading interests helped ensure that excess molasses was converted into rum. Refining of crude sugar results in white crystal sugar, which can be used in granulated or powdered forms or as lumps. In previous times, sugar loaves were marketed, while rich banquet hosts had their chefs produce sugar sculptures similar to ice sculptures.

When sugar was first used in ancient Greece and Rome it was regarded mainly as a medicine, but it was used in food by the very rich. Venice in the 10th century started building its fortunes by importing sugar along with spices and silks from the Orient. The Arabs introduced crystallized sugar as qandi (which gives us our word candy) and various products of sugar such as syrups and caramel. Apothecaries made pleasing medicines with imaginative use of these products.

By the 16th century, there was an increasing availability of sugar from ports in the New World as well as Asia, and it became familiar in the diet, especially as a sweetener of the new spices, coffee and chocolate, and subsequently tea (http://unitproj.library.ucla.edu/biomed/spice/index.cfm?displayID=23).

“in 1788 the French were using only about a kilogram (2.2 pounds) per head per year” (Tannahill 319).

Major Consumption Increase Were Fueled by Change in Production:

The first luxury item to become mass-produced, widely consumed and globally sourced, sugar had a distinctive role in commodification and the culture of consumption. From 1830 until 1930, annual US sugar consumption per capita increased from 12 to 110 pounds. At the beginning of the nineteenth century, refining technology was crude, quality varied geographically and prices were high relative to wages. Between 1830 and 1850, technical advancements in refining reduced the turnover time of capital and the risk of failed batches, homogenized the product and reduced the price (Hollander 63).

Modern Production/Use of Sugar

IN USA

The US sweetener industry today is based on multiple sources and regions, including domestic cane from Florida, Hawaii, Texas and Louisiana, overseas cane suppliers, beets from over a dozen US states, and corn sweeteners from the Midwest (Hollander 61).

A US Department of Agriculture (USDA) publication warns:

Sugar is ubiquitous and often hidden. In a sense, sugar is the number one food additive. It turns up in some unlikely places, such as pizza, bread, hot dogs, boxed mixed rice, soup, crackers, spaghetti sauce, lunch meat, canned vegetables, fruit drinks, flavored yogurt, ketchup, salad dressing, mayonnaise, and peanut butter. (Putnam 1999: 12)

This ‘hidden’ aspect of sugars reflects the change in the destination of processed sugars that accompanied the development of the durable food system (Hollander 61).

Modern Consumption IN INDIA (2nd largest producer)

Sugar cane in India mainly goes towards the manufacture of gur or jaggery, and raw and refined sugars. It is also used in the preparation of many industrial chemicals. The rest in India is used for chewing and drinking. Chewing cane is popular in India, and canes for this purpose are frequently sold from carts in markets.

Gur, or jaggery, is the concentrated sugar cane juice traditionally produced throughout India. It is available either in a block-like solid lump or as a soft dough-like consistency.

These (raw) sugars are also compressed into sugar cubes or made into syrup. White sugar can be further processed into icing sugar to be used in desserts, baking and confectionery.

In India, the young shoots of sugar cane are sometimes steamed and roasted as a vegetable(http://www.kew.org/plant-cultures/plants/sugar_cane_food.html).

OTHER
The brown sugars are more complex and flavorful; they contain calcium, iron and vitamins. It is an interesting aspect of human behavior that now ensures that the formerly cheaper products are coming back into favor (as more expensive products!) since they are more nutritious than white sugar (http://unitproj.library.ucla.edu/biomed/spice/index.cfm?displayID=23).

Invention of Sugar from Beets:
"...in 1747 the German chemist A.S. Marggraf isolated a small, usable percentage from beets. But cane sugar was plentiful enough in relation to demand; in 1788 the French were using only about a kilogram (2.2 pounds) per head per year.
Then came the Napoleonic Wars, when the British blockade of continental ports cut off supplies of cane sugar coming from the West Indies and south-east Asia. In 1801-2, the world's first sugar-beet factory was built in Silesia, and Napoleon was soon urging similar enterprises on the businessmen of France, Germany and the Low Countries. By the 1840s France had fifty-eight sugar-beet factories producing enough to meet home needs, and Germany and Belgium were also well on the way to becoming self-sufficient. Britain, however, continued to rely on cane sugar from its colonies in the West Indies until well into the twentieth century. Today about 40 percent of the world's sugar intake is manufactured from beet." (Tannahill 319).

<u>OILS</u>

SUMMARY
With all of the oils that I researched more specifically below, I saw some recurring patterns. For instance, it was common for the crops that would eventually be used for vegetable oils to have been initially used solely for animal feed. Once the technology came about roughly at the end of the 19th century that enabled oil to be pressed at a greater volume and rate, vegetable oils were made at a level that can be considered industrial. In the beginning, the majority of these oils were only used industrially and were not considered edible.

There are a couple of factors that led to the transitions of using a particular oil for solely industry to considering the oil to be a valuable edible oil. One possible factor was that the industry in which the oil had been integral to disappeared. This was the case with rapeseed oil that originally was used as a lubricant with steam engines. Once the industry disappeared, the farmers were in search of another market for their crop. Another possible cause was the presence of a large surplus that needed to be used somehow. The final factor that I took notice of in my research was the presence of an increasing need or at least perceived need and therefore demand for oils to be produced in America instead of abroad.

Before World War II, the U.S. imported more than 40% of its edible fats and oils. Disruption of trade routes during the war resulted in a governmentally funded effort to increase domestic oil production so that the U.S. would not be as dependent upon foreign oils. The government as well as large companies such as Cargill, for example, funded research that focused upon ways in which to produce crops with seeds that had a higher oil content as well as seeds of a certain chemical composition. For instance, research at times focused upon how to obtain a seed that would be higher in a certain desirable fatty acid. There was a plethora of this type of research going on in the 1960's to 70's during what became known as the "PUFA" boom.

Coupled with this research, was research upon the possible health benefits of the new oils. Future investors wanted to have at hand an arsenal of health claims that could be utilized in order to open up the markets for these novel oils. In addition, it was also important that the meal that was left over from extracting the oil would have a widespread, industry-driven use. In most cases, a meal that was protein-rich was most lucrative because it could be sold as animal feed. The US made and still makes soy meal that is exported worldwide for animal feed, bringing a lot of money into the U.S. just for this one industry. The statistics below on soy highlight the enormous financial incentive this crop carries with its production.

As was stated in a newspaper article (see last section under Peanut for more) from 1942, "For fats and oils are an essential part of the diets of both man and animal and they play an important role in many industries. Consequently, the life and progress of a nation depends to a great extent upon its supply of these products." It appears that the overlying belief among Americans around this time period was that in order to progress as a nation, they would need to produce their own oils. Whether this was from a true need of Americans or whether it was due to a need to use the farmer's crops up with a new industry is, in my opinion, debatable. One may wonder why they could not have used the lard from the large amount of livestock most Americans had access to since its origination. Furthermore, the fact that the health benefits of certain oils are not brought to light until a new oil needs to be sold is an interesting phenomenon that is still taking place today.

The details on specific oils from soy, corn, canola, safflower, and peanut are included below. I was not able to find information on these patterns described above already spelled out. Therefore, I used this detailed information in order to arrive at some of the generalizations that help to shape the story I wrote of in this summary. In bold type, you will see some of the most interesting points.

***Also interesting was a story I came across about how Procter & Gamble, the creators of ivory soap, created and patented "Crisco" as well after discovering the way in which to create a solid fat from a liquid. The new chemical process, discovered by a German chemist, was intended solely for use in the soap industry. However, after the company's scientists created a pearly, creamy white substance that resembled the most popular cooking fat of the day, lard, the company decided to sell this new substance as a replacement for animal fats. A huge marketing campaign that included false health claims (that were unregulated at that time) that claimed that cottonseed oil was healthier than animal fats for digestion. This campaign was remarkably successful, bolstering sales of Crisco from 2.6 million pounds in 1912 to 60 mil pounds just 4 years later. The substance was 50 percent trans fat, and it was not until the 1990s that its health risks were understood. The author quotes, “It is estimated that for every 2 percent increase in consumption of trans fat (still found in many processed and fast foods) the risk of heart disease increases by 23 percent....and as surprising as it might be to hear, the fact that animal fats pose this same risk is not supported by evidence.” (Graham & Ramsey 27).

SOYBEAN OIL

Found good general info on wiki at http://en.wikipedia.org/wiki/Soybean#Oil, extracted below.

Protein content of soy make it a more desirable crop & provide further incentive to make an oil out of soy:
“Fat-free (defatted) soybean meal is a significant and cheap source of protein for animal feeds and many prepackaged meals. For example, soybean products such as textured vegetable protein(TVP) are ingredients in many meat and dairy analogues. Soybeans produce significantly more protein per acre than most other uses of land. (wiki under “soy”)

“The oil is used in many industrial applications.”

“Soybean oils, both liquid and partially hydrogenated, are exported abroad, sold as ‘vegetable oil’, or end up in a wide variety of processed foods. The remaining soybean meal is used mainly as animal feed.”

Present Financial Incentives for Soy: (#1 export crop for US)
“Soybeans are the United States' second largest crop in cash sales and the number one export crop. In 2003, the export value of soybeans was more than 9.7 billion dollars, or about one-sixth of all agricultural exports. Normally, more than half of the total value of the U.S. soybean crop comes from exports as whole soybeans, soybean meal, and soybean oil. About 40 percent of the world's soybean trade originates from the U.S. China has become the largest single country customer for U.S. soybeans with purchases totaling nearly $3 billion. (ironic since they are originally from Asia)” (Gibson, Lance; Benson, Garren).

Variety of Uses in present day for Soybean Oil:
“The majority of the soybean crop is processed into oil and meal. Oil extracted from soybeans is made into shortening, margarine, cooking oil, and salad dressings. Soybeans account for 80 percent or more of the edible fats and oils consumed in the United States.

Soy oil is also used in industrial paint, varnishes, caulking compounds, linoleum, printing inks, and other products. Development efforts in recent years have resulted in several soy oil-based lubricant and fuel products that replace non-renewable petroleum products.

Lecithin, a product extracted from soybean oil, is a natural emulsifier and lubricant used in many food, commercial, and industrial applications. As an emulsifier, it can make fats and water compatible with each other. For example, it helps keep the chocolate and cocoa butter in a candy bar from separating. It is also used in pharmaceuticals and protective coatings." (Gibson, Lance; Benson, Garren).

HISTORY
"The first use of the word "soybean" in U.S. literature was in 1804. However, it is thought that soybean was first introduced into the American Colonies in 1765 as "Chinese vetches" . Early authors mentioned that soybeans appeared to be well adapted to Pennsylvania soil. An 1879 report from the Rutgers Agricultural College in New Jersey is the first reference that soybeans had been tested in a scientific agricultural school in the United States. For many years, most of the references to this crop were by people working in eastern and southeastern United States where it was first popular. Most of the early U.S. soybeans were used as a forage crop rather than harvested for seed. Most of the early introductions planted in these areas were obtained from China, Japan, India, Manchuria, Korea, and Taiwan.

For many years, soybean acreage increased very slowly. There were only 1.8 million acres in the United States in 1924 when the first official estimate became available. At that time, most of the crop was used for hay. It was not until the 1920's that soybean acreage expanded to any great quantity in the U.S. Corn Belt."

Before World War II, the U.S. imported more than 40% of its edible fats and oils.

Disruption of trade routes during the war resulted in a rapid expansion of soybean acreage in the U.S. as the country looked for alternatives to these imports. Soybean was one of only two major new crops introduced into the U.S. in the twentieth century. The other major crop, Canolawas initially developed in Canada and is now grown on some U.S. acres.

Soybean was successful as a new crop because there was an immediate need for soybean oil and meal, its culture was similar to corn, and it benefitted other crops in a rotation.

Following World War II, soybean production moved from the southern U.S. into the Corn Belt.

The U.S. dominated world soybean production through the 1950's, 60's, and 70's, growing more than 75 percent of the world soybean crop. The U.S. was the major supplier of animal feed protein in the world during this period. A worldwide shortage of feed protein in the early 1970's led to the initiation of large-scale soybean production in several South American countries, most notably Argentina and Brazil. By 2003, the U.S. share of the world's soybean production had shrunk to 34 percent, while Argentina's and Brazil's had increased to 18 and 28 percent, respectively." (Gibson, Lance; Benson, Garren).

History of Soy's First Introduction to the US & Involvement in the making of Ford cars:
"Soy was first introduced to Europe in the early 18th century and to British colonies in North America in 1765, where it was first grown for hay. Benjamin Franklin wrote a letter in 1770 mentioning sending soybeans home from England. Soybeans did not become an important crop

outside of Asia until about 1910. In America, soy was considered an industrial product only, and was not used as a food prior to the 1920s." (wiki under History heading of "Soybean")

"Soybeans were introduced to America in 1765 by Samuel Bowen, a sailor who had visited China. He grew soy near Savannah, Georgia, and even made soy sauce for sale to England.

Soy took on a very important role in the United States after World War I. During the Great Depression, the drought-stricken (Dust Bowl) regions of the United States were able to use soy to regenerate their soil because of its nitrogen-fixing properties. Farms were increasing production to meet with government demands, and Henry Ford was a great leader of the soybean industry.

In 1932–33, the Ford Motor Company spent approximately $1,250,000 on soybean research. By 1935, every Ford car had soy involved in its manufacture. For example, soybean oil was used to paint the automobiles, as well as fluid for shock absorbers. Ford's involvement with the soybean opened many doors for agriculture and industry to be linked more strongly than ever before. Henry Ford promoted the soybean, helping to develop uses for it both in food and in industrial products, even demonstrating auto body panels made of soy-based plastics. Ford's interest led to two bushels (120 pounds)of soybeans being used in each Ford car, as well as products like the first commercial soy milk, ice cream and all-vegetable nondairy whipped topping. The Ford development of so-called soy-based plastics was based on the addition of soybean flour and wood flour to phenol formaldehyde plastics. A prototype vehicle, colloquially titled the "Soybean Car", was built in 1941 out of such plastics." (wiki under History=>America=>all under "Soybean")

CORN OIL

The first commercial corn oil for cooking purposes was extracted in 1898 and 1899 by machinery invented by Theodore Hudnut and Benjamin Hudnut of the Hudnut Hominy Company of Terre Haute, Indiana, and called "mazoil." (http://schools-wikipedia.org/wp/c/Corn_oil.htm).

From the Corn Refiner's Association:
"Around the same time, the industry also began to realize the value of the non-starch parts of corn. Fiber, germ, and protein from the corn had simply been discarded until manufacturers discovered they could turn them into valuable animal feed ingredients. Corn gluten feed was first manufactured in 1882. The industry then discovered that corn oil could be extracted from the germ. The first commercial production of corn oil took place in 1889." (http://www.corn.org/about-2/history/).

SUMMARY + HISTORY

Rapeseed in which canola oil is derived from, was used in ancient civilizations for fuel. One source (the Canadian Encyclopedia) reports that it was used as an edible vegetable oil for almost 4000 years. It was also used as both a lighting and edible oil in Europe since the Middle Ages.

Later on, it was discovered that rapeseed could be useful as a lubricant for steam engines. Thus, it was very important in World War II for use in the many steam powered naval ships. After the war, the farmers needed to find another use for their plant and its products. In 1956-57 rapeseed extracts first hit the markets, but did not go over well due to a very distinctive taste and green color from chlorophyll.

There were also some studies that were done that found that the erucic acid found in the oil may cause heart damage if eaten in large quantities (found in animal studies). The meal leftover from making the oil was fed to livestock, but, the livestock would not eat it. Scientists found out that this was due to a high amount of sharp-tasting glucosinolates present in the meal. If you do not know what glucosinolates are check wiki summary: http://en.wikipedia.org/wiki/Glucosinolate#Biological_effects. They are under study now for use in the mitigation of cancer and use as natural pesticides.

Determined to make the production of the oil into a successful product, scientists experimented with selective cross-breeding as well as genetically modifying various species within the Brassicassae family in order to produce a final product with lower amounts of erucic acid in the oil and glucosinolates in the meal.

In the 1970s, two scientists from Canada bred what is now referred to as Canola. This name comes from "Canadian oil, low acid." The first low erucic acid and low glucosinolate canola was named Tower in 1974. Almost all canola grown is GMO and herbicide tolerant. In 2011, 96% acres sown were GMO. It is now also considered a major American cash crop. 90% of it is grown in North Dakota.

CANOLA OIL

WIKI had a very nice summary:

"Originally, Canola was bred naturally from rapeseed at the University of Manitoba, Canada by Keith Downey and Baldur R. Stefansson in the early 1970s, but it has a very different nutritional profile in addition to much less erucic acid. The name "canola" was derived from "Canadian oil, low acid" in 1978. Genetically modified rapeseed is sometimes referred to as Rapeseed 00. A product known as LEAR (for low erucic acid rapeseed) derived from cross-breeding of multiple lines of Brassica juncea may also be referred to as canola oil and is considered safe for human consumption."

HISTORY

"Canola was developed through conventional plant breeding from rapeseed, an oilseed plant already used in ancient civilization as a fuel. The word "rape" in rapeseed comes from the Latin word "rapum," meaning turnip. Turnip, rutabaga, cabbage, Brussels sprouts, mustard, and many other vegetables are related to the two natural canola varieties commonly grown, which are cultivars of Brassica napus and Brassica rapa. The change in name serves to distinguish it from natural rapeseed oil, which has much higher erucic acid content.

Hundreds of years ago, rapeseed oil was used as a fuel in lamps in Asia and Europe. The Chinese and Indians used a form of rapeseed oil that was unrefined (natural). Its use was limited until the development of steam power, when machinists found rapeseed oil clung to water- or steam-washed metal surfaces better than other lubricants. World War II saw high demand for the oil as a lubricant for the rapidly increasing number of steam engines in naval and merchant ships. When the war blocked European and Asian sources of rapeseed oil, a critical shortage developed and Canada began to expand its limited rapeseed production.

After the war, demand declined sharply and farmers began to look for other uses for the plant and its products. Rapeseed oil extracts were first put on the market in 1956–1957 as food products, but these suffered from several unacceptable characteristics. Rapeseed oil had a distinctive taste and a disagreeable greenish colour due to the presence of chlorophyll. It also contained a high concentration of erucic acid. Experiments on animals have pointed to the possibility that erucic acid, consumed in large quantities, may cause heart damage, although Indian researchers have published findings that call into question these conclusions and the implication that the consumption of mustard or rapeseed oil is dangerous. Feed meal from the rapeseed plant also was not particularly appealing to livestock, due to high levels of sharp-tasting compounds called glucosinolates, and they would not eat it.

A variety developed in 1998 is considered to be the most disease- and drought-resistant Canola variety of rapeseed to date. This and other recent varieties have been produced by using genetic engineering. In 2011 96% of the acres sown were genetically modified canola.

Canola was originally a trademark, but is now a generic term for edible varieties of rapeseed oil in North America and Australia. In Canada, an official definition of canola is codified in Canadian law."

PERCEIVED BENEFITS (WIKI)

"Canola oil is a key ingredient in many foods. Its reputation as a healthy oil has created high demand in markets around the world, and overall it is the third most widely consumed vegetable oil in the world."

"Canola oil is the most nutritionally balanced commonly-used cooking oil, low in saturated fat and containing both omega-6 and omega-3 fatty acids in a nutritionally-preferred ratio of 2:1. It also reduces Low-density lipoprotein and overall cholesterol levels, and as a significant source of the essential omega-3 fatty acid is associated with reduced all-cause and cardiovascular mortality. It is recognized by many health professional organizations including the American Dietetic Associationand American Heart Association. Canola oil has been given a qualified health claim from the United States Food and Drug Administration due to its high levels of cholesterol-lowering fats."

ERUCIC ACID

"Although wild rapeseed oil contains significant amounts of erucic acid, a known toxin, the cultivar used to produce commercial, food-grade canola oil was bred to contain less than 2%

erucic acid, levels that are not believed to cause harm in humans and no health effects have been associated with consumption by humans of the genetically modified oil. Although rumors that canola oil can cause dangerous health problems circulated, there is no reason to believe canola oil poses unusual health risks and its consumption in food-grade forms is generally recognized as safe by the United States Food and Drug Administration."

**The following is from the Canadian Encyclopedia. It gives a nice summary of the history, since Canada was so pivotal in its invention and is now the number one producer of canola in the world. It seems to be accurate from the other sources I saw, however, I will say that they definitely put a super positive spin on its healthy fatty acid comp which I am sure has to do something with the huge amount of economy generated with canola production in Canada...even their encyclopedia reflects it!

"Canola is a type of rapeseed and is a Canadian invention; it is characterized by having improved nutritional qualities in both the oil and the meal. Unlike other seeds and plants canola and rapeseed do not have a single Latin name. Canola plants belong to the Brassicaceae (Cruciferae) family that comprises about 350 genera and 3000 species, including Brassica campestris or rapa (TURNIP) Brassica napus (RUTABAGA), Brassica oleracea (CABBAGE and cauliflower) and Brassica juncea (mustard). Brassica campestris originated in the foothills of the Himalayan Mountains; Brassica napus probably originated in the Mediterranean region and was the result of natural crosses between Brassica campestris and Brassica oleracea plants.

Canola varieties could belong to Brassica rapa, Brassica napus or Brassica juncea. Canada is the biggest single producer of canola. More than 9 million tonnes of canola are produced in Canada annually and the objective is to produce 15 million tonnes by 2015. About half the canola produced is exported to various countries. The main importing countries are the United States, Japan and Mexico.

Rapeseed has been an important source of edible vegetable oil in Asia for almost 4000 years and was used as a lighting oil and edible oil in Europe since at least the Middle Ages. Rapeseed was first grown in Canada during the Second World War as a source of high-quality lubricant for marine engines. Canola oil has become a major source of cooking oil, margarine, salad dressing and shortening. The meal remaining after oil extraction is a high-protein feed for livestock.

Early warnings of potential problems with erucic acid (C22:1) provided the motivation for changing the fatty acid composition of the oil of the rapeseed grown in Canada. The development of the canola as it is known today is the result of the work of 2 Canadian researchers, B.R. STEFANSSON and R.K. DOWNEY, who jointly identified the first low erucic plants in rape (Brassica napus). The development of the first low erucic acid and low glucosinolate canola, named Tower (1974), was accomplished by conventional breeding, which is the selection and the crossing of seeds from plants low in these 2 components. Stefansson and Downey received several awards (eg, Royal Bank Award and Order of Canada) in recognition of their contributions for developing canola. Today, almost all of the canola grown in

Canada is herbicide tolerant. There are 3 types of herbicide tolerant canola. Two were obtained by insertion of a gene and are genetically modified organisms (GMOs); they are Round-up Ready® and Liberty Link®. One, Clearfield®, was obtained by mutation and is a non-GMO. Mature seeds contain on average 43% oil and have thin black, brown or yellow seed coats. Canola oil is one of the healthiest oils present on the market, averaging about 60% oleic acid (C18:1), 20% linoleic acid (C18:2) and 10% ∝-linolenic acid (C18:3). This makes canola oil a good source of ∝-linolenic acid with the ideal ratio (2:1) of omega-6 (∞-6) to omega-3 (∞-3). Moreover, canola oil has the lowest content of saturated fatty acid when compared to other commercially available dietary fats.

The canola industry in Canada is one of the most innovative. High stability canola oil was developed in response to the ban of trans-fatty acids in food products. This new oil has higher levels of oleic acid (65% to 74% versus 60%) and lower levels of ∝-linolenic acid (2% to 3% versus 10%) than conventional canola oil. ∝-Linolenic acid is a polyunsaturated fatty acid (3 double bonds) that oxidize very easily under the high temperature conditions of frying. This leads to the formation of undesirable flavors and trans-fatty acids. This high stability oil is mainly used by the food industry for frying and allows for the reduction/elimination of trans-fatty acids from fried foods (eg, potato chips), making these products a healthier choice.

The evidence below is repetitive for the story of canola, but does verify the story further (only read it if you are looking for more detail; otherwise skip to Safflower Oil):

The following is from this document formed by the Office of the Gene Technology Regulator of the Australian government at this web address:
http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/content/canola-3/$FILE/brassica.pdf.
"Canola was cultivated by ancient civilizations in Asia and the Mediterranean. Its use has been recorded as early as 2000BC in India and has been grown in Europe since the 13th century, primarily for its use as oil for lamps. Canola was first grown commercially in Canada in 1942 as a lubricant for use in war ships. Canola was first grown commercially in Australia in 1969. Traditionally, B. napus is unsuitable as a source of food for either humans or animals due to the presence of two naturally occurring toxicants, erucic acid and glucosinolates. However, in the 1970s, very intensive breeding programs in several countries including Australia produced high quality varieties that were significantly lower in these two toxicants. The term 'canola' refers to those varieties of B. napus that meet specific standards on the levels of erucic acid and glucosinolates. Those cultivars must yield oil low in erucic acid (below 2 %) and meal low in glucosinolates (total glucosinolates of 30 µmoles/g toasted oil free meal) (CODEX 1999), and are often referred to as "double low" varieties." (p. 2)

"Canola lines have become more important to the western world, through breeding for better oil quality and improved processing techniques (OECD Paris 1997). Edible oil was first extracted in Canada in 1956 (Colton & Potter 1999). Canola is now grown primarily for its seeds which yield between 35 % to over 45 % oil. Cooking oil is the main use but it is also commonly used in margarine. After oil is extracted from the seed, the remaining by-product, canola seed meal is used as a high protein animal feed." (p. 3)

“Traditional rapeseed is unsuitable as a source of food for either humans or animals due to the presence of two naturally occurring toxicants in the seed, erucic acid and glucosinolates. The presence of erucic acid in rapeseed oil has been associated with fat accumulation in the heart muscle of laboratory rats, resulting in cardio pathogenic effects. Glucosinolates, located in the seed meal, were found to cause thymus enlargement in laboratory animals and therefore their presence also limited the nutritional value of the meal as feed for livestock. Canola are cultivars of rapeseed that yield oil low in erucic acid (below 2 %) and meal low in glucosinolates (less than 30 µmoles g-1). Breeders have systematically replaced the seedstock with varieties that were selected with low erucic acid content (refer to ‘History of its use/domestication’). Food Standards Australia New Zealand (FSANZ), formerly called Australia New Zealand Food Authority (ANZFA), does not consider canola meal as a food fraction suitable for humans due to the presence of glucosinolates (ANZFA 2001). The quality requirements of commercial canola oil production dictate the absence of any protein in the final product.” (p. 11)

SAFFLOWER OIL

Edible oil since pre-Christian times in Mesopotamia:

“Production of safflower oil was carried out in the reign of Ptolemy II...While it had become known as an edible oil during pre-Christian times in Mesopotamia, it was only in more recent times that it began to be used in India as an edible oil, and of course, it was not until the middle of this century that it began to enter world commerce, first as an industrial oil and then as an edible product.” (Smith 491-492).

HISTORY

(summarized from Smith, Joseph):

Before the 20th century, safflower was mainly a local crop in the US, without any major industry arising from it. In 1925, the USDA obtained seeds from the U.S.S.R. and India and researched ensued thereafter. The conclusion from this research was that safflower had possibilities as an oil seed crop in the North Great Plains and in the far West. (Smith 495)

Next, Cargill tried and failed with trying to make some sort of profitable safflower industry. Shortly after, two men and one company (Claassen, Knowles, and the Pacific Vegetable Oil Company) provided the impetus for establishing safflower as a crop in the U.S. They devoted their energies at first to the selection and breeding of a safflower seed that would yield more oil.

In the 1950s, they tried to grow in California, but were unsuccessful due to root rot from irrigation. Up to the 1960s, 95% of safflower oil sold went to paint, varnish, and coatings. (Smith 496)

End of my summary; the following includes direct quotes but continues where my summary left off:

“Coinciding with this development was the publication of Calories Don’t Count, which became an instant best-seller in 1961. The book advocated a diet that featured daily capsulized doses of safflower oil. Medical research was beginning to demonstrate the close relationship between diet and heart disease. Eminent researchers began to show the relationship of cholesterol to heart disease and, more important, to show that polyunsaturates such as safflower oil would lower blood serum cholesterol for many people." (Smith 497).

"The polyunsaturated bubble almost burst when the U.S. Food and Drug Administration began attacking refiners' claims about the ability of these products to reduce incidence of heart disease and lower cholesterol, but subsequent supportive statements by the American Medical Association and the American Heart Association softened the effect of the attack." (Smith 498).

"The development of markets for oleic safflower oil has been a constant series of steps forward and then back. The oil has enjoyed good success as an ingredient in artificial baby milks (because of its excellent stability), in production of premium chips and snacks (again because of its stability and good frying characteristics), in the production of cocoa butter substitutes, and as an oil for blending with olive oil because of its similar fatty acid structure." (Smith 502)

"In recent years as more research has focused on the role of monounsaturated versus polyunsaturated and their effects on cholesterol reduction, oleic safflower oil (my note: one form--the other being linoleic which is less popular because of nutrition/medical research) has begun to receive more attention." (Smith 502).

"In the United States, Saffola Grocery Products has introduced a grown-without-pesticides salad oil in which linoleic safflower oil has been replaced by the oleic type." (Smith 502).

"A 1966 patent described a blending of liquid safflower with selectively hydrogenated safflower and peanut oils." (Smith 513). My note derived from the article: This was the time of the PUFAs boom, in which medical research was opening up the market for high PUFA vegetable oils.

"In today's marketplace safflower occupies a unique position. It is the oil with the highest level of linoleic acid available commercially. It continues to enjoy a favorable reputation in the mind of consumers, which is a legacy of the polyunsaturated boom of the 1960s. Most safflower oil produced today reaches consumers as a refined, deodorized, and bleached salad oil; as a principal ingredient in margarine; and in several forms of mayonnaise and salad dressings." (Smith 519).

"It is outside the scope of this article to examine the medical literature that fueled the polyunsaturated boom of the 1960s and that has continued to provide impetus to the U.S., European, and Japanese safflower oil markets." (Smith 520).

PEANUT OIL

"The oil had increased use in the United States during World War II, because of war shortages of other oils." (wiki under "Peanut Oil").

In a magazine “The Billboard: The World’s Foremost Amusement Weekly” from December 12, 1942 titled “The Peanut Situation”

“In recent years, peanut oil has been used more and more in oleomargarine, cooking and salad oil, and in the manufacture of soaps, cosmetics, shaving creams, and shampoos. Another factor in the increased use of domestic peanut oil has been the gradual curtailment of imported foreign oils and fats.” (p. 71).

“For fats and oils are an essential part of the diets of both man and animal and they play an important role in many industries. Consequently, the life and progress of a nation depends to a great extent upon its supply of these products.” (p. 71)

“This country has never produced enough oils and fats for its own needs, importing normally about 15 percent of our supply. In 1941, consumption stopped up in an amazing manner - in that year Americans consumed the total of 11,000,000,000 pounds of vegetable oils and fats - the highest rate of consumption in history - an increase of one and one-third billion pounds over 1941. Two billion pounds of the total were imported. The recent outbreak of war in the Pacific cut off 1 billion lbs. of fats and oils in the Philippines.” (p. 71).

This article also speaks of the need to advertise as a superior cooking and salad oil and that peanut oil should be put on a premium basis due to its high smoking point (71). The article states that “the bulk of peanut oil is consumed in the form of shortening, done by the continuous, or the older kettle or batch method...” The article also reports that peanut meal and flour are protein-rich that may be used with livestock. (71)

History of Peanut Oil use according to this article from the Billboard:
“India, Senegal, and China all rank ahead of the U.S. in its production and have long recognized its value as a source of oil.” (70)

“We know they (peanuts) came to this country with the Negro.” (70)

“The slaves fed on peanuts were always in excellent physical condition upon arrival. There was no scurvy. It was thus incidental that peanuts were brought to the Jamestown Colony, where the early Colonial planters found that the soil of their new-found land was ideally suited to their growth.” (70).

Peanuts that first came to America were grown in almost every section of the land where cotton grows. (70).

Originally to be eaten at ballparks or to be fed as a delicacy to monkeys at circus....peanuts were of a low social status....The peanut has climbed to this spotlight of flavor as a human food because it provides for the human body not only a concentrated source of food energy, but also a most economical source rich in the necessary food essentials (carbohydrates, proteins, and fats) and vitamins. They are also purported in this article to be high in calories, phosphorus, iron, Vit B-1 (thiamin), and Riboflavin. (70).

BREAD

Early Breadmaking (egypt, greece, etc): not the high-rising kind

Advantages of wheat that lead to popularity before rye came into the picture:"It was reputedly in Egypt that the art of making modern bread was discovered, although the evidence is elusive and the date even more so. Conditions, however, were favorable, because wheat was the important factor and specifically wheat that did not have to be parched before threshing. Other grains would not do. Barley and millet, because of their chemical composition, are unresponsive to leavening, and so are oats-which were, in any case, unknown in the Near East. Rye, the best alternative, was also unfamiliar in the civilized world before the first millennium BC" (Tannahill 51).

"Since most early grains needed some degree of toasting before they could be threshed, raised bread was a chemical impossibility, but by the beginning of the dynastic period in Egypt a wheat had been developed that could be threshed raw. It seems to have remained scarce for a considerable period; certainly, it did not become common in Greece until the fourth century BC, although the Greeks had been trading with Egypt for 300 years and importing grain for the most of that time." (Tannahill 51-52).

Theories for discovery and use of leavening:

A) Yeast spores drifted onto some bread that had been set aside for a while before baking and the bread would rise---inquisitive minds would try to reproduce this phenomenon.
B) On some occasions ale was used instead of water to mix the dough.---more likely since rise would be more obvious and would easily be reproduced.

Other peoples evolved their own leavens:

The Gauls and the Iberians, according to Pliny the Elder, simply skimmed the foaming head off their ale, which was why they had 'a lighter kind of bread than other peoples.' The Greeks and the Italians, who were not ale drinkers, used millet flour soaked in grape juice, kneaded and then set aside until it fermented; wheat bran steeped in white wine; or wheat flour made into a kind of porridge and then left to go sour. 'Manifestly,' said Pliny, 'it is natural for sourness to make the dough ferment.' (Tannahill 52).
The commonest method, however, as to keep a piece of dough from the previous day's baking and add it to the new mix, and this sourdough starter has continued to be popular ever since. Although leavened bread did not turn rubbery as quickly as the soft flatbreads, and though its texture was superior to the grain-paste's, this did not mean that the ancient world was instantly converted. Coarse flour, even when leavened, still makes a heavy, close-textured loaf, and the worn teeth of surviving skulls show that most Egyptians went on chewing their way through bread made from the old flours, rough with bran and spiky with splinters of chaff (sometimes

with splinters of grinding stone as well). The relatively demanding process of making high-raised bread, and the fact that it worked only with some kinds of grain, meant that it remained a restricted food for many centuries. In northern Europe it was still uncommon as late as the Middle Ages (Tannahill 53).

SIDE NOTE: the source from above refers to: Pliny the Elder (23 AD – August 25, 79 AD) was a Roman author, naturalist, and natural philosopher, as well as naval and army commander of the early Roman Empire, and personal friend of the emperor Vespasian. Spending most of his spare time studying, writing or investigating natural and geographic phenomena in the field, he wrote an encyclopedic work, Naturalis Historia, which became a model for all such works written subsequently. (wiki)

BREAD IN MIDDLE AGES

The main bread, known as "pain de mayne," was a hand-bread or table loaf. Bread consumption in the Middle Ages spanned across class and geographic boundaries. It was a staple food in a Medieval person's diet.

Social status and era within the Medieval period affected the composition of the bread. There were two main types of breads: table bread (pain de mayne) and trenchers. "Trenchers" were commonly used as a sturdy bowl for a dish. Thus, staleness was an asset with day old bread being desired the most for a dinner party. It was commonly made out of brown bread that was ideal for the desired structure for this bread.

While wheat was the most common grain used in bread in the past in the Mediterranean, rye grew well in the British Isles and NW Europe. In fact, rye was the most common cereal crop there until the end of the 18th century. Oats and barley were used mainly as animal fodder, and were absent from the bread in the Mediterranean.

The whiteness of wheat flour and bread from it became signs of times of plenty and high social status because of relative scarcity in the Medieval diet. Furthermore, pure white leavened bread, sometimes called cake, was considered a standard of excellence. Medieval physicians even touted that white leavened bread of the highest quality had curative properties. We now know that this bread actually contained less nutritive value because it was without the wholesome wheat bran.

A mix of flours was considered adulteration of the flour of pure wheat and thus, marked lower status and quality. Peasants were associated with black bread, dark ryes, and whole grain varieties. The whole grain varieties were often made with whatever grains and sometimes whatever plant materials they could find and grind.

The majority of the population fell in between pure white wheat and dark peasant bread, eating "meslin" or "maslin" bread that was a mix of wheat and rye flours that was more economical in the North European growing climate. "The well-to-do often enjoyed a fine white bread bun for breakfast, sometimes with currants or raisins in it, resembling a brioche. Peasants, on the other hand, often ate their coarse black bread with raw apples or cheese for breakfast or a working lunch in the fields.”

(my summary & one quote from <http://www.engr.psu.edu/mtah/articles/flower_of_wheat.htm>. written by Vickie L. Ziegler)

Bread from the Industrial Revolution in Britain (1st half of the nineteenth century):
“Grain was still ground, as it had been for five centuries, in small water- or windmills scattered around the countryside. According to the adjustment of the stones and the fineness of the sifter, different grades of flour could be produced, but none of it was very clean and the oils left in it by the stone-grinding process turned it rancid in a few weeks. Many women still made their own bread, but there was an increasing tendency, particularly in the industrial towns, to buy from the baker. People who held advanced views on hygiene were scandalized to see how commercial bread was made - perspiration dripping into the dough from the half-naked and far from clean bodies of the kneaders.” (Tannahill 291).

Work on Bread & Bread Culture in 1865 by Edward Smith. ***see more on Edward Smith, M.D., from perspectives of health professionals under Modern.US.Colonies.Diet.Rec doc. His advice and works focused on nutrition had effect upon both British and American dietary beliefs:

Brown Bread Transitions to Rich Man’s Food:
“The consumption of whole brown meal had been so much lessened of late years that the price charged for it is as great as that of households or even of fine flour (nay, in London, it is often greater), and hence it has become a mark of luxury and not of poverty, and is the rich man’s, instead of, as formerly, the poor man’s food....” (Smith 36)

Explains what processes in bread making are essential to making a digestible bread, with particular attention to the application of heat, water, fat, as well as the purpose of yeast.
“In the preparation of flour as food, by whatever process, it is essential that so much heat should be applied as will break the cells in which the starch is placed. When water is added to the flour the starch cells absorb it rapidly, and if supplied freely the cells will break, but in making paste or bread the quantity of water never suffices for that purpose. Hence the two principal considerations in the preparation of flour for food are the due admixture of water and the proper application of heat, so that the whole mass maybe equally moistened and the starch cells equally broken throughout. When fat is added to the flour, care should be taken to mix the two with a light hand and produce the paste in thin layers, for as the action of the saliva is of the greatest importance in the digestion of starch, whilst it exerts no influence upon the fat, the starch must not be so enclosed in the fat that it is inaccessible to the saliva during the act of mastication. It is the neglect of this precaution which renders fatty pastes indigestible. The addition of yeast, or baking powder, or soda, to the dough or paste, has no relation whatever to the cooking of the flour, neither is it desired that any of them should induce any chemical change, but the purpose is to mix the paste with some kind of air or gas, and thus by separating the particles of it, to render it more easy of mastication, and to permit the admixture, of the saliva with the greater freedom.” (Smith 37-38).

In the following Smith speaks of the different breads, in particular an unleavened bread made in America. He also stresses the importance of drying this type of bread making it better for proper mastication. However, with dried biscuits much water should be drunk for proper digestion.

“Unleavened bread consists simply of flour, water and salt, with the dough made of a proper consistence and spread out into thin cakes. The Jews' Passover cake is scarcely thicker than thick brown paper, and is baked so dry that it may be readily broken with the finger, but in the Western States of America and elsewhere the cake varies from three-quarters to one inch in thick ness. When milk and eggs are added, it is not regarded as unleavened, since although no fermentation may have been induced, the cake is lighter and more nearly resembles leavened bread. It cannot be doubted that unleavened bread should be made into very thin cakes, and should be well dried, so that no impediment may be offered to mastication. Biscuits are also made without leaven, and are also highly dried; and when they consist simply of flour and water, they are often very hard, and difficult of mastication, solution, and digestion. There is another evil in the use of biscuits in large quantities when taken without fluid, viz., that they absorb much fluid from the juices of the stomach and thus tend to induce indigestion, and failing to obtain the required quantity of fluid they remain for a long time undigested.” (Smith 38-39).

Smith proceeds to write of the various methods of producing fermented dough: by adding a small piece of previously fermented dough, from the yeast from beer, and from dried yeast. He also speaks of the popularity of the three.
“The oldest perhaps is the addition of a portion of the fermented dough which has been reserved for this purpose from the former baking, but it is not the best, since it can with difficulty be well mixed with the new mass, and thus the process is localized and slow. The more usual plan is to obtain the fluid yeast from new beer, or the dried yeast which is now so largely imported into this country, and add water, but others prefer a yeast prepared without beer, called teetotal yeast. The first is not so generally attainable as formerly, since many publicans do not now brew their own beer; but the use of the second has so greatly increased, and its action is so uniform, that in country villages the publicans can no longer sell all their yeast.” (Smith 38).

Smith explains what happens with fermentation. Notice the interesting belief that fermented bread is less nutritious because some of the nutrition is lost with the released gas. There is a belief that the gas forces into the bread, rather than being produced within the bread.
“The action of all ferments is the same, viz., causing the evolution of carbonic acid gas from the sugar, the bubbles of which force their way into the mass of dough and thus lighten it ; and the art of bread- making consists in making the dough so that it shall not be too stiff to resist the entrance of the gas, nor so soft as to permit the gas to pass through it too quickly, and so to knead it that the gas shall be well distributed throughout, without any large portion of it having escaped. Hence, fermentation is effected at the expense of the nutritive materials of the flour, the starch being transformed into sugar and its allies, and these changed into carbonic acid, which is finally lost.” (Smith 39-40).

Another method of producing gas (which was the goal) with an acid and alkali admixture:
“Two other methods are in common use to supply air or gas to the dough, viz., the use of baking powder and the admixture of carbonic acid gas artificially prepared. The former consists of an acid and an alkali mixed together when dry, and kept dry until the period of using it. It is then mixed with the salt, and all well distributed through the flour, so that when the water is added the alkali becomes decomposed and carbonic acid gas is set free to mix with the dough as in the act of fermentation'. In this plan there is the expense of the powder to set against the flour which would have been wasted by the process of fermentation ; and there are the disadvantages of imperfect admixture of the salts with the flour, and consequent discoloration of the bread, the too rapid disengagement of the gas, whereby parts of the dough are often imperfectly leavened, and a certain flavor given to the bread by the salt resulting from the combination of the acid and alkali. Hence, I think, its use is only to be sustained when it is not possible to procure good yeast.” (Smith 40).

Professional Bakers apparently were experimenting with forcing gas into the dough with a special apparatus? (this is what I understand from this but had not heard of this before). The perceived benefit was in that you would not lose flour to fermentation. Also look at last sentence in bold that connects the process of fermentation to the natural process of digestion:
“The forcing of carbonic acid gas into the dough is a most ingenious plan, but as it requires a special apparatus it is not applicable to home baking. The bread which is produced is light throughout the whole mass, and although somewhat insipid to the taste of those who have been accustomed to the use of fermented bread, is good, agreeable and wholesome. In this, as in the former process (alkali plus acid), there is no waste of the flour ; ... I do not think the idea of destruction of the food during fermentation has any importance in reference to that which remains, since if any portion of it be changed at all it will be in the direction in which it must subsequently be changed in the process of digestion.” (Smith 41).

Asserts that bread not baked thoroughly is harder for mastication and subsequent digestion.
“Large loaves are rarely baked so thoroughly as small ones, or are baked equally throughout, and hence the bread is not always so easily masticated and digested.” (Smith 41-42).

The Addition of Various Substances to Bread to obtain desired softness and yet strong:
“The addition of alum (see below after quote for more on alum) has been and probably is now made with a view, as the bakers affirm, to enable the dough to be more easily worked, but really to give strength to the flour, and to enable it to absorb a larger quantity of water (my note: increasing profits of baker). It is, however, a reprehensible practice, since it deteriorates the bread, and injures the person eating it. The bakers try to relieve the dryness of the bread by adding potato starch to the dough; but when the price of flour is low, and that of potatoes high, it does not yield a profit to them. When it is desirable to introduce carbonate of lime as an antacid or otherwise into the system, the bread may be made with lime water, and where skimmed milk is plentiful it may be used instead of water, either with or without lime water.” (Smith 43).

**alum note from wiki: “Alum is used as the acidic component of some commercial baking powders. Alum was used by bakers in England during the 1800s to make bread whiter.[9] The

Sale of Food and Drugs Act 1875 prevented this and other adulterations. (http://en.wikipedia.org/wiki/Alum#Culinary).

More Healthful to Bake Bread at Home or get from the Baker: at home is better as long as you cook the bread well. Also, though, I need to consider whether it is economical to bake at home because of the price of fueling fire to bake bread. This was apparently a concern of the time which in Scotland and Wales led to the production of flat "plank bread" that required less baking time and therefore less fuel. They even had communal bakehouses where people would pay a certain price.

"It is often asked whether it is better to bake at home or to purchase bakers' bread. Assuming that it is convenient to bake at home, it cannot be doubted, I think, that it is better to do so. If the flour is good the bread will be unadulterated, it will keep longer than bakers' bread, and the flavor be generally preferred. On the other hand, it must be stated that sad or heavy bread is sometimes produced at home, the baking is less uniform than at a bakehouse, and if any portion is under-baked it is indigestible. (Qt. & Summary, Smith 43-44).

"There is a general objection to the use of new bread, either on the ground of economy or health...The objection on the score of health may, however, be more safely based upon the less digestibility of new than of stale bread, owing, I think, to its greater tenacity leading to less perfect mastication. The indigestibility of the bread is not so much due to any chemical quality, as it may be attributed to its physical condition." (Smith 44-45)

Smith describes the beliefs of housewives on when bread from home or bakery should be eaten. This is a continuation of the last paragraph that describes the indigestibility of bread being largely dependent upon its physical characteristics that can & has been observed by housewives: "After this period the changes proceed more rapidly in bakers' than in home made bread, so that the former will often taste sour on the third day, and will then have lost much of its agreeable flavor, whilst homemade bread will remain sweet and agreeable in flavor for a week, and during that long period have exhibited no change, other than increased dryness and solidity. I think the plan of thrifty housewives in this matter is based upon correct observation, viz., that bakers' bread should not be eaten until the second day and rarely after that period, whilst homemade bread may be eaten on the second and third day and extended to the fifth or sixth day." (Smith 45)

Nutrition of any food was largely determined by an analysis of carbon and nitrogen (the essential building blocks...protein according to that time). Thus bread was determined to be healthful due to its large % of C and N. An average sample of white bread contains 28.5 per cent. of carbon and 1.29 percent of nitrogen, and hence I lb. will contain 1994 grains and 89 grains of those elements. The extreme nutritive value of bread, and its present low price, render it a very good standard of economy." (Smith 45).

Hence Smith advocated an increased bread ration for the poor and the criminals (may see bio of Smith under Health Perspectives of Practitioners towards end of US.Colonies.Diet.Rec. document).

BREAD IN COLONIAL AMERICA

There was a change in bread-making when it arrived with the first colonizers to America. Corn was soon added to the bread baking mix. Refined white wheat bread only retained its high status in urban centers. Negative associations of admixtures was lost. People had to make do with what they could get their hands on to grind and include in their bread. This even applied to the wealthy. Bread became more egalitarian in America, with even the wealthy eating similar mixes with rye, corn, and little wheat.

Bread was an important source of carbohydrates and food in general in colonial America. Social scientists calculated that the average colonial person living in Philadelphia between 1750-1800 got a pound and a half of grain of some form, usually bread, supplemented by small amounts of other food groups such as dairy and meat.

(my summary from <http://www.engr.psu.edu/mtah/articles/flower_of_wheat.htm> written by Vickie L. Ziegler)

OTHER NOTES

Bread from America, 1900;

source: Atwater, Helen W.

A discussion on the believed nutritional components of bread of that time as well as a debate on the inclusion or exclusion of the entire grain in the flour (incl. bran) considering its effect upon the color as well as whether it may be digested properly or whether it causes harm to the alimentary canal and digestive organs, although is noted to be helpful with constipation: “It is useful for those interested in milling to know what parts of the grain will be most valuable in yielding a nutritious flour capable of making a white, well-raised loaf. In considering the nutritive value of flour let us remember the principal kinds of nutrients which the body needs: (1) The nitrogenous substances, called protein compounds of proteins, typified by the white of egg and the lean of meat, and chiefly represented in wheat by the cerealin and the gluten — these are the tissue-building materials of our food, though they also furnish energy; (2) the carbohydrates, principally starch and sugars, found mainly in the endosperm, and serving the body as fuel to produce energy for warmth and muscular work; (3) the fats, occurring principally in the germ of the grain, and being valuable to the body as fuel, and (4) mineral matters,, seen in the ash, especially that of the bran, and providing material for bones, teeth, etc. We must also bear in mind that it is not only the chemical composition of a substance which determines its food value, but also the amount of nourishment which the digestive organs can extract from it — in other words, its digestibility.

The abundant cellulose in the bran and the coloring matter in the testa tend, if left in the flour, to give it a coarse, dark character very detrimental to the appearance of the bread. Accordingly, until recently, that flour was quite generally considered the best which had the least of the bran in it. Lately, however, much stress has been laid on the nutritive value of the mineral matters and the cereal of the bran, consequently a great effort has been made to get a line flour which shall include the entire wheat grain. Such flour can not produce as white a loaf, and, what is still more to the point, it is doubtful whether the cereal is thoroughly digested by the human stomach;moreover, the sharp, rough particles of the cellulose in the bran are said to irritate the membranes of the alimentary canal and thus to hasten the passage of the food through the intestines. This would tend to diminish its digestibility, although it might be advantageous in counteracting a tendency to constipation. It would seem, then, that the value of bran in flour, unless it can be ground more finely than at present, is at least questionable. The germ, though rich in fat and ash, is also of doubtful value in the flour, as it tends to darken the color, and its fat occasionally grows rancid and spoils the taste. (Atwater)

GLUTEN
“The more gluten a flour holds, the more water it can be made to take up in dough, and the greater will be the yield in bread from a given amount of flour. Hence flours are classified as "strong" or "weak" according to the proportion of gluten which they contain and their consequent ability to yield bread. Gluten has also a high nutritive value as an easily digested proteid.” (Atwater)

Milling: a brief historical account, common and innovative technologies around 1900 from an American point of view describing high and low milling, the crushing and sifting involved, and the various grade flours obtained:
“When people first began to grind their grain, they did so simply by crushing it between any two stones which happened to be handy; a little later they kept two flat ones especially for the purpose, one of which they soon learned to keep stationary while the other was turned about on it. At first each woman ground the meal for her own family on her own stone; but after treadmills, windmills, and, later, water wheels came into use all the grinding was done by the professional miller in the village mill.

In feudal days the lord forced his tenants to have their grain ground in his mill, even to bake their bread in his oven, and charged a good round toll for the use of each. Various devices for grinding and sifting the grain have gradually been invented, until to-day we have mills covering acres of ground and doing apparently impossible things with the grain. In Hungary the old Roman system of cylinder milling, similar in principle to an ordinary coffee mill, has been developed, but elsewhere the systems which are known as high and low milling are more common. Here we have the original system of crushing between two stones, or rollers, but so elaborate as to be almost unrecognizable. In low milling the grain is ground in one process between two crushers placed as near together as possible. Graham flour and that commonly known as "entire wheat flour" are prepared in this way. Of these only the former, invented by the American physician, Dr. Sylvester Graham, really contains the entire grain; it is made by simply washing and cleaning the grain and then grinding it between two stones or rollers, whose surfaces are so cut as to insure a complete crushing of the grain. Entire-wheat flour is made in much the same way, except that after being washed the grains are run through a machine which removes the three outer layers, and then are ground. In this way the supposedly valuable cerealin layer is included without the almost useless cellulose of the outer bran.

In high roller milling the grain is washed and skinned as in milling entire wheat, and then is run through five or even more pairs of rollers, each successive pair being set a little nearer together than the last. After each grinding, or "break," as the miller terms it, the meal is sifted, and the leavings of each sifting, called "tailings/' are themselves ground and sifted several times. In a mill where the grain goes through a series of six straight breaks, there are as many as eighty direct milling products, varying in quality from the finest white flour to pure ground bran. Careful millers always try to grind as near the cerealin layer as possible, and to leave as much of the germ in the flour as is consistent with a good color. The so-called "straight-grade" flours ordinarily seen on the market consist of the sifting of all the breaks plus the first product of the first tailings. "Patent" and "baker's," or "household," flours are varieties of the straight-grade flours. (Atwater)

HIGH QUALITY FLOUR
Its color should be white with a faint yellow tinge; after being pressed in the hand it should fall loosely apart; if it stays in lumps it has too much moisture in it; when rubbed between the fingers it should not feel too smooth and powder}but its individual particles should be vaguely distinguishable; when put between the teeth it should "crunch" a little; its taste should be sweet and nutty without a suspicion of acidity.

Those used to cheapen the cost are usually rye flour, corn (maize) flour, rice meal, potato starch, and meals from various leguminous plants, such as peas or beans. They are not harmful in the food and sometimes improve the color of the bread; nevertheless they are fraudulent because they lower the quality of the flour without harming its appearance.
Mineral substances, such as alum, borax, chalk, carbonate of magnesia, bone, etc., are occasionally put into the flour to whiten it or to neutralize its acidity, but as these are more often used by the baker than by the miller. (Atwater)

RYE
not same quality of gluten, but more easily cultivated in cooler climates so lower cost, and whole-grain rye contains more protein than wheat
It differs, however, in one important particular — its gluten has not the same elastic, tenacious quality and does not yield so light and well-raised a loaf. Although this fact and its dark color make it less desirable than wheat flour, it is second in importance as a breadstuff. It is more easily cultivated than wheat, especially in cold countries, and consequently costs less. In many parts of Europe it practically replaces wheat among the poor...When it is milled entire, as it usually is, it contains more protein than wheat flour, but is probably less completely digested. Wheat and rye flour are often used together in bread. (Atwater)

BARLEY AND OATS
These cereals are so seldom used in bread.

CORN FLOUR
Not for raised bread, only unleavened, rich in fat. Compared with wheat, maize is rich in fat, poorer in cellulose and protein, and about equal in carbohydrates, mineral matters, and moisture. Most of its fat is in the embryo or germ, which is often removed in milling to prevent the flour or meal becoming rancid. Maize flour makes very nutritious and appetizing unleavened bread, hoecake, johnnycake, etc., but this dries so quickly that it must be eaten fresh. Maize flour contains no tenacious gluten-like protein, and therefore can not be used alone to produce a good loaf raised with yeast. (Atwater)

YEAST
The perspective on yeast around 1900 in America: believed to be a collection of tiny plants (fungi) that fed on sugar, knew that came from the air, produced alcohol, and that different yeasts produced different fermentation rxns...best line is “Yeast is literally as old as the hills.”
“The yeast, which is really a mass of tiny plants, has reproduced again and again, and in this growth has fed upon the sugar of the liquid and given off alcohol and carbon dioxide. These microscopic plants and many others are widely distributed in the air, and often find their way accidentally into different materials, where they grow and multiply, causing fermentation, just as thistle seeds, for instance, are blown about in the air until they lodge in some favorable spot and grow.... Yeast is literally as old as the hills.” (Atwater)

Wild yeast (harder to control), Brewers/Distillers Yeast (less desired because more likely to possess bacterial contamination), and Compressed Yeasts (considered reliable if made and preserved with care)
Wild yeast was cultivated in a decoction of hops or potato and water and some of the material thus obtained was mixed with the dough. Brewers' and distillers' yeasts are taken from the vats in which malt extract has been fermenting. Compressed yeasts are made by growing yeast plants in some sweet liquid, then drying the material to check their growth, and pressing it; sometimes a little starch is added to make the little cakes keep their shape. The strength of any yeast depends on the care with which it is made and preserved. Ordinary brewers' yeasts are likely to be full of the bacteria which set up lactic or other fermentations in the bread and give it a disagreeable taste and odor. (Atwater)

Yeast was believed to not only lessen the yield of bread but also the nutritional value leading even Harvard University to devote its efforts to finding Yeast Replacements:
Partly because yeast is uncertain in its workings, partly, too, because it uses up some of the nutritive ingredients of the bread by feeding upon them, attempts have been made to find some substitute for it. Various chemicals have been used to produce carbon dioxid gas in the dough. The first noteworthy attempts were made about fifty years ago at Harvard University and in Germany. Yeast powder, as the American preparation was called, was a mixture of an acid and an alkaline powder— the former calcium phosphate and the latter bicarbonate of soda and potassium chloride. When duly mixed with the dough these were supposed to give off carbon dioxide as effectively as yeast. Liebig, who calculated that in Germany the daily loss of material by the growth of the yeast plant was, if saved, sufficient to supply 400,000 persons with bread,

made a great effort to introduce a similar preparation into Germany, but with little success. (Atwater)

Popular (even with the US Army) once discovered, but produced tasteless bread & chemical leavening agents could have been easily adulterated:
Numerous baking powders made from various chemicals are in the market now. The self-raising flour used in the United States Army is a flour ready mixed with such a preparation. The chief objections to such yeast substitutes are that unless carefully prepared they may be inefficient or harmful, that they are easily adulterated, and that bread made from them is usually rather tasteless, lacking the flavor and aroma which good yeast imparts. (Atwater)

AERATED BREAD
Aerated Bread Popular in London: water to make bread is infused with CO2 (!!); sometimes adding a little fermented barley into the water as well, helping with flavor:
The "aerated bread" so popular in London is made by a different method, invented by the English physician Dauglish in 1856. According to this method, the water used for wetting the dough is directly charged with the requisite amount of carbon dioxid gas and then mixed with the flour in a specially constructed machine. Sometimes a little fermented barley infusion or wort, as it is called, from a brewery, is put into the water. This aids it in absorbing the gas, renders the gluten more elastic, and improves the flavor of the bread. (Atwater)

Salt-rising bread was considered “interesting” in that it prevented unwanted fermentations:
“The so-called "salt-rising" bread is interesting as an illustration of self-raised bread. In it the ferments originally present or acquired from the air produce the fermentation which leavens it. To make it, warm milk and cornmeal are mixed together into a stiff batter, which is left at blood heat until the whole mass is sour; that is, until the ferments present have produced fermentation throughout. Next a thick sponge is made of wheat flour and hot water, in which a little salt has been dissolved. This sponge and the sour batter are thoroughly kneaded together and set in a warm place for several hours. The leavening action started in the batter spreads through the dough and produces a light, porous loaf, which many people consider very palatable. Such bread is quite free from acidity, as the presence of the salt prevents undesirable fermentation.” (Atwater)

MAY ADD MILK TO HOMEMADE BREAD FOR EXTRA PROTEIN AND FAT: “Sometimes, especially in private families, milk is used in the place of water. Such dough is slower in rising, but makes an equally light loaf. Milk bread naturally contains a larger percentage of proteins and fats than water bread and is equally digestible. Its use is by all means to be advocated, especially on farms where skim milk is abundant. (Atwater)

FERMENTATION
The ways of mixing dough most used in this country by bakers are probably those known as " straight dough " and " sponge dough."

Straight dough, or "offhand" dough, as it is sometimes called, is made by mixing all the materials at one time, and then setting the mass in a warm place to rise for ten hours or more before baking. It requires more yeast and stronger flour than other methods in which the yeast is allowed to grow in an especially favorable medium before being mixed with the main dough, and needs a longer time to rise, but on the other hand gives an unusually large yield in bread. It is convenient in family bread making, especially when strong, compressed yeast is used, as the dough can be mixed overnight and baked in the morning. Some wholesale bakers dislike it because the dough is stiff and hard to knead, because the large quantities of materials used at one time require extensive kneading apparatus, and because the bread is usually coarse in texture, with a raw, grainy taste, due to the strong flours used.

SPONGE DOUGH
This method is best adapted to fancy working, and makes equally good crusty loaves or light biscuits. To make the "sponge," as the bread mixture is commonly called, the yeast is allowed to work for eight or ten hours in a portion of the flour or water. This is then mixed with the remaining materials and left to rise a few hours before baking. The sponge is "slacker"— that is, contains more moisture than offhand dough — and thus gives the yeast a better chance to work.Bakers usually set their sponge with a strong flour, which gives a light, elastic quality; a little salt is put into it to prevent lactic fermentation. A weaker flour may be used in the second mixing, as the greater part of the gas has already been given off in the sponge, and no great pressure will come on the newly added gluten. If strong flour is used instead, the bread yield will be greater, but the soft, sweet flavor imparted by the weaker kinds will be replaced by the harsh taste noticed in bread made from offhand doughs. Great care must be taken to mix the second lot of flour in thoroughly, or the bread will be full of hard lumps on which the yeast has had no effect.

Sponge- made bread usually rises evenly and well, and can be worked into almost any shape. It has the further advantage of keeping well. It requires longer labor than the method described before, still the difference is really between two short readings in soft dough and one long one in stiff. Like offhand dough, it can be started the night before it is baked. After mixing his dough in the way he considers most desirable, the baker sets it in a warm place to rise. Here the yeast continues to work and the gas given off stretches the spaces between the particles of dough. If the gas is allowed to go on increasing until its pressure is greater than the elasticity of the gluten can resist, the latter breaks apart, leaving large holes throughout the dough. If such "over-proved" dough is kneaded a little before it is put into the oven the excessive gas will be forced out and the holes will be more regular.

Ferment, sponge, and dough method. — common in England and Scotland...As the name implies, this is a combination of the two methods last described. The ferment is mixed with the sponge, then, after this has stood for several hours, the rest of the flour and water are mixed in the sponge and dough fashion. There is, perhaps, a slight economy of yeast by this method, but it is very complicated, and therefore less certain. A similar proceeding is sometimes practiced in the southern part of the United States, and is known as a "bleaching process," because the long rising is supposed to whiten the dough. (Atwater 22).

“Scotch bar method from Scotland. — This is not unlike the ferment, sponge, and dough system, " barm " taking the place of the other ferments. Barm is literally the foamy scum which rises to the top when beer, etc., is made. This may be used to ferment other materials. A variety of yeast is also called barm. To make barm in the household malt is crushed in warm water, hops and boiling water are poured over it, then flour is added, and the mixture is allowed to stand until the starch granules from the flour have been burst open by the hot water and the starch thus freed has been changed into sugar by the diastase of the malt. A sweet liquid is drained off from this and mixed with flour and water, the resulting sticky mass being subjected to the action of yeast, either acquired spontaneously by exposure to the air (virgin barm) or added in the form of a little old barm or ordinary yeast (Parisian barm). The fermentation thus started is allowed to continue several days and then the barm is ready for use in the sponge. A strong flour is needed for both the barm and the dough, and consequently the bread yield is large. In Scotland, where this method is almost universal, bakers consider it most economical, because there is practically no yeast to be bought and the flour used in the barn goes into the bread. These arguments seem hardly tenable, however. The cost of labor in preparing the barm must be considerable and at least a portion of the flour in the barm is lost in the form of alcohol and carbon dioxide. Moreover, while the barm is exposed to the air in making it takes in a great many bacteria which start lactic and other fermentations and give a decidedly sour taste to the bread. To be sure, persons accustomed to such bread find an ordinary sweet loaf insipid. Still such a flavor would, it is probable, hardly be acceptable to the average American palate.

FRENCH VS. AMERICAN

Leavened bread vs. bread made with compressed yeast

The french writer boutroux believed that the leavens were better for digestion due to presence of acids not found in bread made from compressed yeast. However, compressed yeasts were popular in America because of their convenience.

“Boutroux considers bread made with leaven more healthful than that made with yeast, because the acids it contains aid in its digestion. He also maintains that leaven is more reliable than the yeasts ordinarily found in the French market, but probably the majority of experts in this country would hold that the best of our compressed yeasts are more reliable and much more convenient. Whatever its practical value nowadays, bread made from leaven is interesting from the historical point of view, as it represents the way in which almost all the world made its bread from the time of the Pharaohs down to our own century.” (Atwater)

More on the process of French leavening according to French author Boutroux: Gradual Mixing of the Leaven Prevents the Growth of Unwanted Lactic and Butyric Bacteria

“A little of the dough ready for baking is saved and mixed with an equal amount of flour and water and is allowed to stand four or five hours; this operation is repeated three or four times before the leaven is ready to be mixed into the actual dough. This gradual mixing of the leaven is preferred, because in this way the yeast is allowed to act on one lot of flour only for a short time, then before it has become exhausted and other fermentations set in new yeast food is added, and thus a large number of yeast cells is supposed to be produced along with relatively few lactic and butyric bacteria. In spite of this precaution, bread made with leaven has a much more acid taste than that made with yeast, especially if the leaven has been kept some time." (Atwater 22).

What was on the Market in 1900 America: Ordinary white bread described in the last section, there are innumerable fancy white breads, breads made from other flours than wheat, and unleavened breads on the market. (Atwater)

FANCY LEAVENED BREADS
Most like the ordinary white bread are of course the fancy white ones, Vienna and French rolls, milk breads, etc. These usually differ chiefly in the use of milk, sugar, butter, lard, etc., in the dough. Entire wheat, graham, rye, barley, or oatmeal flours tire made into bread in essentially the same way, and vary in texture and nutritive value according to their original composition. Soda, cream of tartar, or baking powder biscuits, shortcakes, etc., are intrinsically the same thing as ordinary white bread, except that the baking powder or its substitute does the work of yeast. Such breads do not require to be kneaded or set to rise, and bake very quickly, hence are very convenient when yeast is unobtainable or time is short. They never become so light and porous as yeast-made bread, however, and dry very quickly. (Atwater)

UNLEAVENED BREADS
The most interesting of these is perhaps the passover bread, which has been used during passover week by orthodox Jews from the time of Moses until now. It is simply a mixture of flour and water, baked in small round cakes until it is dry and hard, and is not unlike plain water crackers. Pilot bread, or ship's biscuit, is another simple preparation of flour and water so cooked that it can be kept for any length of time. Crackers, or biscuits, as they are often called, especially in England, are also a variety, or, more correctly, innumerable varieties, of unleavened breads. Milk, butter, lard, spices, dried fruits — anything or everything desired to give them a particular consistency, color, or flavor — is mixed with the flour and water, and the dough is then passed through very ingenious cutting machines and quickly baked in a hot oven.Such crackers are a concentrated form of nourishment.
The original graham bread made without yeast from graham flour according to the receipt of its inventor, and not to be confused with raised graham bread, is made by kneading the flour and water thoroughly, and allowing the dough to stand several hours before baking. It is heavier than ordinary yeast bread, but still has a few "holes" in it, due probably to fermentation started by bacteria accidentally present in the flour or the air; it is sweet and by no means unpalatable, but probably the nutritive value of its protein is lower than Dr. Graham supposed.
Gluten bread, as its name implies, contains the gluten of the flour from which more or less of the starch has been removed. To make it, strong flour and water are made into dough, which is pressed and strained under a stream of water until the starch has been worked out; it is then kneaded again and baked. It makes a light, elastic loaf, frequently prescribed for diabetic patients from whose diet it is considered desirable to exclude starch.
(Atwater)

HOUSEHOLD METHODS OF MAKING BREAD
(all Atwater)
What are perhaps the two most popular ways of making bread at home are sometimes called the "quick- raising" method and the "slow-raising" method.
Quick-raising method. — A stiff dough is made of the flour, water, and yeast. It is thoroughly kneaded and is then allowed to rise until it doubles its bulk, when it is again kneaded thoroughly. After rising a second time it is baked. In the quick-raising process a large quantity of yeast is used, and the time of fermentation is only about two and a half hours. The baking is completed in about four or live hours after the bread is first started to rise.

SLOW RISING METHOD
A batter is made of the flour, yeast, and water, which is allowed to ferment ten or fifteen hours, usually overnight. More flour is then added, the dough is kneaded until smooth, and then allowed to rise and is treated in the same way as in the first method. In the slow-raising method less yeast is used than in the short process, and the fermentation is carried on for a longer time. The usual temperature at which the fermentation thus takes place is perhaps not far from 70°.
Various forms of "raised biscuits," "hot bread," etc., are made in the household by adding shortening, milk, eggs, etc., to the dough, or by modifying in some way the process followed. Sometimes baking powder of some sort is used as a leavening agent instead of yeast, and the form of bread called " baking-powder biscuit," or by some similar name, is the result.
An interesting variety of bread made without leavening is known as "Maryland" or "beaten" biscuit. A rather stiff dough is made from flour and water, or milk, with shortening and salt added. It is kneaded and then beaten or pounded, being frequently turned over and over until it looks light and puffy. The biscuits are then formed and baked. The folding and pounding of the dough includes small quantities of air in numberless little blisters. These expand in baking and make the biscuit light and porous.

The different kinds of bread from other grains than wheat, as "corn bread," "brown bread," "rye bread," "gems," etc., which are made in many households vary somewhat in different regions, but they all follow the same principles which govern the bread making from wheat flour — that is, the flour or meal is mixed to a dough with water or milk, and some leavening substance is generally added to make the dough porous. (Atwater)

BAKING
In the earliest days of bread making the dough was simply put into the ashes of the fire to bake; then came the ovens heated by a fire within, which are still used to some extent, and finally the elaborately constructed ovens which can be heated or cooled to any temperature by means of furnaces and ventilating devices around them. But whatever the structure of the oven, the changes which the bread undergoes while in it are essentially the same. The gluten becomes stiffened by the heat, so that even after the gas in the bubble-like pores has escaped the walls still retain their shape. The starch granules and perhaps the protein compounds undergo certain chemical changes which render them more digestible.

Bread Impurities (from 1900 American perspective)

“One of the most common and dangerous faults in bread is heaviness and sogginess. As we have seen, this may be caused by the use of cheap flours, poor in gluten, which can not absorb all the water put into the dough, or, to state it in another way, by the use of too much water in proportion to the flour; by too little or by too poor yeast; or by insufficient kneading, rising, or baking. Heavy bread is popularly considered one of the most indigestible of foods. When chewed it rolls itself into solid lumps, which give the saliva and gastric juices very little chance to work upon them.”

“Occasionally the crumb of fresh bread breaks when cut, instead of separating cleanly under the knife. According to Jago, harsh dry flours, not sufficiently fermented, may be the cause of this, or the dough may have lost its tenacity by being overworked. Another common fault in bread, especially in baker's bread, is a crumb full of large, irregular holes instead of the small, even pores which it should show. These occur in over kneaded or over raised dough, or if they are found just below the crust they mean that the oven was too hot and that the crust formed before the carbon dioxide had finished expanding.” (Atwater)

“Sometimes bread makers are troubled by what is known as " sticky" or "slimy" bread. In such cases bread three or four days old takes on a light-brown color and a peculiar taste and odor.Gradually, 'too, it becomes sticky or slimy until it may be pulled into strings, sometimes several feet in length. The trouble appears to be caused by the common potato bacillus {Bacillus mesentericus vulgatus), a minute organ ism which finds its way into the materials of the dough, survives the baking, and, growing in the bread, causes it to decompose. Experiments recently made at the Wisconsin Experiment Station show that the bacilli enter the bread with the yeast, which in the cases investigated was a variety of the compressed yeasts ordinarily on the market. It was also proved that the bacilli will survive the heat of baking. Accordingly, if yeasts are not carefully made such trouble may occur at any time, but especially when the weather is warm and favorable to the growth of the bacilli. The best safeguards are to keep the bread in a cool place and to bake only as much as can be consumed within a day or two. Not infrequently, especially in damp weather, mold forms on the outside, or even in the inside of bread. Mold, like yeast, is a minute plant whose spores (or seeds) are floating about everywhere in the air, ready to settle down and grow wherever they find a moist, suitable home for themselves. The best practical way to protect bread from them is to keep it in a dry, air-tight box.” (Atwater 30).

“But all these faults seem insignificant compared to that dread of all bakers, sour bread. This is due to lactic, or, in the worst cases, butyric, acid given off by undesirable bacteria in their growth. A little acid is not necessarily harmful, as was seen in the discussion of bread made with leaven and barm; but when the acidity is very pronounced or even accompanied by putrefaction (developed in company with butyric acid) then something is radically wrong.
Possibly the vessels in which the bread was made were not thoroughly cleaned after the last using and some of the undesirable bacteria got into the dough from them; or perhaps the yeast contained an undue proportion of these bacteria; or, if the latter were found only in normal quantities, possibly the yeast itself was weak and was quickly exhausted. The trouble may be due to the fact that the dough was allowed to stand too long after mixing, the yeast ceased

working, and the dangerous bacteria which grow best in the presence of acetic acid, such as occurs after alcoholic fermentation has ceased, had gotten the upper hand. If none of these things are at fault, the undesirable bacteria may have come from the flour itself." (Atwater 31).

Use of Adulterants: Alum, copper sulphate, and lime (more details)...thought to injure the digestive system, but makes a good looking loaf out of poor quality flour, increases water absorption of a weak flour, and masks off flavors..

"Aside from the adulterants mentioned in the section on flour, those most commonly met with in bread are mineral salts mixed into the dough for the purpose of producing a good-looking loaf from poor flour. Alum is the most common of these. It tends to check the action of the diastase and permits a weak flour to absorb more water than usual. It also improves the color of the bread. Many reliable bakers use it under the impression that it does good and not harm; but besides producing a bread whose nutritive value is not so great as appearances indicate, it is believed to be really injurious to the digestive system, and must be ranked as an objectionable adulterant. Alum tests are usually made by soaking a sample of the suspected bread in a solution of tincture of logwood and ammonium carbonate, in which alum betrays itself by a bluish color. Copper sulphate is used to produce an effect similar to that of alum in bread, but is believed to be more dangerous. Lime exerts practically the same influence and does no particular harm.

Soda is often used in bread to prevent souring, and as it does not lessen the value can hardly be called an adulterant. In breads made from special flours poor in gluten— oatmeal, barley etc.- — soda is necessary in the production of a sweet, well-raised loaf. (Atwater 31-32).

DIGESTIBILITY OF 4 DIFFERENT KINDS OF BREAD WERE COMPARED AND IT WAS CONCLUDED THAT LIGHTNESS CAN BE AN INDICATOR OF DIGESTIBILITY:

"The next question is, Which kind of bread furnishes the greatest amount of digestible nutrients? Unfortunately no experiments have been made with exactly the same materials as those represented in these tables, but investigations conducted on similar lines will not be without value in this connection. Among the best known of such experiments are those conducted by Meyer and Voit, of Munich, about twenty-five years ago. Four kinds of bread were used: (1) Rye bread, raised with a leavening powder; (2) bread made from a mixture of rye and wheat flours and raised with yeast; (3) fine white bread raised with yeast, and (4) coarse whole-wheat bread, which the Germans call "pumpernickel,'raised with yeast. The third of these, fine white bread, yielded the highest percentage of digestible nutrients, next came the wheat and rye bread, then the bread raised with the leavening powder, and last the pumpernickel. The pumpernickel may be left out of account, as it was too coarse to be justly compared with whole-wheat bread such as is made in the United States. The fine white bread was the lightest of the other three, next to it stood the rye and wheat, and last that raised with the powder, the same order that they took with regard to digestibility. These experiments prove, not so much the comparative value of different flours, as that the digestibility of bread depends largely upon its lightness." (Atwater 33-34).

In another experiment done in Maine, they tried to determine and compare the digestibility of the various breads doing a comparison of carbs, fat, and pro, and the amount of heat given off in a bomb calorimeter.

Kind of Food	# Experiments	Protein	Fat	CHO	Energy Utilized
White bread alone	4	82	70.7	98.4	92.2
White bread with milk	9	88.3	66.6	98.2	94.8
Graham Bread with milk	6	77	58.1	92.4	88
Entire Wheat Bread with milk	5	86.6	46.2	97.2	94

“The figures in the last column, marked "energy utilized," were found by burning (in a bomb calorimeter) the equivalent of the food consumed and measuring the heat given off thereby, and from this calculating the heat which the amount digested should furnish. Heat and the energy of muscular work, voluntary and involuntary, are but different manifestations of the same force; consequently, using the proper factors, we may approximately determine the value of any food as a source of energy by measuring its heat of combustion. From this table we infer that white bread yields the highest percent age of digestible nutrients; next comes entire wheat and last graham bread. (It should be stated that the graham bread used here was not the unleavened variety, but was made with yeast.) As was to be expected the whole-wheat breads made from carefully prepared flours proved much more digestible than the cheap pumpernickel used in the German experiments. It is also worth noticing that the entire wheat flour prepared without the three outer layers of the grain makes a more digestible bread than the graham flour containing the whole grain.

DETAILS ON CALCULATIONS: From the tables given in the Maine Station Report these are found to average: Multiplying these by the percentage of energy utilized from each bread, we find that 1 gram of white bread eaten alone yielded 2.69 calories, eaten with milk, 2.78 calories; 1 gram of graham bread yielded 2.18 calories and 1 gram of entire-wheat bread 2.35 calories. From this point of view white bread is still the most advantageous. The chief argument for the entire wheat and graham flours is that they furnish larger amounts of protein, the kind of food in which bread is most lacking. Let us see what these Maine experiments say of this. From them we calculate that 1 gram of average white bread contains 0.086 gram of protein, graham bread 0.083 gram, and entire- wheat bread 0.086 gram. Multiplying these by the percentages of digestibility of protein, 1 gram of white bread with milk will furnish 0.076 gram of digestible protein, while the same weights of graham and entire-wheat bread will furnish, respectively, 0.064 and 0.074 gram.

Thus we see that even in regard to the amount of protein digested, white bread is still the most valuable; next comes entire wheat and last graham bread. As regards the claim that the bran-containing flours furnish valuable mineral matters and fats, it should be stated that as yet no experiments have been made to test the digestibility of these substances, and until that is done nothing positive can be said on either side. Too much stress should not be laid on the importance of the extra amount of phosphates and other ash constituents of bran. Fine flour also contains these same constituents and it is not unlikely that they are more available than in the bran, even if finely ground. These substances are of undoubted value, but there is little experimental data to show the amount of different ash constituents necessary for maintaining the body in health. It is doubtless safe to say that the ordinary mixed diet of children and adults furnishes an abundance of mineral matter. The coarser flours, with the particles of bran, often increase the peristaltic action of the intestine and thus tend to prevent constipation. They may at times otherwise aid digestion, hence for persons in need of a laxative, bread made from such flours may often be preferable to white flour, but for a healthy person its claim of superior value is very questionable. Certainly no plea can be made for them on the ground of economy, for entire-wheat and graham flours cost more than white flour.rye, corn, and other breads. In German investigations recently made in reference to army bread the conclusions are drawn that if complete digestion of the nutrients of the bread is the main object the cheaper grades of white flour are the most economical, but that if low cost is also an object, a mixture of rye and white flour is to be recommended.

Rye, barley, and oats have less gluten than wheat, and maize has none, and therefore wheat, despite its higher cost, yields the most nutriment for a given sum. It is possible that of the various kinds of wheat flour those containing part of the bran — entire wheat and graham flours — furnish the body with more mineral matters than tine white flour, but they probably do not yield more digestible protein, as was for a time supposed. It seems safe to say that, as far as we yet know, for a given amount of money white flour yields the most actual nourishment with the various food ingredients in the best proportion. (Atwater)

There are many methods of growing yeast at home or in the bakery, but the compressed yeasts now in the market seem to give equally good results with so much less labor that their use, in the United States at least, is becoming practically universal. Heavy, badly raised bread is a very dangerous food, and unfortunately very common, and probably more indigestion has been caused by it than by all other badly cooked foods. As compared with most meats and vegetables, bread has practically no waste and is very completely digested. It is too poor in protein to be fitting!y used alone, but when used with due quantities of other foods it is invaluable, and well deserves its title of "the stall' of life." (Atwater)

BEER

HISTORY

It seems that the discovery of ale was stimulated by the process of bread-making. At some stage in the Neolithic era people had learned that if, instead of using ordinary grain, they used grain that had been sprouted and then dried, it made a bread that kept unusually well. Something very like this was used in brewing. The Egyptian process was to sprout the grain, dry it, crush it, mix it to a dough and partially bake it. The loaves were then broken up and put to soak in water, where they were allowed to ferment for about a day before the liquor was strained off and considered ready for drinking (Tannahill 48).

Until about 1500 BC brewing remained a hit-or-miss affair, the presence of microorganisms responsible for fermentation being largely fortuitous. But brewers ultimately came to recognize that their old pottery ale jars (full of cracks and crevices that were an ideal home for natural yeasts) produced a much more consistent brew than new ones (Tannahill 48).

In Egypt the commonest ale was haq, made from the red barley of the Nile. It seems to have been fairly weak, though other Egyptian ales were so sweet and aromatic that they were very little inferior to wine, and are thought to have achieved an alcohol content of about 12 per cent. Some of them, certainly, must have been potent or it would not have been necessary to warn drinkers, as an Egyptian papyrus of 1400 BC did: ‘Do not get drunk in the taverns in which they drink ale, for fear that people repeat words that may have gone out of your mouth, without you being aware of having uttered them.’

Ale continued to be the favored drink on the Nile, but not in Mesopotamia, where, as irrigation soured the soil and even barley became difficult to grow, there was no grain to spare. It was then that the Sumerians’ successors changed their drinking habits and took to date wine (Tannahill 49).

Certainly, a staggering amount of the Sumerian grain yield went into ale; something like 40 percent of the total. The ordinary temple workman received a ration of just under two pints a day, and senior dignitaries more than eight pints, some of which they may have used as currency. There was, of course, no great range of alternatives at this time - no grape wine, no tea, no coffee, and water that, coming from irrigation canals rather than free-flowing streams, must have been badly contaminated (Tannahill 48).

Hopped beer was not known in England until the early 16th century (AD) and its predecessor, the old 'ale', was a cereal preparation which could be brewed at home. (Ellison 91-92).