Against the Grain

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The Case for Rejecting or Respecting the Staff of Life

Gluten intolerance, wheat allergy and celiac dis- ease are all related categories of digestive and immune system disorders that have become increasingly familiar to anyone following modern trends in human health. Barely a decade ago, gluten intolerance and celiac disease were considered uncommon genetic aberrations, occurring in perhaps 1 in 2500 persons worldwide.

In just the last few years the prevalence of putative sufferers has been revised upward so frequently that it is hard to find general consensus moment by moment, but about 1 in 130 (or approaching 1 percent of the U.S. population) seems to be the current speculation by several researchers and celiac support organizations, with similar numbers recorded in Europe. The National Institutes of Health convened its first conference on celiac disease only in 2004, however, yet concluded in its report that the condition is "widely unrecognized" and "greatly underdiagnosed" while symptom-free cases appear to be increasing.[1]

The story of how a class of food long revered as "the staff of life" should suddenly become a toxic substance to large numbers of people worldwide is complex and controversial, yet also provides revealing insights into modern agriculture, world trade and industrialized methods of food production.

Wheat Ancestors

In its over 8000-year history as a domesticated food, wheat continues to be the major grain consumed by humans, although it has not been the same wheat for all of those many centuries. Worldwide wheat production for 2004 was approximately 624 million tons; only corn production (largely used for animal consumption) exceeded this amount, and rice came in third. The Food and Agriculture Organization (FAO) of the United Nations notes that wheat production has been growing by 1 percent annually to keep pace with world population growth, but that level will need to increase to 2.5 percent annually by 2025. With most arable land already in production, plant geneticists are laboring to develop wheat strains with "enhanced" characteristics that will produce ever more on limited acreage to meet demand.

Modern wheat has had a very long history of hybridization, starting with ancestral grasses in the wild and also occurring naturally in farmers' fields in antiquity. Humans have continued the process chemically in the last century, and especially during the last 50 years in order to increase yields, resist fungal diseases and pest attacks, improve ease of mechanical harvesting and meet rigorous demands of industrial milling and mechanized baking methods. Transgenic wheat varieties via GMO technology are now waiting in the wings for their debut, albeit to an unexpectedly (at least to Monsanto) hostile audience both at home and abroad.

But even before these latest GMO changes, it appears that recent forced and accelerated hybridizations have changed wheat nutritionally in ways that no one seems to have considered, while research into the health effects of these transformations has barely begun. It is through the story of modern wheat's pedigree, some of which is still disputed by archaeobotanists, that some light can be shed upon gluten intolerance and celiac disease.

Among the early grasses that produced nourishing food for people is the species of Triticum. Within this species, the einkorn, emmer and spelt groups all had a common ancestor about 10,000 years ago. Wild and cultivated einkorn are classified as diploid by plant geneticists; that is, their DNA contains two sets of chromosomes. Einkorn was widely distributed throughout the Near East, Transcaucasia, the Mediterranean region, southwestern Europe and the Balkans, and evidence of wild einkorn harvest remains have been dated in the late Paleolithic and early Mesolithic Ages (16,000-15,000 BCE). Cultivated einkorn continued to be a popular food crop during the Neolithic and early Bronze Ages (10,000-4,000 BCE) until finally giving way to emmer wheat in the mid Bronze Age. Einkorn cultivation continued from the Bronze Age until the last century in isolated regions within France, India, Italy, Turkey and Yugoslavia. A nutritious grain with high levels of protein, fat, vitamins and minerals, einkorn excelled at growing in cool environments and in marginal agricultural zones such as the thin soils of mountainsides.

A variant of wild einkorn probably mixed with another diploid wild grass, *T. speltoides* to produce a tetraploid cereal, *T. dicoccoides*, called wild emmer, with 4 sets of chromosomes. With more inherited characteristics, cultivated emmer wheat eventually pushed out einkorn in popularity as it could thrive in more environments and under wider, warmer, climate variations. Emmer became the predominant wheat throughout the Near and Far East, Europe and northern Africa until about 4,000-1,000 BCE, although it was still cultivated in isolated regions such as south-central Russia into the last century, and even today remains an important crop in Ethiopia and a minor crop in Italy and India.

Cereal geneticists have two theories for the sites of the emergence of spelt, a hexaploid wheat variant with 6 sets of chromosomes, but they agree that either wild or cultivated emmer must have moved into a geographical area where *T. tauschii* (goatgrass) was an indigenous species (southern Russia, western Iran and northern Iraq). Just as emmer wheat benefitted by the addition of genetic material in its adaptive advantage over einkorn, spelt (*T. spelta*) exhibited even more adaptability from the contribution of the characteristics of its wild grass parent. The spelt group of wheats are all hexaploid, although it is interesting to note that there are no known wild hexaploid forms of Triticum.

Common bread wheat, *T. aestivum*, also a hexaploid cereal, has the same ancestry as spelt, but exhibits the attractive characteristic of grain kernels that thresh free of their hulls. Einkorn, emmer and spelt all have tough, tenacious hulls that must be rubbed off with quite a bit of effort before the grains can be further processed and consumed by humans.

The high gluten content of *T. aestivum* also made it an excellent candidate for the development of leavened bread which is commonly believed to have occurred in Egypt, due to its favorable wheat growing conditions, during the 17th century BCE, although bread wheat remained rare for a long time. Leavened bread made from refined flour, that is, milled and sifted many times, would have been very expensive and therefore a food only for the rich. Less affluent Egyptians ate flat bread from barley, and the poor ate sorghum. At about the same time, rye (*Secale cereale*, a diploid grain closely related to wheat and barley but considered a weed grass by the ancient Egyptians) was becoming a major bread grain of Slavs, Celts and Teutons in northern areas where the growing season was too short and cool for dependable production of *T. aestivum*.

Culprit Genes

Recent genome mapping of modern bread wheat with an eye to its toxic influence in celiac disease has isolated a small chain of peptides on a portion of the gluten protein which is directly responsible for stimulating the reaction in those with the celiac genetic inheritance. The plant genes responsible for contributing these peptides in wheat gluten are located on the third set of chromosomes that the hexaploid variants inherited from their wild parent. It is very interesting to note that neither the diploid nor the tetraploid cereal grains contain this genetic material. That is cultivated diploid einkorn, and tetraploid emmer wheat along with certain of the durum pasta wheats as well as durum variants such as Kamut® (a brand name for *T. turgidum* or *T. turanicum*) and *T. polonicum* (Polish wheat) do not contain this genetic material.

These recent findings have of course sparked interest in cultivating wheat variants that may be harmless to those with celiac disease, or at least prevent the disease in others by limiting their exposure to the problematic wheat proteins.[3] As always with a not-well-understood condition such as celiac disease, caution is advised. There may be other constituents in all wheat varieties and their close relatives yet to be identified as provocateurs in celiac disease, wheat allergies and gluten intolerance. However, reintroducing some of these wheat ancestors into small scale production will be an exciting improvement in the diversity of grain choices currently available, as well as offering us a broader nutritional profile. These ancestral grains are generally superior to the modern hybrids in mineral, vitamin, protein and fat content.

An Empire of Wheat

Food prejudices created class markers even in antiquity, as dark breads were associated with the poor and highly refined white breads with royalty and the rich. Only remnants of the works of Diphilis, a Greek dramatist of the 4th century BCE, have survived to our time, but among them is his paean to white bread: "Bread made of wheat, as compared with that made of barley, is more nourishing, more digestible and in every way superior. In order of merit, the bread made from refined [thoroughly sieved] flour comes first, after that bread from ordinary wheat, and then the unbolted, made of flour that has not been sifted."

Still, *Triticum aestivum* took time to become the major world grain it is today and only became widespread during the onset of the modern age of industrialism when population shifts swelled Europe's major cities with new labor forces needing to be fed. During the Middle Ages, for example, Europeans were very fond of the taste of rye, and as late as 1700 rye comprised 40 percent of all English bread, although by 1800 the percentage was barely five. Wheat bread had long been rare in Scotland, with only the wealthy indulging at Sunday dinner, but by about 1850 all classes, including laborers, ate it regularly.

Even in the new nation of America, wheat was only harvested for the first time in 1777, and was merely a horticultural hobby for George Washington–wheat was not yet eaten commonly by the citizenry, who preferred corn for its ease of cultivation and flexibility as food for both people and certain livestock. Poland exported three times as much rye as wheat in 1700, but a hundred years later the numbers were reversed, and even traditional rye-eating countries such as Denmark and Sweden became converted to eating wheat bread. However, "[w]here rye bread was very firmly established–in large parts of Germany and Russia–it remained. Physicians and farmers insisted that people who for centuries had eaten the dark bread of their fathers, which gave forth a spicy fragrance like the earth itself, could not find the soft white wheat bread filling. They pointed to the physique of the Germans and the rye-eating Russians. . . . The rye eaters said that wheat bread had no more nutritive value than air."[4]

The population of western Europe surged after the end of the Napoleonic Wars (1815), and so did a taste for wheat bread. European agriculture was struggling to meet the demands of an increased urban population as centuries of cultivation had depleted soil fertility. European soil chemists had recently discovered ways to produce chemical fertilizers but their overzealous application along with an incomplete understanding of the importance of soil organisms in humus led to soil poisoning and inconsistent yields. Political unrest in Europe, the Crimean War, the potato blight of 1846, a cholera epidemic and several bad harvests left France and England with severe food shortages. The timing was right for farmers in America to exploit vast areas of virgin soil to produce wheat to feed Europe and at the same time create millionaires in the young nation. By about 1860 America was exporting millions of tons of wheat to much of Europe and had built a vast, lucrative railway system to funnel the torrent of grain toward its ports. Except for parts of the world that still had a tradition of eating rice, such as Asia and Japan, or in isolated spots where rye, corn or minor cereal grains continued as traditional fare, it was wheat that had triumphed over much of the globe.

Bread to Feed the Masses

"The bread I eat in London is a deleterious paste, mixed up with chalk, alum and bone ashes, insipid to the taste and destructive to the constitution. The good people are not ignorant of this adulteration; but they prefer it to wholesome bread, because it is whiter than the meal of corn [wheat]. Thus they sacrifice their taste and their health. . . to a most absurd gratification of a misjudged eye; and the miller or the baker is obliged to poison them and their families, in order to live by his profession." So wrote Tobias Smollet in *The Expedition of Humphrey Clinker* in 1771.

According to Anthony S. Wohl, professor of history at Vassar, ". . . to look back nostalgically and assume, for example, that the bread [of Victorian England] which formed the staff of life was home-baked, or, if bought, was wholesome and nutritional, is romantic nonsense. By the 1840s home-baked bread had died out among the rural poor; in the small tenements of the urban masses, unequipped as these were with ovens, it never existed. In 1872 Dr. Hassall, the pioneer investigator into food adulteration and the principal reformer in this vital area of health, demonstrated that half of the bread he examined contained considerable quanities of alum [aluminum sulphate]."[6]

With the advent of the Industrial Age, parts of the world destined to become the wealthiest empires–such as Great Britain and the United States–eventually gained reputations as nations that produced the worst bread. One could lament about it, joke about it, rage about it. . . but not much could be done about it, and certainly not on a scale necessary to provide excellent bread (or other foods, for that matter) to every citizen. But that, of course, is the point. The industrial scale is not the human scale, the scale of the artisan baker, cheesemaker or small farmer. The wealthy nations attracted many laborers from the countryside at home, and from towns and cities abroad, all wanting relief from poverty and various other serious privations. For better or worse, the people needed to be fed, and the fact that their bread was insipid, their milk watered, did not strike officials as a matter of first importance.

The US and UK finally passed laws criminalizing food adulteration in the 19th century, in order to put a stop to some of the worst abuses of heavy metal adulterants and other outright poisons, but violations continued to occur. Industrialized food production was and continues to be aimed at maximizing profits by keeping production costs low, accomplished by using the cheapest ingredients and cutting time spent in actual production itself.

The industry no longer uses aluminum sulphate to whiten bread, since its multiple poisoning effects are now well understood, but continues to resist prohibitions against the addition of harmful chemical additives and dough “improvers” necessary to produce consistent products via mechanized methods. Mass-produced bread in affluent countries in the 20th century has also certainly let standards slide as far as taste, texture, character and nutrition are concerned.

Seventy percent of all bread eaten in the United States was baked at home in 1910, but the percentage had plummeted to 30 by 1924. In 1927, the Continental Baking Company first introduced Wonder Bread, and three years later presented *sliced* Wonder Bread in a protective wrapper to the national market. That same year, 1930, Continental Baking also introduced Twinkies.

(Shredded wheat entered the food supply in 1889; the National Biscuit Company formulated Triscuits in 1902 and Oreo cookies in 1924.)

Wonder Bread was involved in a government-sponsored experiment dubbed “the quiet miracle” to enrich white bread with vitamins and minerals as a way of ameliorating deficiency diseases suffered by the poor; what officials never acknowledged was the fact that it was the new foods themselves that were impoverished.

Industrial Baking Technologies

The history of commercially produced bread in factory bakeries includes feats of mechanical and chemical engineering that are breathtaking in their sheer contempt for the art of traditional food preparation. The boast of “never touched by human hands” has become the new mark of pride in food science, hygiene and modernity. Indeed, when reading industry-directed presentations on methods and machinery, one can easily be confused by seemingly familiar terms such as “dough,” “proofing,” “rising” and even “bread,” which no longer bear any resemblance to their original and expected meanings.

Mechanized bread production lines have evolved over time to include three main dough mixing variations. The first is the continuous mixing method, introduced in the 1950s. By the mid 1970s, this rapid production method accounted for 60 percent of all commercial bread produced in the United States. With this process, all ingredients are added at the beginning of a cycle and the slurry of flour and yeast and “improvers” travels via conveyors without pause to the oven. Any proofing (rising) occurs there. An early television commercial for WonderBread highlighted the fact that it was made from a batter, not from dough, “so there are no holes in the bread!” Bread made in the continuous mixing method more resembles cake in texture, with a soft texture and no fermentation flavor or aroma. This method has generally become much less popular today because of the drab quality of the final product and because of income lost during breakdown periods when entire batches had to be discarded if repairs took longer than 20 minutes.

A serious change in bread-making techniques occurred in 1961 when the Flour Milling and Baking Research Association at Chorleywood, Hertfordshire came up with a method to speed up production of raised bread for industrial manufacture. Called the Chorleywood Bread Process (CBP), the method depends on high-speed mixers and chemical oxidants along with solid vegetable fat, lots of commercial yeast and water, which produces a loaf of bread from flour to sliced-and-packaged form in about three and one-half hours. Low-protein soft wheat grown at home in Britain can be used in this high-energy input method, dispensing with the expense of importing high-protein bread wheats from abroad.

Since the introduction of CBP, domestic wheat varieties have been hybridized with protein profiles specifically appropriate for the abuse of the CBP machinery, and the wheat is milled under tremendous pressure to force open starch cells so that the flour will absorb the maximum amount of water during processing. Lots of water and air make the loaf springy and light. Solid fat–hydrogenated or fractionated plant oils–is necessary to provide structure during baking or the loaf collapses.

With this process–also appropriately called the “no-time method”–flour, chemical oxidants and “improvers,” water, yeast, fat and salt are pumped into vast computer-controlled mixers and the dough is violently shaken for about three minutes. The large amount of energy used generates higher-than-needed temperatures to raise the dough with its large dose of yeast, and computer-regulated cooling systems modulate the next stages. The air pressure in the mixer headspace is maintained at a partial vacuum to keep the gas bubbles in the dough from getting too large and creating an unwanted “open” structure in the finished crumb.

The dough is then tipped into a divider, cut into individual pieces and allowed to “recover” for 8 minutes. (Can’t you hear the timer ticking?) Each piece of dough is then shaped further, placed four to a tin and hurried off to the humidity- and temperature-controlled proofing chamber, where it sits for almost an entire hour. It is now ready to be baked. Baking takes 20 minutes at 400oF and then the loaves rush off to the cooler, where, about two hours later they are sliced, packaged and ready for dispatch to a supermarket near you.

This is not some demented bakery version of the Keystone Kops, but the most common method used throughout all sectors of the bread baking industry, including over 80 percent of factory-produced bread in the United Kingdom, Australia, New Zealand and India. Even many “specialty” and organic breads are produced this way. The CBP has been used in 28 countries worldwide, and very recently has made inroads in France, Germany and Spain, with plans to introduce the system to China, offering its “advantages” in the production of steamed buns over their traditionally-fermented counterparts.

The CBP is only minimally used in the United States, however, largely due to the high-gluten, “strong” wheats grown in North America that cannot be properly “worked” in a typical high-speed, 2-5 minute mixing cycle. Even when the cycle is increased to seven minutes (technically adequate to “work” the dough according to CBP requirements), the dough structure suffers in the later processing stages.

The process used most often in the US is called the conventional batch mixing method. Utilizing a “sponge” stage, 60 percent of the ingredients are mixed and fermented for 2-4 hours, then mixed with the remaining ingredients and baked. Conventional batch mixing is easily adapted to “no-time” methods and recipes, and also relies on chemical inputs to “condition” the dough during the mechanical processing, as well as impart anti-staling and moisture-retentive properties to the finished product. It is this method that produces not only hotdog and hamburger buns at fast food joints, but the “baguette” at the little deli with the cute name, the flour tortilla at the Mexican restaurant and the kaiser roll with crab salad at the campus cafeteria.

One of the biggest markets for these factory bakeries is frozen sales. The frozen bread is shipped out to boutique food establishments and high end markets and then baked onsite, so customers can experience the aroma of “fresh-baked” bread and pay more for what seems like a home-made product.

Clash of Cultures

All of the mechanical dough development methods are engineered for fast, efficient and cheap production, computer controlled and automated; only a few operators are needed to run an entire factory. Similar to the extrusion process–used to make cold cereals and snack foods from slurries of water and pulverized grains shot at high pressure through small apertures, dried and spray-coated with oils–factory bakeries make bread products according to industrial “science.” Although the exact proportions vary according to processing method and final product, the ingredients areremarkably similar, whether the result is sandwich bread, hamburger buns, flour tortillas, chapatis or pizza crust. The industry seems convinced that what drives their research and quality standards is consumer demand for a lofty, soft white bread with a consistent tiny crumb and barely perceptible crust. The breakfast cereal makers seem convinced that novel shapes, sugary crunch and resistance to all weather conditions will keep their products permanently in customers' shopping baskets.

The industry does not realize–or will not admit–that although grains are nutritious foods, they must be processed in ways that enhance their nutrition and digestibility while coaxing their inherent complex flavors through slow development of starches and proteins, usually via a combination of sprouting and souring with the help of a host of useful microorganisms. The modern "no-time" food processing industry has ignored these traditions to the peril of everyone's health, flooding the market with cereal products that are no longer recognizable as nourishment, but thanks to their means of breeding, cultivation, milling and manufacture, are instead downright dangerous.

Careful Preparation

In contrast to the ongoing technological experiments to which cereal products are subjected, many cultures throughout the world have long ago developed careful means of preparing all grains for human consumption. Soaking, sprouting, and souring are very common aids for grain preparation, which ensure the neutralization of enzyme-inhibitors and other anti-nutrients with which seeds are naturally endowed. Some preparation methods involved complex, labor-intensive steps that produce now very unusual foods from common grains. The Japanese, for example, make *mochi* from soaked and steamed glutinous rice that has been pounded into a homogenous sticky mass and then formed into cakes that are then baked or grilled.

Tolokno is oat flour made by an old Russian folk method. Whole oats were soaked for 24 hours (sacks of oats would be submerged in a pond or river) and the swollen grains then set overnight in the Russian oven–a large masonry oven for cooking and home heating. The oats would be taken out, the oven refired and the oats placed inside again to gently roast until completely dry and smelling of malt. The oats would then be pounded or ground, and the resulting sifted flour was called *tolokno* from the verb "to pound." It would be cooked with milk or meat bouillon to make a thickened soup which–in contrast to modern grain products–was very easy to digest, considered good for stomach or intestinal ailments and deemed an excellent food for convalescents and children.

Oat *kisel'* is another old Russian delicacy made from soured oat gelatin. Whole oats were sprouted, gently dried in a warm oven and then set in warm water for 24 hours at the back of the oven where they started to ferment. The oats and the soaking water, now containing many nutrients from the oats, were slowly heated to just the boiling point while a patient cook stirred constantly. The *kisel'* was then strained and the liquid poured into a dish, where it would gelatinize, becoming thick enough to cut with a knife. It was pleasantly sour ("kis" is related to "kvas" and means sour) and was traditionally served with milk and honey. *Kisel'* could also be made with rye or peas, and in the latter case was served with meat bouillon.

Real Bread

Of course the sourdough fermentation of flour from whole wheat and rye to make bread has strong traditions in several countries of the world, whether the breads are leavened, oven-baked loaves or flat leavened breads cooked over hot coals. This method is time-consuming and–even more problematic for the modern age–requires the careful maintenance of a culture medium, the sourdough starter, which is a stable relationship of a family of wild yeast fungi and several strains of local lactobacilli. Rather like the carefully nurtured cultures and caves that produce delectable fermented cheeses, sourdough bread cultures are a product of place and the people who care for them and use them. They are all different, produce flavors and rates of fermentation peculiar and beloved unto themselves, require temperatures and other conditions known intimately and respected by the baker. Commercial baker's yeast, on the other hand, is a monoculture of just one single variety of yeast, grown to be a consistently fast and vigorous replicator and producer of carbon dioxide, but incapable of developing grain flavors (the lactobacilli are best at that). Sourdough cultures produce reliably leavened and complexly flavored breads via the alchemical communion of the culture microorganisms, flour, water, fire and time–plenty of time.

Michael Gaenzle, a cereal microbiologist now at the University of Alberta, Canada, has suggested that sourdough cultures are in fact so intimately connected with the people who use them that they form a mutually supportive and sustaining relationship.[7] That is, the microorganisms are part of you (and come from you) and so the bread you ferment with them is tailormade to nourish and support especially you. You bolster your own health by eating bread cultured with your domestic friendly "beasties." This "home advantage" is an obvious traditional benefit conferred on newly married daughters whose mothers included a barrel of sourdough in the wedding dowry to start their new households–to ensure their daughters' health and vigor (especially since they were soon likely to bear children) and provide them extra strength in their new positions in life.

The traditional sourdough process reliably neutralizes the anti-nutrients in the cereal grains as the flour is kept moist and acidic for many hours (or days). Ongoing research in cereal microbiology is investigating some preliminary evidence that the traditional sourdough method may also sever the bonds of the "toxic" peptides in wheat gluten responsible for the celiac reaction and neutralize them as well.[8] In short, certain lactobacilli in a sourdough culture acting on wheat flour for a 24-hour period achieved nearly complete digestion of the peptides. When bread made with these species was fed to recovered celiac patients for two days, the patients showed no signs of increased intestinal permeability that were found among recovered celiac patients who consumed the same amount of regular bread over the same time period. These intriguing results suggest that wheat (or rye) flour that has undergone 24 hours of culture fermentation may render the "toxic" peptides harmless and allow the bread to be safely eaten by those with celiac disease, although studies of celiac patients consuming sourdough breads for a much longer period of time will be needed to confirm this.

In the study cited, test bread was made with fermented wheat flour and the remainder of the flour from the non-gluten grains millet, buckwheat and oats. The recipe does not resemble a classically prepared sourdough bread which is traditionally made in a building-up process of stages; some of the flour will have fermented for as long as two or three days, whereas some of it for only several hours prior to baking, during the period when the culture microorganisms experience exponential growth rate. The result of breaking down gluten completely is that it can no longer raise the dough!

Deviation from Rational Principles

Another outcome of the mass production of industrial bakery products has been to create grotesque taste standards and expectations that have no connection to an honest ingredient. Commercial cereal products have become health hazards because of everything from grain hybridization to flour adulteration to inadequate, inappropriate and violent processing. They also are aesthetically repugnant, which is just as important a factor to consider when talking about the nourishment of food.

Consider this prophetic statement by Rudolf Steiner in an address to members of the Anthroposophical Society on June 20, 1924 and published in *Spiritual Foundations for the Renewal of Agriculture*: ". . . [U]nder the influence of our modern philosophy of materialism, it is agriculture–believe it or not–that has deviated furthest from any truly rational principles. Indeed, not many people know that during the last few decades the agricultural products on which our life depends have degenerated extremely rapidly. In this present time of transition. . . it is not only human moral development that is degenerating, but also what human activity has made of the Earth and what lies just above the Earth. . . Even materialistic farmers nowadays. . . can calculate in how many decades their products will have degenerated to such an extent that they no longer serve as human nourishment. It will certainly be within this century."

Grains comprise a wholesome category of foods that must be respected for the complexity of nutrient contributions they can make to the human diet, and must always be prepared with care to maximize those nutrients' availability as well as neutralize naturally occurring antinutrients. Resources also exist to reintroduce ancient grains, such as emmer and einkorn wheats, into our food supply and diversify cereal choices with alternatives to the few overly hybridized cultivars largely in use today.

Growing and preparing food ought to be a sacramental service. It should not be based on violence, as is most of modern agriculture, factory animal farms and factories that produce finished food items like bread. All those processes are based on "conquering" the food item and forcing it into a form defined by commerce. There are no more subtle energies in these debased foods, let alone mere measureable nutrients or soul-satisfying taste and vitality.

Food is holy. Its preparation and enjoyment constitute a daily opportunity to experience happiness, satisfaction and gratitude.

Sidebars

THE SYMPTOMS OF CELIAC

Celiac disease is characterized by a chronic inflammation of the small intestine driven by a multi-gene response to a specific chain of peptides (gliadin proteins) in modern wheat gluten, and in analogous protein chains in rye and barley. Antibodies in the sufferer's small intestine react to these ingested peptides by attacking them (and the surrounding intestinal mucosa) as invaders.

This long-term autoimmune reaction causes serious damage to the small intestine, with common symptoms such as abdominal pain, bloating and diarrhea, but signs such as restless legs or anemia might be just as likely. In children, weight loss and failure to thrive are common markers of the disorder. The chronic inflammation destroys healthy villi in the small intestine, which are tiny, finger-like outgrowths of the mucosa that vastly increase the surface area available for nutrient absorption during digestion. This flattening of the villi leads to many malabsorption and vitamin and mineral deficiency problems, including severe anemia and osteoporosis, especially after the condition has persisted unrecognized for many years. Other inflammatory responses such as rashes, rheumatoid arthritis, lupus and chronic fatigue syndrome may develop, along with lymphoma and digestive system cancers. Psychiatric symptoms such as severe depression and schizophrenia have also been linked to the disorder.

The list of possible symptoms is vast and often confusing, and no two celiac sufferers react or recover in the same way once their condition is recognized. In short, a sizable proportion of our population is gluten intolerant and reacts with a wide spectrum of symptoms ranging from no apparent reaction to severe life-threatening diseases.

DIAGNOSING CELIAC DISEASE

Definitive laboratory diagnosis of celiac disease is often tricky, since blood tests have not always been sensitive enough to pick up markers, or have often resulted in both false positives and false negatives. Biopsy of small intestine tissue to search for evidence of villi damage can also be a hit-or-miss situation. There may not yet be extensive flattening of the villi, or the biopsy is taken in an area just beyond extensive damage and therefore will not disclose it.

A fairly new approach that seeks to provide more sensitive, complete, and early screening is available from EnteroLab.[2] Their test is based on earlier research which demonstrated that antigliadin antibodies appear in the contents of the intestines before they appear in the blood. EnteroLab utilizes stool samples to test for these antibodies in gluten sensitive individuals with the hope of positively identifying the condition before more extensive damage to the body has occurred. Often though, if one suspects that celiac is the likely cause of one's problems, removing all sources of gluten from the diet is the immediate first action. Of course, relief of most symptoms in a short period of time when gluten has been banished is enough evidence for many people to conclude the diagnosis for themselves.

THE WHY OF RYE

Since antiquity, rye has presented problems of its own, namely a susceptibility to a parasitic fungus called ergot (*Claviceps purpurea*) which causes severe and debilitating symptoms in animals and people who eat it. Ergot causes both gangrenous and convulsive syndromes, with hallucinations, "fits," excruciating pain and loss of extremities due to severe vascular constriction and consequent gangrene.

Rye ergot is the original source of lysergic acid from which LSD is synthesized. Although rye will happily grow in cool, damp parts of the world not best suited for wheat, those same conditions favor the spread of the ergot fungus, which can be devastating during poor harvest years with cold, wet springs. Mass ergot poisoning has been recorded since the early Middle Ages, and historians speculate that manifold pockets of ergotism appearing after the wet, cold spring of 1347 increased Europeans' susceptibility to bubonic plague (the Black Death of 1347-48), since ergot seriously damages the immune system and likely helped increase the numbers of the dead. The coincidence of both calamities also explains why population numbers took such a long time to recover in the wake of the plague: those who survive ergot poisoning suffer from reduced fertility and frequent spontaneous abortion.

Some historians speculate that outbreaks of ergotism were the cause of other historical disasters, including the Salem witch trials in this country (the colonists ate rye, not wheat) and the early, easy conquests by the Vikings (who were barley eaters) in Europe–their forays coincided with bad harvest years and recorded ergot outbreaks. Evidence indicates that peasants understood something of the toxic nature of ergot, and may have had some ways of mitigating its worst effects–one undocumented source claims that sourdough leaven will neutralize the ergot alkaloids.[5] But although crude ergot was indeed used medicinally (to staunch hemorrhage and as an abortifacient), poisoning continued to occur, although sporadically, even up to the middle of the last century.

Modern methods to keep ergot out of rye include screening of seed used for planting, deep plowing and crop rotation to disturb the fungus's two-part reproductive cycle. It is always wise to inspect and clean rye that you plan to grind for your own flour at home.

SPELT, A CLOSE COUSIN OF WHEAT

There is a good deal of confusion surrounding the question of whether or not spelt is "safe" for those with gluten intolerance or wheat allergies. Part of this has to do with errors in taxonomy–spelt is indeed a true hexaploid wheat and a close, not distant (as commonly supposed), relative to bread wheat. Modern scholars generally agree that references to spelt in the Bible are incorrect; better translations identify that early wheat as (tetraploid) emmer. With its tenacious, coarse husk, spelt has always presented difficulties in processing for use in human foods, although it was in rather popular use in northern and middle Europe especially during the Middle Ages. More recently relegated almost entirely for use as animal feed (much like the fate of oats), spelt was overlooked during the last century as a likely candidate for "improving" through hybridization, and it may be thanks to its status as the "homely spinster sister" of glamorous bread wheat that it remains more true to its original genetic inheritance.

Bakers will notice that spelt has more protein and fat than modern bread wheat, producing a heavier product than the starchier, lighter hybrids–another strike against it as far as commercial bakery products standards go. It fares much better in sourdough applications where its flavors can develop fully, and long souring enhances its digestibility. There are numerous anecdotal reports of those with wheat allergies tolerating spelt products, but it is wise to be cautious as all aspects are not fully understood. At the very least, though, suspicious evidence begs a thorough investigation into the nutritional changes wheat has undergone in the thousands of forced hybridizations of the last half-century.

FLOUR BLEACHING

Most flour mills bleach their products with either benzoyl peroxide (the active ingredient in acne cremes and hair dyes) or chlorine dioxide, a potent poison also used to bleach paper products and textiles. Some add potassium bromate to artificially strengthen the flour, and in fact commercial bakeries have relied on this "improver" to permit flour to survive the violent and/or brief mixing times used and still create dough structure. Potassium bromate is a recognized carcinogen banned since 1990 in the EU, Japan, Australia, New Zealand and Canada, but in the US the FDA has suggested only a voluntary curb.

AND IN ADDITION

In the factory bakery, the mixing of flour with municipal water and other "functional ingredients" can include, but is not restricted to, any of the following:

- Soy or canola oil and shortening (GMO), which gives products larger volume, finer cell structure, tender crust and soft texture;
- Esters of mono and diglycerides, which act as emulsifiers and anti-staling agents;

- Calcium propionate, a mold-inhibitor shown in studies to cause irritability, sleep disturbances and inattention in children, even at very modest intakes;
- Sodium stearoyl 2 lactylate, which increases dough absorption, improves mixing tolerance and machinability of dough, accelerates proof time, improves grain and texture, creates crust tenderness and extends shelf life;
- GM soy flour, goitrogenic and loaded with inhibitors, which creates whiter crumb;
- Dextrose, an easily fermentable sugar to feed yeast;
- Diacetyl tartaric acid, a chemical leavener;
- Azodicarbonamide, a flour oxidizer banned in EU, Canada, Japan, Australia and New Zealand, but permitted in US;
- Ammonium chloride, a form of nitrogen used by yeast to build protein;
- Gluten–yes more gluten–added for better texture and doughiness;
- Starch enzymes and several protein enzymes derived from GM technology to rapidly break down starches to sugars to feed the yeast and to "mellow" the gluten to allow for reduced mechanical mixing times. These enzymes are also engineered to survive baking temperatures and great variations in pH in order to impart anti-staling and softening qualities to the finished products. Enzymes and several of the other "improvers" are not required by law to be listed on ingredient labels, as they are considered to be "consumed" in the baking process, even though residues have been detected and the express purpose of several is to carry their functions through to the baked product and affect its life on the shelf.

Hidden Sources of Gluten

Bread products and baked goods of all kinds represent the usual suspects as far as gluten sources go, but gluten (wheat starch) is an ingredient in many other processed foods (for example as a thickener or extender in foods lacking honest substance) and also in a surprising array of non-food items. The following list gives an idea of how pervasive gluten is in many consumer products. Check labels, but better, check with manufacturers to be sure of ingredients. As far as food goes, homemade is always best.

- Flavored prepackaged rice or pasta
- Tomato and spaghetti sauces
- Condensed canned soups
- Vegetable cooking sprays
- Flavored instant coffees and teas
- Some veined cheeses such as Roquefort and blue
- Chow mein noodles
- Artificial coffee creamer (all kinds)
- Bouillon cubes or powder, gravy and sauce mixes
- Imitation seafood products
- Ground spices
- Chewing gum can be dusted with wheat starch
- Communion wafers

These label ingredients can indicate the presence of gluten:

- Hydrolyzed plant protein (HPP)
- Hydrolyzed vegetable protein (HVP)
- Modified food starch (source is either corn or wheat)

- Mustard powder (some contain gluten)
- Monosodium Glutamate (MSG)
- Gelatinized starch
- Natural flavoring, fillers
- Whey protein concentrate
- Whey sodium caseinate
- White vinegar or white grain vinegar
- Rice malt (contains barley or Koji)
- Rice syrup (contains barley enzymes)
- Dextrin, malt, maltodextrin

These non-food items may also be gluten sources:

- Lip stick and lip balm Sunscreen
- Glue on stamps and envelopes
- Laundry detergents
- Soaps and shampoos
- Toothpaste and mouthwash
- Cosmetics, lotions, creams
- Prescription drugs
- Health supplements (vitamin pills, etc.)

SOURDOUGH PANCAKES

One way to culture your wheat and eat it, too, is to make sourdough pancakes. A particularly delicious variation is to mix **1 1/2 cups of freshly ground Kamut® flour** and **1 cup water** into which you dissolve about **2 tablespoons starter**. Let the mixture ferment at room temperature for 24 hours (it can stand for as long as 36 hours if needed). When fermented, remove a few tablespoons for your next batch and refrigerate. Separate **1 egg**, mix the yolk into the batter and whip the white. Add **water or milk** to the batter to thin it a bit, then add the beaten egg white and mix thoroughly. Fry as you would any pancake and serve with salmon roe and melted butter, or mushrooms and sour cream.

If you make the pancakes small and thin, and then dry them out in a warm oven or dehydrator, you have a delicious sourdough cracker.

This recipe suggestion is a simple yet effective approach to preparing a cereal food for nourishment as well as an authentic experience of the grain’s flavor development.

The Genetics of Gluten Sensitivity

By Chris Masterjohn

Either of two genes–HLA-DQ2 or HLA-DQ8–is required for celiac disease. [a] And these and several other HLA-DQ genes raise the risk for non-celiac gluten sensitivity.[b]

The HLA-DQ genes determine whether or not your body notices that gluten is in your system, but don't determine whether your body recognizes gluten as harmless or as a foreign invader. In order to recognize gluten as a foreign invader, the immune system must be tricked into recognizing other patterns of events that mimic a microbial infection.[c]

Under what conditions, then, are the immune systems of many people with the pre-disposing HLA-DQ genes tricked into believing that gluten is a microbial invader? No one knows the complete answer, and there may be different answers for different people. The following are a few possibilities:

- Some people may possess as-yet unidentified genes that cause their immune system to think an undigested fragment of the gluten protein looks like a microbial invader.
- Some people who consume gluten may have dysbiosis–damaged gut flora–from antibiotic use or consuming foods that they cannot digest. Feeding infants grains before they are able to digest them may raise the risk of dysbiosis. In this scenario, the immune system may see the products of microbial invasion from the dysbiosis and the undigested gluten fragment at the same time and be tricked into thinking that the gluten fragment is the microbial invader.
- Low-nutrient diets may interfere with the body's ability to suppress immune cells that are capable of attacking harmless proteins. For example, one of the chemicals the body uses to suppress these immune cells is TGF-beta,[c] which is upregulated by vitamin A. [d] A diet deficient in vitamin A, then, might undermine the body's ability to keep its immune system from attacking harmless proteins like gluten.

A sibling of someone with celiac disease who has the same HLA-DQ genes has a 40 percent chance of also having celiac disease, while the identical twin of someone who has celiac disease–who has all the same genes–has a 70 percent chance of having celiac disease.[a] This suggests that there are other, unidentified genes at play, as well as non-genetic factors.

Waiting to introduce grains into a child's diet until after infancy, raising children on nutrient-dense diets that include liberal amounts of fat-soluble vitamins (especially vitamin A), and keeping good care of intestinal flora may all help prevent celiac disease and non-celiac gluten intolerance in those who are genetically susceptible.

References

a. Green and Jabri, "Celiac Disease," *Annu Rev Med* 57 (2005) 207-21.
b. Fine, M.D., Kenneth, "Early Diagnosis of Gluten Sensitivity Using Fecal Testing: Report of an 8-Year Study," http://www.enterolab.com/Lecture/Lecturenew/frame.htm. Accessed May 23, 2006.
c. Alberts et al., Molecular Biology of the Cell: Fourth Edition, New York: Garland Science (2002) 1405-1409.
d. Masterjohn, Chris, "Dioxins in Animal Foods: A Case for Vegetarianism?: Dioxins, Vitamin A, and Cancer." Published October 17, 2005. Accessed May 23, 2006.

REFERENCES

1. NIH Consensus Development Conference on Celiac Disease, June 28-30, 2004 at http://consensus.nih.gov/2004/2004CeliacDisease118html.htm
2. EnteroLab testing procedures and protocols at http://www.enterolab.com/

3. Wheat ancestors lack the gluten immunogenic factors of modern wheat. Mapping of gluten T-cell epitopes in the bread ancestors: implications for celiac disease at http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=15685550&dopt=Abstract
4. Jacob, H.E. *Six Thousand Years of Bread: Its Holy and Unholy History*. The Lyons Press, 1997
5. De Lange, Jacques, "The Bounty of Rye," printed in *Healing with Whole Foods*, Paul Pitchford, North Atlantic Books, 1993.
6. Adulteration and Contamination of Food in Victorian England, by Anthony S. Wohl at http://www.victorianweb.org/science/health/health1.html
7. Michael Gaenzle, discussion on origins of starter microorganisms at http://www.faqs.org/faqs/food/sourdough/faq/
8. DiCagno, R., et al., Sourdough bread made from wheat and non-toxic flours and started with selected lactobacilli is tolerated in celiac sprue patients, AEM, February, 2004, pp 1088-1096, Vol.70, No. 2.

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