Bread and Beer

The Early Use of Cereals in the Human Diet

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This article has an intellectual history that begins with a fascinating exchange in the early 1950s. Robert Braidwood’s field work at Jarmo (see the introduction to this issue) led the botanist Jonathan D. Sauer to suggest that the earliest use of wheat and barley may not have been as flour for bread, but for beer. Braidwood posed Sauer’s question to his colleagues as follows:

“Could the discovery that a mash of fermented grain yielded a palatable and nutritious beverage have acted as a greater stimulant toward the experimental selection and breeding of the cereals than the discovery of flour and bread making? One would assume that the utilisation of wild cereals (along with edible fruits and berries) as a source of collected food would have been in existence for millennia before their domestication... took place. Was the subsequent impetus to this domestication bread or beer?” (1953:515).

The respondents to this question read like a Who’s Who of anthropology and archaeology at that time. These scholars looked at the topic from almost every angle, and tentatively concluded that people never lived by beer alone, but must have lived first by gruel, then by bread, and finally by bread and beer. In the past thirty-five years, much new evidence has come not only from archaeology, but also from the field of human nutrition, and especially from the study of what Katz has called the “biocultural evolution of cuisine.” This information provides new insights into the relationship between people and food in prehistory, as well as a somewhat different answer to Braidwood’s question.

A New Paradigm: The Biocultural Evolution of Cuisine

There are thousands of plants that humans could consume. Yet the number for which there is actual evidence of consumption, either now or in the past, is only in the hundreds, and approximately thirty plants provide over 95 percent of the vegetable calories consumed by the world’s human population today. These staple crops include grasses such as wheat, rice, corn, millet, and sorghum, and root crops such as yams, manioc, taro, potato, and sweet potato. A third group of cultivated plants, the legumes or pulses (lentils, many varieties of peas and beans), are eaten in smaller quantities than the staples, but play an important role because of the high quality of their protein nutrients and the variety that they provide.

The plants we now eat connect us in some remarkable ways with our past. Most of the plants we prepare as foods today are domesticated varieties of the wild plants that our ancestors consumed thousands of years ago. Over the last twenty years Katz has worked on a number of problems that integrate the past and present by examining how traditional peoples select diets and prepare foods that satisfy their nutritional needs. By studying the ways in which natural nutritional limitations present in some modern food plants are overcome by their

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1 During the Paleolithic period, hunters and gatherers utilized a wide variety of plant species. With the beginning of food production in the Neolithic, certain plants began to increase in importance, gradually becoming dominant. But while the number of plant species consumed declined, variety was maintained within the diet through an increase in the numbers of recipes used to prepare plant foods.
Plant defenses present an enormous wall that blocks potential predators. Over time, some organisms are able to scale this wall through long-term evolution, developing specializations to overcome the plant defenses. The key to human evolution is the presence of both cultural and biological adaptations, carefully balanced to unlock plant defenses. The result is a biocultural phenomenon, a set of traditions concerning food preparation that we call "cuisine.

Cuisine

Transformations

PLANT VARIETY

HEATING, FREEZING, FERMENTATION, YEASTS, MOLDS, BACTERIA, ENDOPHYTIC FEEDING, DRYING, HARSHING, SPOILING, CHEMICAL COMBINATIONS WITH OTHER PLANT FOODS

Recipe Variety

Combination of Rituals, Preparation, Timing, Sequence, Parts, Pasts

Food preparation processes transform "raw" or unmodified plant products into "cooked" or culturally modified foods. Variety exists not only in the techniques used to transform foods, but also in the ways in which they are eaten.

for a long period of time, individuals with such genetic traits would have been at a nutritional disadvantage, and their descendents presumably declined in numbers until the gene became rare or totally eliminated from the population.

Such examples of human biological adaptation appear to be rare. The majority of cases where natural plant defense mechanisms have been overcome by humans involve cultural adaptations rather than biological ones. Any change in behavior that can be transmitted by learning can be more rapidly established than a change that is genetically based. Katz hypothesized that the learned behavior that is most effective in rendering plants nontoxic takes the form of food processing, or practices of cuisine. There are, of course, other ways of culturally overcoming plant defenses. For example, those who experiment in cultivation and propagation of a particular plant led to the discovery of a variant that lacked the toxic effects that protected the wild form. While new nontoxic varieties might seem desirable at first glance, the investment of time and labor in such crops would have been self-defeating: the plant's defenses would have been lowered not only to humans but also to all of the other organisms that competed with humans for this food source. These competitors, including insects, birds and other mammals, would have outnumbered and out-lived humans.

So the evolution of cuisine made certain plants more accessible to humans, but only to humans. No other organism could acquire the complex behavior necessary to transform marginally nutritious and outright toxic substances into high-quality nutritious foods; instead they required elaborate genetically based digestive and metabolic adaptations. Hence Katz has proposed that our ancestors, like us, overcame plant defenses in the proverbial "cooking pot" (Fig 3). This process will probably continue into the future. With modern scientific understanding of this largely empirical process, it is possible that plants not yet edible will be consumed in the future, once we learn their chemical "secrets."

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The study of processes of adaptation such as those described above has led to a basic change in the way that many anthropologists view the process of human evolution. Katz's "paradigm" or conceptual approach has developed that does not treat biological and cultural evolution as isolated phenomena, but instead examines the relationship between the biological and the bioculturally evolved capacities of the human species. This biocultural hypothesis has suggested that the evolution of culture is not a "cultural" or "biological" evolution in isolation, but rather a co-evolution of biological and cultural systems. This means that the relationship between humans and their environment is not a linear one, but rather a complex interaction of biological and cultural processes. The study of human evolution requires an understanding of both biological and cultural processes, and the interplay between them.

nervous system. Biologically, the central nervous system has highly specialized capacities; these capacities permit the transmission of cultural information that in turn helps to "program" the central nervous system. Thus, the specific form that human behavior takes is the result of both biological and socio-cultural factors. Both systems of information evolve and are critical for the survival of a particular human population in the environment that it exploits.

Given this feedback process, one important concept of the biocultural evolutionary process is the unreasonably long time that humans take to reach full maturity. It is widely accepted that this extended period of growth and development is a biologically critical role in the process of stabilizing the content of traditions that are passed from one generation to the next, as well as the social context through which they flow. Once stability has been achieved, the trial and error processes that lead to the evolution of specific traditions is no longer necessary.

Among the most crucial traditions are those related to subsistence: the acquisition, processing, and consumption of food. One general pattern in the evolution of subsistence traditions can be observed worldwide. The domestication of plants and animals marks a turning point in the relationship between foods and food-processing technologies. Plants that were once wild foods were domesticated and became staple crops. This led to the formation of elaborate agricultural systems, which in turn led to the development of complex social structures and political systems. The result is a cycle of evolution, in which new technologies for food processing and new agricultural practices lead to the formation of new social and economic structures.

The process of human evolution is not a simple linear progression from the past to the present. Rather, it is a complex interplay between biological and cultural processes, in which both systems of information evolve and are critical for the survival of a particular human population in the environment that it exploits.
The Origins of Food Production

The model of biocultural evolution provides us with insights that are useful in attempting to answer a question that still confronts archaeologists: How did the "Neolithic Revolution" ever get started in the first place? The complex processes by which people domesticated plants and animals occurred independently in several regions of the world. In this article we will consider only the Near East, and specifically the factors that led to the domestication of cereals.

At present, the earliest known domesticated plants in this region have been found at sites in the Levant, the area that is now Syria, Jordan, and Israel. Rare seeds of wheat, barley, and lentils that differ in shape from their wild ancestors appear at settlements such as Tell Aswad, Jericho, and Nahal Oren by ca. 9000 B.C. (Fig. 4). At earlier sites, occupied by hunters and gatherers (known collectively as the Natufian "culture" or "tradition"), the presence of sickle blades, grinding tools, storage pits, and seeds indicates that wild cereals were harvested at many locations.

Over the last two decades, many archaeologists have favored environmental factors as causal elements leading to experimentation with the cultivation of wild cereals. Briefly, they theorized that as climatic conditions changed at the end of the last glaciation or Pleistocene period, groups in the Near East, and especially in the Levant, gradually became more dependent on one wild resource—the easily collected and stored wild cereals. (The extent to which cereals were present within this region during the Pleistocene is not certain; evidence from pollen cores as well as from archaeological sites does indicate that wheat and barley were more widespread and abundant during the warmer, wetter

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motives may have been critical in the shift from hunting and gathering to food production. This point of view was summarized by Robert McC. Adams: [I find] it hard to escape the impression that throughout the entire Near Eastern prehistoric sequence, there was a lot of room to rattle around in. Where, and how densely, people settled, then, is more likely to reflect a culturally constrained choice among subsistence or other locational preferences than a decision imposed by an uncontrollable decline in the net balance of resources over needs (Young et al. 1983:371).

Our own explanation for the beginnings of cereal cultivation is consistent with the biocultural model for the evolution of cuisine. The key element in this explanation, the event that "primed the pump" and led people to invest energy in the collection and propagation of wild wheat and barley, was the discovery of new food processing techniques and their fermentation of these grains.

Fermentation: The Key to Alcohol and Nutrition

Suppose that the consumption of a food produced an altered state of awareness or consciousness that was noticeable, but that did not have serious toxic side effects such as motor impairment. Now suppose that this food also had a second, imperceptible effect, a substantial improvement in nutritional value over the unprocessed wild cereal grains. This is exactly what happens when barley and wheat are fermented into beer.

We suggest that among the factors that led to the domestication of wild cereals were the following. First, the motivation for a change in behavior (an allotment of time and labor to the collection and eventually to the propagation of cereals) was provided by a noticeable pheno-

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meneon—the "high" that people obtained from beer. Second, individ-

uals and groups who consumed beer were better nourished than those who consumed wheat and barley as gneu or who ignored these wild resources. Beer would have had sustaining powers well beyond any other food in their diet except animal proteins. In biological terms, beer drinkers would have had a "selective advantage" in the form of improved health for themselves and ultimately for their offspring. Third, cereals were a desirable resource because of the ease with which they could be harvested, transported, and stored from year to year. In the following section we will examine the first two factors.
Beer in Mesopotamia

The most ancient documentary evidence for beer production comes from Mesopotamia, written in the Sumerian language on tablets that date to the 3rd millennium B.C. The world’s oldest recipe is for beer! A highly detailed description of the brewing process is related as part of a myth that tells how Enki, the third-ranked god in the Sumerian pantheon, prepared a banquet for his father, Enlil, the second-ranked god. A second recipe is found in a hymn to the beer goddess Ninkasi, whose name is translated as “the lady who fills the mouth.” Lesextals contain long lists of very specific terms related to brewing techniques. Rations of beer (as well as barley) were issued to those attached to the estates of Sumerian temples and palaces, ordinary laborers receiving about one liter per day. In general, we can say that beer was an important food that was integrated into the mythology, religion, and economy of the Sumerians.

The purely personal pleasure that these people took in beer drinking is summed up in the following song, written to celebrate the building of a tavern. The toast in the second verse quoted here is addressed to the tavern keeper, who is apparently a woman:

“Let the heart of the goblet [fermenting] vat be our heart! What makes your heart feel wonderful, makes also our heart feel wonderful. One beer is happy, our heart is joyful. You poured a libation over the brick of destiny, you placed the foundations in peace and prosperity, May Ninkasi live together with you! Let her pour for you beer and wine, let the pouring of the sweet liquor exude pleasantly for you. In the...reed buckets there is sweet beer, I will make cupbearers, boys, and brewers stand by. While I turn around the abundance of beer...

While I feel wonderful, I feel wonderful, Drinking beer, in a blissful state Drinking liquor, feeling exhilarated, Walking in the heart and a happy liver—

While my heart full of joy, And my happy liver I covered with a garment fit for a queen!”

(Civil 1966)

Pictorial representations show the vessels used to brew and store Sumerian beer. All have a similar shape, with long narrow necks and a pointed base (Fig. 7). This form also appears on the most ancient (pictographic) tablets, and is translated as “clay container” by Margaret Green of The University Museum’s Babylonian Section. A clay container sign with dashes inside refers to beer (Fig. 8). The beer was consumed from goblets, or from jars through long straws (Fig. 11). The earliest example of this kind of scene, on a stamp seal, is from Tepe Gawra, and extends the period for which we have direct evidence of beer drinking to ca. 4000 B.C. (Fig. 10).

The use of straws has sometimes puzzled modern authors. One expert on the history of technology interprets them as evidence that the beer was of “doublet quality” (Hodges 1970:115). Leaving aside the question of what constitutes a good-tasting beer, a study of traditional methods of brewing in Africa provides a very practical explanation of the straws. The Sumerian texts describe both filtered and unfiltered beers. In drinking unfiltered beer, a straw would have been necessary to penetrate below a layer of hulls and yeast floating on the surface. Most straws were probably made from reeds, but the wealthy used pure gold straws such as the one found in the tomb of the lady Pu-abi at Ur (Fig. 11). Pu-abi’s straw was lying next to a silver vessel that presumably contained her daily ration of beer.
The enormous nutritional potential provided by cereal proteins and vitamins made the cultivation of these crops biologically as well as economically profitable. Both wheat and barley are largely composed of complex carbohydrates, with approximately 13-20 percent protein and a small amount of fat. As a source of food, they are limited in several ways. First, both of these cereals have low levels of the essential amino acid lysine; without lysine, most of the remaining amino acids in wheat and barley cannot be synthesized into usable proteins by the human body. Second, barley (but not wheat) has low levels of the essential sulfur-containing amino acids (see below). Third, B vitamins (riboflavin, niacin, and thiamine) are too high in wheat and barley, but not in sufficiently high levels to meet basic nutritional needs. Fourth, these grains, in particular wheat, are high in the concentration of substances called phytates that bind essential minerals like calcium and prevent their absorption in the digestive tract.

It is yeast that converts the cereal grains from a nutritionally limited source of proteins and vitamins into an outstanding source of human nutrition. Both brewing and the making of many types of bread involve the growth of yeast cells. Yeast produces a rich source of lysine, significantly improves the B-vitamin content of the mixture, and decreases the concentration of phytates, thereby permitting the absorption of more essential minerals such as calcium. Some of the vitamins that are enhanced are not available from other plant sources, and the disadvantage of yeast is that the adult human can consume only about 20-35 grams of yeast mucic acid per day. Beyond that level, a build-up of serum uric acid occurs that may cause high blood pressure, gout, and kidney abnormalities.

Wild yeast is present in the air. The simple exposure of unsterilized cereals and water, whether in the form of a thin gruel or a thicker dough, will result in the multiplication and growth of yeast cells. For example, the sourdough used by pioneers in the American West and Alaska was made by combining flour with milk or water and keeping it in a warm place until it began to bubble from the activity of the airborne yeast. Once established, a yeast strain can be saved and used as a starter to ensure the quality of the next batch of bread or to speed up the fermentation process. The critical step that differentiates bread from beer is the addition of diastase enzymes that convert the cereal starches into sugar, which is used by the yeast to be eventually turned into alcohol. Traditional brewing techniques increase these levels through the addition of malt, or spiced it by yeast that had been exposed to the Tradition Methods of Bread and Beer Making system of drawing out sugar from the grains. The process of making beer is to soak the cereals in water. A substantial amount of diastase enzymes form in the root tips. Yeast is not as efficient as barley in breaking it down to ferment, but barley produces enough diastase to break down the starch of an almost equal quantity of wheat. The value of a mixture of wheat and barley is that wheat adds the sulfur-containing amino acids that barley is low in. If the process of growth is allowed to continue, the amount of diastase present continues to increase. The sprouted cereal is therefore left to parch in the sun or is artificially heated until lightly toasted, as a result the rootlet dies, but the diastase enzyme levels remain high.

Once the sprouted cereal is dried out, the softened hull is easily ground. When the ground malt is added to a mixture of hot water, the conversion from starch to sugar begins. This process is known as "mashing" the ground starches, obtained from heating water and raw cereal grains into a porridge, are most susceptible to the effects of the diastases, so that the barley diastases are often mixed into a cooked porridge of water and cereal grains. During fermentation, the maltose feeds the yeast so that it grows. This process will be slowed if alcohol (or some other metabolic product) is present; if two other conditions are met: the ferments can be both acidic and anaerobic (without oxygen). Acid conditions can be maintained by allowing the porridge to sour overnight through the introduction of lactic-acid-producing bacteria from the air. Once such bacteria are found, they can be kept alive as a starter along with the yeast, and transferred from an old brew to a new one. Anaerobic conditions are also relatively easy to obtain. When there is sufficient starch to begin, grow carbon dioxide forms and bubbles up to the surface. If the beer is in a container shielded from the air, the carbon dioxide will itself shut off enough oxygen to ensure alcohol production.

It should be noted that beer and bread are not nutritionally equivalent. The nutritional value of bread requires the full transformation of sugar into carbon dioxide and water. If alcohol is produced, yeast will grow and sugar declines; there is, therefore, an inverse relationship between the amount of sugar left and the nutritional value of the resulting cereal product. Under optimal conditions, 4 percent of the energy of the oxygen supply is carefully regulated and the resulting beer will contain about 15-20 percent of the energy.

Traditional brewing methods, however, are less controlled, allowing air to reach the mixture. As a result, the alcohol concentration is only 5 percent or less, leaving plenty of sugar to be fermented. For example, Soho sorghum beer (see box with recipe) contains about 3.5 percent alcohol. On the other hand, bread production requires heat, which kills the yeast and stops the conversion of the protein content.

Within the contest of the argument presented here, it seems likely that beer may represent a more efficient way to enhance the nutritional value of cereals. In a very primary way of preparing and consuming wheat, is not strictly traditional methods of bread and beer making.

**BEER**

**Traditional Methods of Bread and Beer Making**

**Bread**

In the Middle East today, most of the bread eaten by town or city dwellers is made by specialized bakers. Produced in a great variety of forms, these breads are usually relatively thick and resemble European love breads in texture and flavor. Traditional flat breads are, however, still made by village housewives for their own families. The following recipe is from Iran, is typical of breads produced from Turkey to India, usually on a domed metal plate over an open flame (Fig. 3). It has been modified for the American kitchen.

Lavoah (pita) 2 cups warm water 1 tsp. salt 3 cups all-purpose white flour for rolling

Dissolve yeast in warm water. Add salt and mix well. Mix in flour and knead using an electric mixer with a dough hook or by hand for 10 minutes. Cover with a damp cloth and let dough rise for 2 hours. Divide the dough into 20 equal size balls. Roll as thin as possible and place on a cookie sheet that has been warmed and sprinkled with flour. Bake for 1 minute in a 500° oven. Serve hot, or cool for a few minutes and store in a satchet container. Can be easily reheated in a toaster. (Traditionally, lavoah is freshly frenshed by sprinkling it with water.) (Chanoonparvar 1982)
relevant. Relative quantities of vitamins and proteins are not immediately perceptible to consumers, and could only be determined by very conscious decision-making in 10,000 B.C. Traditional unfermented beer with low alcohol. (At this time, neither of the worthily valuable food; but more importantly, the presence of alcohol signifies a subtle social and religious aspect of its consumption, its cultural value.

A Hypothetical Reconstruction

Although few seeds have been recovered from Natufian sites in the Levant, the presence of sickle blades, storage pits, and stone pounding and grinding tools from sites dating to 10,000 B.C. (the Terminal or Epipaleolithic period) has been interpreted as evidence for the cultivation of wild cereals by groups of hunters and gatherers. At contemporary sites in Syria, large quantities of wild wheat and barley as well as legumes have been recovered from hearths. If wild cereals prepared as food? The first step was probably to pound the seeds in a stone basin. Wheat and wild barley (as well as early domesticated varieties) are husked cereals and are not freed of threshing. Epipaleolithic groups could have broken up the husks by placing the grain in mortars and pounding them with pestles—tools that are usually not found at these sites. Alternatively the cereal could have been "parboiled" or roasted on an open fire. Water was usually added to the pottery vessels nor ovens with closed firing chambers were in use.

The Critical Role of Beermaking in Domestication

The essential difference between bread and beer as a means of exploiting cereal-grain resources is that bread is dried and baked while beer is made by fermentation. One major advantage of bread (in addition to the fact that it does not contain alcohol) is that it could be made faster than beer. It is also more portable, and can be carried on expeditions. One study has shown that the hunters and cultivators of the southern Levant (the area in which domestication appeared) in the absence of carbohydrates (as indicated by present evidence) did cereals were only a minor part of the Natufian diet (see Silk, this issue). A low dependence on cereals could also be inferred from the near absence of charred cereals. In the case of the Natufian camps and villages in this region and from sites where domestication began, we would observe increased yields of domesticated barley, two of domesticated wheat, and three pieces

of unidentified legumes (o). On the other hand, charred seeds are common at Natufian Abu Hureya and Mugharet el-Hamam, and the presence of wine suggests that either the picture of Natufian diets is distorted by the preservation bias or that the amount of wild cereal consumed varied significantly between regions. Regardless of the different ethnographic and ecological conditions, we can return to our initial question: Under what conditions would a group be likely to consider a wild plant resource be sufficiently important to lead to a change in behavior (as evidenced by wine making) in order to ensure an adequate supply of this resource? If wild cereals were in fact a minor part of the diet, any argument based on caloric need is weakened. It is our hypothesis that if a group considered alcohol would constitute a perceived psychological and social need that might easily prompt changes in subsistence behavior. This type of need would be present whether beer or wine was actually consumed. As a result, it would be possible to identify Neolithic beer drinkers from their skeletal remains, especially in the case of the older members of a population.

The desire for alcohol would constitute a perceived psychological and social need that might prompt changes in subsistence behavior.

(1) The scattered but sometimes abundant wild cereals were gathered by groups living in the natural habitat cones of the wild cereals.

(2) After initial use of the cereals in a gruel or porridge, the technology of brewing was developed in a series of steps including: the accidental sprouting and drying of the cereals which assisted in the reduction of the hull or seed coat; discovering the sweet taste of the sprout; the use of fermenting of the sprouted cereals in a gruel that was left to stand for some period; the observation that certain grains of sprouted barley and wheat would spoil, but instead tasted sweet and had distinct effects on the mind and consciousness.

(3) Alcohol gained importance to the society because of its social uses. Of course, alcohol could have been made from other foods such as honey or fruit. A cereal-based brew, however, would have had two additional benefits, one readily observable by the members of the community and one hidden: it would have allowed the rare and seasonally restricted sweetening agents to be used with other foods other than alcohol. It also permitted the production of beverages, and it would have added a new high-value food to the diet.

(4) Once alcohol had been incorporated into specific social and/ or ritual events, maintaining a supply of the plants necessary for the preparation of this beverage would have some importance. When the supply was adequate, the availability of numerous charred grains after ca. 7000 B.C. is related specifically to the quantity of beer. The historical and ethnographic records provide evidence of the value placed on beer. Within the area where cereal domestication took place, the Near East, the earliest known evidence for the production of beer are the Late Neolithic artifacts of the Shesta culture. The importance of beer to the Neolithic art testify to its importance. Studies of modern traditional groups in the Near East demonstrate the simplicity of the technology, and the ease by which critical steps of the process can be mastered. Ethnography also indicates the extent to which alcohol and other drugs were prescribed by the deposition of the grapes (arica acid salts) in and around the jars. If the grapes leave any kind of permanent mark on the bone itself, it may eventually be

the desire for alcohol would constitute a perceived psychological and social need that might prompt changes in subsistence behavior.
that maintained the cereals from generation to generation until they were fully under human control, or "domesticated." Based on present archaeological evidence, this process probably occurred within the natural habitat zone, when the supply of wild cereals was disrupted for an unknown reason. Should new excavations securely place the earliest domesticates outside the natural habitat zone, such experimentation would have served to ensure a supply of cereals in the immediate vicinity of new settlements.

To summarize, it is possible with a careful assessment of the facts about nutrition to propose behavior-al sequences that could parsimoniously explain the facts discovered by archaeologists. Careful analysis of nutritional biochemistry can lead to generalizations about the human diet and its relations to biocultural evolutionary processes. This yields the hypothesis that the early intensification in the use of barley and wheat, leading eventually to their domestication, could have stemmed from the desirability of alcohol-containing beers. Under controlled circumstances, alcohol could provide a cultural and social advantage. Unlike other alcohol-yielding brews that were probably available to people at this time, beer would have also had an enormous biological advantage. It enhanced the original nutritional quality of a readily available plant to a level almost comparable with that of meat. Finally, we leave each reader with one last test of any hypothesis, its plausibility. Given a choice of gruel, bread, or brew, which would you rather have with your next meal? 24

"Given a choice of gruel, bread, or brew, which would you rather have . . .?"

Mary M. Voigt is a Research Specialist in the Near East Section of The University Museum. She has conducted archaeological field work at early farming villages in Iran and Turkey. Her interest in beer had an early start. Her grandfather kept a tavern in a small town in Wisconsin, and as a small girl she was sometimes allowed to draw beer and sweep away the excess foam with a bone spatula. As a Milwaukee resident for nearly 20 years, she developed strong opinions on beer quality and conducts frequent taste tests.

Solomon H. Katz is a professor of anthropology at the University of Pennsylvania, and the director of the Kroghman Center for Research in Child Growth and Development. He has been conducting scholarly research into the biocultural evolutionary basis of cuisine over the last 15 years. The idea for this particular paper arose as a result of a lecture he presented to Prof. Bernard Wailes's archaeology seminar, in which he was asked to comment on the evolutionary significance of fire for cooking. Subsequently, he was encouraged by the work of Nelson Friemer, one of his students, to consider the nutritional advantages of beer. About 5 years ago, with the help and encouragement of Mary Voigt and the insistence of Bernard Wailes, he presented a paper on this to the MASCA group on nutrition. Within the next year he had also collaborated with the late Prof. Sandborn Brown of M.I.T. on a "beer paper" for a symposium on religion and food in ancient Egypt for the American Association for the Advancement of Science. Finally, he received further bibliographic assistance from Denny Silverman, an undergraduate at Penn, and considerable encouragement from his son, Noah, who after hearing of this paper presented him with a complete brewing outfit for his birthday (for experimental purposes).

General Bibliography


Beer in Ancient Times


