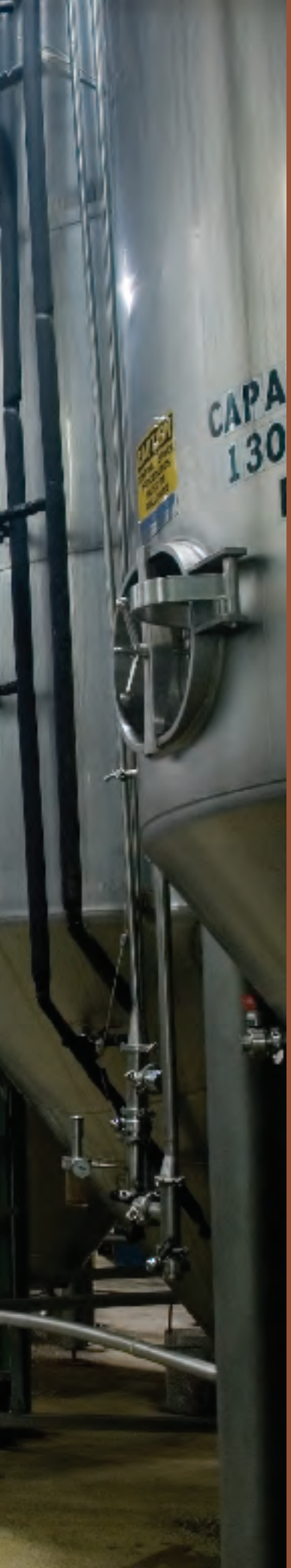

Brewing Beer

By Mike Field

Beer is a drink that gets no respect.

Really.

Never mind that it is the oldest and most widely consumed alcoholic beverage in the world. Or that it is the third most popular drink of any kind, after water and tea.

To most of the world, beer is ***the*** *everyday tipple of the average Joe. It's suds, brewskis, grog or, as oft remarked after five or six mugs, it's the liquid you don't buy, you rent.*

Beer has been consumed since the dawn of civilization. The ancient societies of Egypt and Mesopotamia left extensive records of their beer production and consumption 2,000 years or so before the Greeks and Romans made a cult of their fancy fermented beverage stomped from grapes. It was probably those same Greeks and Romans who first insisted on the great dichotomy that persists to this day: we are *civilized*, we drink wine; they are *barbarians*, they drink ... well, uh, *beer*.

But take heart, beer drinkers, and don't let the wine drinkers intimidate you. The reason beer is so popular, say the experts, is because it's so darn good. "There is a beer out there for everyone," says Charlie Papazian, president of the Brewers Association, and author of *The Complete Joy of Home Brewing*, widely considered to be the home brewer's bible. "Quality beer is not a geographic heritage. There are high-quality beers being made almost anywhere you go in the world."

Not only is beer less dependent on geography—as any wine connoisseur will tell you, the influence of soil and climate is the secret to great wine—but beer also has the advantage of great consistency of quality and taste, particularly with the modern brewing techniques developed in the last century. After all, when did anyone ever say, "Ah, that was a bad year for Budweiser"? Beer can deliver the same delicious taste, bottle after bottle, year after year.

And those years can add up, if beer is drank in moderation. As strange as it may now seem, for most of human history beer was considered a health tonic, and was especially recommended for new mothers who were nursing. In part this was because most sources of water were suspect, often containing pollutants and pathogens that could cause

"... for most of human history beer was considered a health tonic ..."

disease and death, such as the cholera-causing bacterium vibrio cholerae. Beer, which is brewed by boiling, filtering and infusing with hops (which have strong antiseptic properties), is by contrast pathogen free. In much of the world, including major European and American cities, it was actually safer to drink beer than the local water supply until well into the 20th century.

In addition, since for much of human history the average person faced regular and prolonged periods of insufficient food supply, the calorie-rich profile of a hearty beer was an important dietary supplement. The ancient Egyptians, whose beer was produced as an adjunct industry to their barley-based bread bakeries, brewed their beverage from bread remains and served it unfiltered with hunks of old bread still in the solution. This they drank morning, noon and night, as often for the calories as for the alcoholic lift it provided.

That alcoholic content of beer—which typically ranges from 3 percent to 8 percent ABV (alcohol by volume)—is, of course, the matter that has made beer suspect in the eyes of many ever since the rise of the temperance and Prohibition movements in the mid-19th century. But more recently evidence has emerged that perhaps the ancients' belief in the value of beer was not as misguided as once supposed. Beer is laced with significant amounts of magnesium, selenium, potassium, phosphorus, biotin and B vitamins, with the darker brews typically being the more nutrient dense. Many studies, going back to Johns Hopkins University researcher Raymond Pearl's 1926 book, *Alcohol and Longevity*, have demonstrated that drinking alcohol in moderation is associated with greater longevity than either abstaining or drinking heavily. In the late 1990s the American Cancer Society released a study surveying 490,000 people over a nine-year period that showed that men and women who had at least one alcoholic drink a day (such as beer) averaged a 21 percent lower risk of death than nondrinkers. Moderate drinkers in the study reduced their risk of heart disease by 30 to 40 percent, in part, it was thought, because of higher levels of HDL cholesterol (the good cholesterol) produced through moderate alcohol consumption. In persons who consume three or more drinks per day, however, total mortality climbs rapidly with increasing numbers of drinks per day.

All this from a beverage that is, at least at first appearance, surprisingly simple to concoct. Beer is an alcoholic drink obtained by mixing ground-up malted barley with water, fermenting it with yeast, and flavoring it with hops. Sometimes, other grains can be used in addition to, or as a

replacement for, the barley. The malted barley and yeast used to create fermentation are the basis of beer, but only part of the flavor equation. As one American brewery famously asserted, "it's the water" used in making beer that has a strong influence on the final taste, and most especially, the hops.

But beer starts as a grain, and in 90 percent of all beers (the notable exception being the German weissbiers, made from malted wheat) that grain is barley, a notoriously hard seed that grows in clusters on a stalk of grass and that, once cracked open, leaves an unpleasant aftertaste if eaten. Luckily for all, about 10,000 years ago someone figured out that if you soaked the seed in warm water for two or three days and let it begin to germinate, then dried the seeds before they actually sprouted, the resulting half-germinated seeds—known as malt—were soft enough to be easily chewed or milled, and a great deal better-tasting to boot.

Malting barley is a science and an art unto itself, and from the earliest days of beer production brewers have relied upon maltsters —specialists who coax the seeds into germinating just enough before toasting them dry—to provide the fundamental ingredient in their craft. These days, malts are dried in a process known as kilning. Just like in coffee, the

Partially germinated barley seeds are dried in a kiln to produce a finished malt. Temperature increases are gradual so that enzymes in the grain are not damaged. Higher drying temperatures produce deeper colored and more flavorful malts.

Whose Beer is Better?

Unless you're willing to insult his mother or stomp on his national flag, there is probably no surer way to pick a fight than to disparage another man's beer.

All the world will readily acknowledge the supreme craft of Swiss chocolates and French wines, Colombian coffee and Turkish tobacco, Scottish whiskey and English gin. But beer, well, that's another matter entirely. Even the most pacific of internationalists can become a fire-breathing loyalist xenophobe if greeted with the suggestion that maybe another country's brew is better.

Englishman Charlie Bamforth, when leaving his native land to take up teaching and research duties as the first Anheuser-Busch endowed professor of malting and brewing sciences at the University of California, Davis, was asked how he would be able to endure the "weak and tasteless" American brews after a lifetime drinking lovely English ales. His answer, recounted in his book *Beer: Tap into the Art and Science of Brewing*, captures perfectly the great variety of occasions where the right beer makes all the difference. An English ale with a plate of shepherd's pie before a blazing fire on the hearth can't be beat, he says, but "if I'm in a baseball stadium, seventh inning stretching with a pile of nachos topped with jalapenos ... an ice-cold Bud is to die for." And as for American beers being "weak" he concludes: "Do remember that a U.S. lager will typically contain 20 percent more alcohol [at least] than an ale from England."

If only the controversy over national brewing prowess could always be so amicably settled. There are, however, many national and international beer tasting and judging events, the most respected of which use a kind of "double blind" system so that neither the people pouring and serving the beer, nor the judges tasting it, know the brewer or nation of origin for each sample. One example is the 2006 Brewers Association World Beer Cup, held this April in Seattle, which claims to be the world's largest and most diverse international beer competition for commercial breweries. This year, 2,221 beers competed in 85 beer style categories, with 540 breweries from 56 countries participating. The event required the services of 109 judges from 18 countries (though half the number were from the United States, as were three-fifths of the breweries in competition).

When the dust had settled, American breweries came away with medals in 73 of the 85 style categories, and took four of the five Champion Brewery and Brewmaster awards. Brewers from Germany placed second, earning medals in 18 style categories as well as the Champion Brewery Award in the small brewing company category.

A ringing endorsement for the superiority of American beers? Not so fast, says World Beer Cup sales and marketing director Cindy Jones, who helped plan and run the event. "The brewing community is very open and very friendly," she says when asked to describe the atmosphere at the competition. "Brewers are always traveling to other countries to visit other breweries and sample their beers. More than anything, this competition is about raising the bar to make better beer available everywhere. One of the gold-medal winners this year [in the category of American-style 'light' beer] was from Iceland. When that was announced, they received their award to thunderous applause."

Craft Beers

Beer can be fragile. In the days before pasteurization, rapid transportation and widespread availability of refrigeration, it simply wasn't practical to package and ship beer great distances. Every city and town had its own brewery—sometimes several—and, through the influence of the water supply and local conditions, its own favored style of beer.

But with the advent of modern production and packaging techniques, and climate-controlled shipping and storage, beers began to travel. In the United States, a tremendous consolidation of breweries took place through acquisitions, mergers and bankruptcies, until by the 1960s there were fewer than 50 breweries left. For the most part, American beer drinkers could choose between a couple dozen similar styled lagers.

Then, in the late 1970s, President Jimmy Carter signed a bill legalizing home brewing. Interest in different kinds of beer began to grow, and soon the country witnessed the birth of the first microbreweries—small, often single-owner brew houses that produced fewer than 15,000 barrels of beer a year. These operations were then joined by brewpubs, even smaller on-premises beer production facilities coupled with some kind of restaurant that sometimes had production capabilities of only a few hundred barrels a year.

In the following decades, literally hundreds of these operations, focusing on traditional by-hand brewing styles, would pop up all across the United States, and their product would eventually come to be known as craft beers. Today, there are nearly 1,400 breweries in the United States, the great majority of them devoted to making relatively small batches of hand-crafted beers and ales.

In the 1980s, Baltimore's Hugh Sisson opened the first brewpub in Maryland (a friendly state senator helped change state law to make it happen) and one of the very first brewpubs in the entire country. "It was exciting, I became the brewer," recalls Sisson, who had to first fly to England to get some pointers on how it was done. "Luckily, in those days, the market was much more forgiving. Some of my early beers were not very good by any standard. Mash control in particular was a problem, and it took a while to learn how to make beers that weren't kind of thin and grainy."

Microbrewing has come a long way in the past two decades, and today some of America's most prized and favored brews are craft beers. Sisson is now general partner in Baltimore's Clipper City Brewing Co., which distributes its three product lines in 12 neighboring states. He says that microbreweries, brewpubs and craft beers in general are here to stay.

"If you look at the overall trends, people are trading up. I mean, who would have thought of a Starbucks, and $4 for a cup of coffee? But people don't bat an eye, because they realize they are getting more flavor for their money. And that's what craft beers deliver."

longer the time and higher the temperature used, the darker the malt and, ultimately, the darker and more full-bodied will be the beer. Malts destined for ales are generally kilned to a higher temperature, while lager-style beers usually rely on malts that are only mildly kilned.

Once the proper malt has been achieved (usually done in a malt house as opposed to a brewery), the toasted, half-germinated barley seeds are sent to the brewery. There, they are ground in a mill to a fine flour. This is the basic ingredient the brewer starts with, mixing the flour with warm water in a ratio of about three parts water to one of flour. This process is known as mashing, and takes place in a mash mixer, an enclosed vessel with a large mixing blade that can be adjusted to raise the temperature of the liquid contents to 65 degrees Celsius (149 degrees Fahrenheit) or more, a point at which enzymes in the malt will begin converting the plant starches into fermentable sugars. After about an hour the temperature of the mixture is raised again, this time to a point that will stop most of the enzymatic activity.

Now the mash is pumped into a large, shallow vessel called a lauter tun, in which the large particles and residual spent grains will settle off, and the sugary liquid portion of the mash, known as the wort (rhymes with Bert), is filtered out and run to the kettle. The remaining spent grains are rinsed with hot water (or sparged) to extract all additional fermentable material, and then eventually sold off as cattle food.

Most people, if they have any mental image of a brewery, think of large, round-shouldered, gleaming copper kettles topped with a straight vent stack. In fact, most commercial breweries today use stainless steel kettles, though through traditional usage they are still called the "copper." Here the wort is boiled, which both sterilizes the drink and drives out proteins that might make the beer cloudy. Boiling also eliminates any of the barley's distinctive "grainy" aftertaste that might have survived the malting and mashing processes.

At some point during the boil, brewers add beer's "special ingredient," hops, which is derived from the flower cone of the female hops plant, a hardy perennial herbaceous vine that is singularly remarkable for the fact that it is grown only for beer, and has no other commercial agricultural purpose. Hops gives beer its characteristic nose and bitterness, depending upon how it is used. Although the cost of hops is

Above: Malt is ground to flour and mixed with water to produce mash, which is then sent to a lauter tun. Here large particles will settle off and a sugary liquid called wort is left. Right: After hops are added to wort, the mixture is sent to fermenting tanks for up to several weeks.

less than 1 percent of the cost of a pint of beer, the end effect on product taste and quality is enormous. There are many ways hops flavoring can be introduced into the beer-making process, as dried cones, in a pulverized pellet form, and as essential resin and oils.

After the boil, the hopped wort is filtered, cooled and transferred to fermenting tanks, where it is "pitched" with yeast. Here again there are many different strains of brewing yeast, and brewers jealously guard and protect their own strains to ensure a consistent and identifiable taste to their beer. Beer is best fermented at low temperatures (in the range of 6-20 degrees C or 43-68 degrees F), which is why, in centuries past, the best beers were made in the winter months.

Depending upon the kind of beer brewed, the fermentation process can last anywhere from several days to several weeks. When fermentation is complete and the correct alcohol content has been achieved, the yeast is harvested for re-use in the next fermentation, and the clarified beer is "conditioned" at about 1 degree below freezing for three days or more to encourage more proteins to drop out of the solution and prevent cloudiness. The final product is filtered, "enlivened" with additional carbonation if necessary, and packaged in kegs, cans or bottles.

Unlike wine, the sooner a new batch of beer is drank, the better. "One of the biggest misconceptions out there is that canned beer lasts forever," says Ray Klimovitz, technical director of the Master Brewers Association of the Americas, the trade association of brewers and maltsters in the Western Hemisphere. "I hear of these guys who buy cases of beer on sale and store it in their garage for months at a time. That's not the thing to do. Beer is a foodstuff, like milk, and the fresher the beer, the better."

Some specialty heavier beers, like very dark porters or stouts, will actually improve with age, and Klimovitz admits to having purchased 12 bottles of a favorite Alaskan Smoked

Porter that he is "putting down" and keeping from year to year. "But for the majority of beer, drink it right away," he says, "and if you do keep it, make sure it's refrigerated. That will extend the shelf life quite a bit."

Although beer won't support pathogens, it can spoil, and develop a flat and vinegary taste indicative of the presence of non-lethal bacteria. And almost all beer, unless specially formulated, is extremely sensitive to light. Bitter substances naturally found in the beer, when exposed to light, create an aroma that brewers call "lightstruck" but consumers typically describe as "skunky." Even a few seconds exposure to bright sunlight can start this process of degradation, which is why most beers are packaged in dark brown bottles, minimizing the light invasion and protecting the taste and aroma of the beer.

Which suggests, perhaps, that the ancients had it right: don't let those six-packs just hang around. After all, with more than 1,300 breweries in operation in the United States alone, we may well be in the golden age of beer. A recent study by the Brewers Association found that the average American lives within 10 miles of a brewery. "Good beer is so ubiquitous now," says Papazian of the Brewers Association, "that it's a shame to always drink the same old brew. Get out and be adventurous. It's amazing what you'll find out there."

Special thanks to Hugh Sisson and Clipper City Brewing Co. for their assistance with photography for this article.

Blood Red Beer

Wine plays a ceremonial role in both Judaism and Christianity, but what about beer? Surely somewhere there is a religious rite that uses humankind's oldest alcoholic concoction?

Turns out there is, though it's not one that's been practiced for a few thousand years. According to archaeologist Betsy Bryan, the ancient Egyptians celebrated a special rite in honor of the goddess Mut (pronounced like mute), in which beer was consumed—lots and lots of it.

"We have excavated a temple complex dedicated to Mut and found that it contained extensive bakeries and breweries so that supplicants could purchase beer and bread to provide offerings to the goddess," says Bryan, a noted Egyptologist and professor at Johns Hopkins University. Much of that beer, however, was consumed by the supplicants themselves.

According to legend, in the ancient Egyptian religion, the sun god Ra once grew weary of the human race, and so sent his daughter Mut to destroy it. This she proceeded to do with a vengeance. When Ra decided that perhaps he did not want to destroy all humans after all, he found it difficult to dissuade his daughter, who had developed a lust for their blood. So the sun god arranged to flood the fields of the upper Nile with beer colored red to look like blood.

"Mut drinks it all, and falls into a drunken stupor," recounts Bryan. "When she awakes, she no longer possesses her former blood lust and forgets about punishing humans."

In honor of this event, and to persuade the goddess to forget more recent human transgressions, the ancient Egyptians practiced a "Festival of Drunkenness" in which participants would drink the temple beers, which were specially dyed red to commemorate the occasion of Mut's change of heart.

"The people would come into the courtyards of the temple and they would drink and drink until they were completely drunk," says Bryan. "In the courtyard there was a statue representing the goddess which was also being given this drink. Eventually everyone would just pass out—and the idea was that she had passed out as well." For a time, the inebriated celebrants were allowed to sleep where they had fallen. Then came the painful part.

"A couple hours later another group of people would come in and start playing music very, very loudly, beating on lots of drums until everyone began to awaken. It was believed at that moment, awaking from a drunken stupor, that you could actually experience the presence of the goddess Mut," says Bryan. "That's the moment when they could actually come at the goddess one-on-one and ask her for whatever it was they wanted. And that's really what the Festival of Drunkenness was all about."

By the Numbers: The Top 20 Beer-Loving Nations

Rank	Country	Consumption*
1	Czech Republic	156.9
2	Republic of Ireland	131.1
3	Germany	115.8
4	Australia	109.9
5	Austria	108.3
6	United Kingdom	99.0
7	Belgium	93.0
8	Denmark	89.9
9	Finland	85.0
10	Luxembourg	84.4
11	Slovakia	84.1
12	Spain	83.8
13	U.S.A.	81.6
14	Croatia	81.2
15	Netherlands	79.0
16	New Zealand	77.0
17	Hungary	75.3
18	Poland	69.1
19	Canada	68.3
20	Portugal	59.6

**** Annual Per Capita Consumption in Liters***

Source: Independent Research Survey, 2005; Kirin Research Institute of Drinking and Lifestyle at Kirin Brewery Co. Ltd.